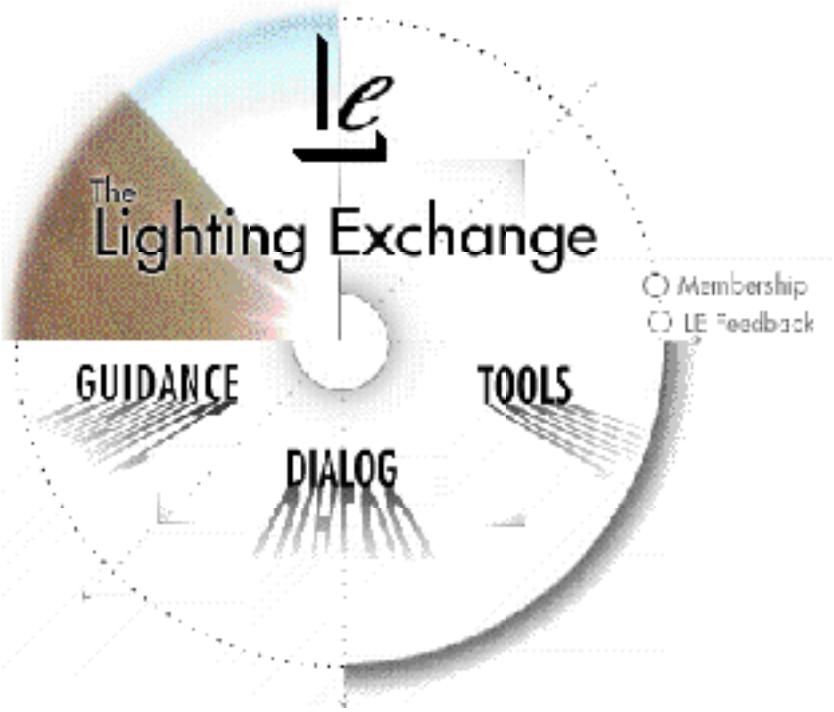
PG&E Contract Number 4600009300

Baseline Market Study Assessing the Potential for Pacific Gas and Electric's Lighting Exchange Program



A Report Prepared for
Pacific Gas and Electric Company

June 1999

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Acknowledgements

A report such as this one requires the efforts of many people. We would like to thank the Project Manager, Chin-I Lin, for his guidance and assistance. We would also like to thank Ed Sugar and his staff at the Pine Company for their heroic efforts. Special thanks to Debbie Harbort of the Pine Company who makes the most incredible instant SPSS files.

We also wish to thank Geri King and her staff at Issues & Answers for their hard work in completing the telephone interviews. The interviewers were Yameka Bailey, Allison Ball, Llaby Beita, Susan Bittle, Jinnell Butler, Pam Casciato, Sara Crabtree, Beverly Dawson, Laura Douglas, Kelly Forehand, George Frasier, Catherine George, Glynnie Greenidge, Tamika Hall, Xiomara Hightower, Karen Hinton, Shemika King, Felisa Madrigal, Latrice Mitchell, Mary Nicholson, Lakisha Owens, Carrie Riley-Jones, Kaveen Scott, Sallye Stephens, Louise Toulouse, Eric Vandevender, Claudette White, and Dawn Wilkins.

Executive Summary

The Lighting Exchange

In this report we have attempted to assess the market potential for the PG&E's Lighting Exchange. The Lighting Exchange is a set of Internet tools that provide information and analytic capabilities to professionals in the building sector. The goal of the Lighting Exchange is to:

- increase the availability of data related to lighting design
- reduce the amount of effort required of building professionals to obtain the data they need
- increase the range of design and equipment options that are considered
- improve the energy efficiency of commercial buildings

The Exchange is comprised of several tools. The Lighting Exchange Search capability allows users to obtain manufacturer data for lamps, ballasts, controls, and fixtures. In addition, the Lighting Exchange Tools include a retrofit and an economic calculator designed to allow design professionals to evaluate their options.

The Lighting Exchange includes a moderated discussion list, the Lighting Exchange Dialog, which allows users to ask questions and exchange information about equipment and design options and to receive comprehensive and technically correct responses very quickly. The responses are stored in a database which allows users to access the responses to previously asked questions. The database serves as a repository of information about good design practice.

Purpose of the report

This report focuses on the market for the Internet tools which are designed to increase the amount of information and the ease with which building professionals can access information about design options and product availability. The purpose of the Internet tools is to overcome information gaps and barriers that make it difficult for building professionals to implement energy efficiency in new and renovated commercial structures.

The purpose of this document is to describe the market, the target audiences, and the potential for the Internet tools to penetrate the market. In addition, PG&E wishes to establish a market baseline so that it can track the penetration of the tools and assess the effects of the tools in the market place. This report attempts to identify:

- The target audiences, particularly the types, number and characteristics of actors interested in this program
- The functions of the Lighting Exchange Program

- Barriers to the introduction of this program
- The potential for this program to be adopted in the market
- The potential for this program to influence the market
- Market effects measures that will allow changes in the use of this program to be tracked in the future

How the data were collected

This study is based on interviews with PG&E staff, 30 in-depth one-to-one interviews with building professionals lasting between 30 minutes and an hour and a half, and a telephone survey of 201 randomly selected building professionals in Northern California. The telephone interviews lasted from 15 minutes to 40 minutes or more.

Key findings about the market

Internet use is substantial in the building professions with 85 percent of respondents saying they use the Internet for work related purposes.

If non-Internet users carry through with their intentions to become Internet users, more than 96 percent of the target audiences will be Internet users within two years.

Based on these data, we conclude that access to the Internet is not a barrier to the potential use of the Lighting Exchange. A further implication of this is that the PEC can focus on creating awareness of the tools and training users on them rather than focusing on general Internet training.

High percentages of the target audiences say they access product information (89 percent) and visit manufacturer sites (86 percent) when they use the Internet.

However, only about 15 percent say that they participate in discussion groups. Discussion groups are an analog of the Lighting Exchange Dialog.

The fact that the market audience already searches for product information and visits manufacturer sites bodes well for the success of the Lighting Exchange search tools. The lack of use of discussion groups suggests that the PG&E may have to market the Dialog fairly heavily. It is clear from other studies that marketing will be essential in order for the Lighting Exchange to be successful.

The target audience is highly aware of the PEC Internet site and about 21 percent of the target audience has visited the site. Seventy percent of those who have visited the PEC Internet site have visited four times or more.

Thus, PG&E already has some presence on the Internet upon which it can build.

About ten percent of the target population has used the inter.Light search site. The inter.Light site is a product referral site that is directly analogous to the Lighting

Exchange Search Tool site. The Lighting Exchange Toll will compete directly with the inter.Light site. However, this site does not provide product data as the Lighting Exchange will.

There are differences by profession in who is aware of the two sites and who uses them. Energy consultants are most likely to be aware of and use the PEC site. Architects are least likely to use the PEC site.

After examining the data concerning market preferences related to the Lighting Exchange, we concluded that:

- Eighty percent or more of the respondents are interested in concepts that are embodied in the Lighting Exchange search tools and the Lighting Exchange Dialog.
- There is slightly greater interest in the product search tools than in the Dialog.
- This difference in interest is consistent with the revealed preferences with respect to the types of materials that users currently seek on the Internet.

Thus, we conclude that the target audiences are strongly predisposed to use the Lighting Exchange. These predispositions are supported by the target audience's stated motivations for using the Lighting Exchange.

The key stated motivations for using the dialog are to:

- Obtain general information, technical data, and insight into trends in the field.
- Get alternative solutions and diverse feedback from experts.

The key motivations for using the product search tools are to:

- Reduce the time and effort expended for information searches from current levels.
- Perform searches yielding a greater number of options for the same or nearly the same level of effort.
- Use searches to research significantly different alternatives that might lead to better designs.

These findings indicate people perceive that these tools will provide benefits. We believe that the product search tools have the potential to become an extremely important resource in the building professions. The Dialog is also likely to meet with success but perhaps less quickly.

These products will need to be marketed to building professionals before they will become widely used.

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Chapter 1 Introduction

Background

In 1996, the California state Assembly Bill 1890 (AB1890) established a uniform funding mechanism for ratepayer funded energy efficiency programs and charged the California Public Utilities Commission (CPUC) with overseeing the mechanism. Subsequently, the CPUC established the California Board for Energy Efficiency (CBEE) to advise it on how best to provide public purpose energy efficiency programs in California.

In addition, the CPUC Decision (D.) 95-12-063 calls for public spending to shift towards activities that will transform the energy market (Eto, et. al., 1996). Based on the utility performance award mechanisms approved in D. 97-12-103 and updated in Resolution E-3555, adopted July 23,1998, for the 1998 Energy Efficiency programs, the CBEE has directed PG&E to use Public Goods Charge (PGC) funds to perform Market Baseline and Transformation Studies on the 1998 energy efficiency programs. The present study represents an evaluation covered under that directive. There is currently no regulatory verification plan in place for these studies. PG&E and the CBEE will use the results of these reports as appropriate to augment and refine future programs.

Goals of the Program

A recent study of emerging technology and practices in the building sector concludes that energy saving opportunities appear to be the most pronounced in three areas, HVAC, lighting, and integrated new building design. Based on the analysis of technologies and practices included in that study, the highest potential savings for building energy use in the year 2015, about 4.5 percent of the total projected savings, is likely to be from integrated commercial building design (Nadel, et. al., 1998). In order to be able to reap these savings, integrated building technologies and practices will have to be developed and the resulting technologies will have to be diffused to the market and adopted by practitioners.

Currently, Pacific Gas and Electric Company (PG&E) is attempting to address both the technology and the diffusion issues by developing analysis and information tools that will enable building professionals to increase the energy efficiency, occupant comfort, and value of commercial buildings they design and build. PG&E's goal is to create and deliver tools that will find acceptance in the day-to-day world of practitioners. Greater use of such tools should provide architects and designers with increased confidence in their evaluation of lighting design and daylighting options which, in turn, is expected to lead to changes in design practice. PG&E's intent is to transfer these tools to users in order to effect changes in design practice that will increase the use of efficient lighting and daylighting in designs. PG&E's short term objectives are to:

- create a viable set of products and an allied set of educational offerings
- transfer the products to the marketplace
- encourage others to become partners in the continuing development of these products and the market

In 1998 Pacific Gas and Electric Company began developing a set of tools targeted to building professionals. PG&E, through its Pacific Energy Center (PEC), identified two areas of focus. One focus is to increase the amount of information about design options and lighting products that are available by developing information resources and making them available on the Internet. The second focus is to provide a set of analysis tools that make it quicker and easier to study daylighting design options and to provide outputs that will aid building professionals and their clients in their decision making. This report focuses on the Internet information tools. A companion document, *A Market Baseline Study Assessing Pacific Gas and Electric's Daylighting Design Tools*, addresses the market for the daylighting design tools.

PG&E's software contractor has delivered two of the Internet tools to PG&E. The tools that have been delivered are the Lighting Exchange Tools which include the product search tool, a retrofit calculator, and an economic calculator and the Lighting Exchange Dialog which is a Web based discussion list. A third tool, Lighting Exchange Guidance, is scheduled for delivery in the fall of 1999. It is now up to PG&E to implement the first two tools on its Web site.

Purpose of the Report

This report focuses on the market for the Internet tools which are designed to increase the amount of information and the ease with which building professionals can access information about design options and product availability. The purpose of the Internet tools is to overcome information gaps and barriers that make it difficult for building professionals to implement energy efficiency in new and renovated commercial structures.

The purpose of this document is to describe the market, the target audiences, and the potential for the Internet tools to penetrate the market. In addition, PG&E wishes to establish a market baseline so that it can track the penetration of the tools and assess the effects of the tools in the market place. This report attempts to identify:

- The target audiences, particularly the types, number and characteristics of actors interested in this program
- The functions of the Lighting Exchange Program
- Barriers to the introduction of this program
- The potential for this program to influence the market
- The potential for this program to be adopted in the market
- Market effects measures that will allow changes in the use of this program to be tracked in the future

Overview of the methods and research activities

Several data collection methods were used in this research. The first is the analysis of secondary data. These data are primarily from F. W. Dodge and represent data about construction activity in Northern California in 1997 and 1998. In addition, we have obtained and examined the lists of registered architects and electrical engineers in California in 1998.

The second source of data is 30 one-to-one interviews with architects, electrical engineers and lighting designers. The respondents are from a stratified random sample of firms representing four different levels of participation in the market based on the 1997 and 1998 F. W. Dodge data.

These interviews were conducted on-site at the respondents' premises. The interviews lasted from 30 minutes to an hour and a half. The interviews were open-ended but were conducted using a protocol.

The third source of data is a random telephone survey of 201 building professionals including architects, electrical engineers, lighting designers, energy consultants, and others. The survey was conducted in May of 1999. The survey lasted from 15 to 40 minutes or more depending on the respondent. The Lighting Exchange portion of the survey took between five and ten minutes.

The content of the survey focused on:

- Current lighting practices
- Current use of the Internet in terms of the amount of use and the types of information
- The potential for respondents to adopt and use some or all of the tools in the Lighting Exchange
- Firmographic and demographic information.

Data from all these sources have been synthesized to create this market baseline report.

Overview of the report

In the next chapter the Lighting Exchange is described so that the research reported later in the document might be better understood. Chapter 3 provides a description of the theoretical underpinnings of this report. Chapter 4 describes how we went about collecting the data that are used in the report. Chapter 5 briefly describes selected characteristics of the individuals in our sample and the firms they represent. Chapter 6 summarizes what we know about how building professionals currently use the Internet. Chapter 7 summarizes what respondents told us about their interest in the Lighting Exchange. Chapter 8 discusses how the impacts of the Lighting Exchange on the market might be assessed. Chapter 9 presents the report summary and conclusions.

Chapter 2. The Lighting Exchange Program

Introduction

This chapter describes the tools that are being developed as part of the Lighting Exchange. At the time of this writing, the programming for the Lighting Exchange Dialog and the Lighting Exchange Tools is complete and is ready for public implementation. A public debut is expected shortly.

Figure 1 displays the current version of the home page for the Lighting Exchange. In its initial implementation, the Lighting Exchange is to have three main sections, Guidance, Dialog, and Tools. The Dialog and Tools sections are being implemented immediately. The Guidance section is to open in the Fall of 1999. Each of these sections is briefly described below.

Guidance

The guidance section (**Error! Reference source not found.**) is to provide educational information about current best practices by way of text and graphics on a wide array of topics of interest to architects, lighting designers and engineers. As currently envisioned, the guidance area will have nine topic areas such as applications, visual tasks, techniques, luminaires, lamps, ballasts transformers, etc. Each of these areas will have two or more levels of content below them. For example, the applications area will include information about reading and computing spaces, retail spaces, food service areas, meeting spaces, etc. The information about reading and computing spaces may be further subdivided into topics such as office spaces, libraries, and classrooms.

Other organizations have posted documents and case studies on the Web. However, the Lighting Exchange Guidance will be the most comprehensive, systematically organized set of information currently available.

Dialog

This Web based moderated discussion list is designed to provide timely and technically accurate lighting design information to users. Users who participate in the discussion list submit questions and receive answers about lighting products and design issues. The difference between this and most other discussion lists is that answers are screened by a moderator assisted by a panel of experts who help to insure that responses are technically accurate. In addition, the responses to questions are maintained in a database that users may search. A goal of the system is to provide some response to a query within 24 hours and a technically correct and more comprehensive answer as soon as it is feasible.

Figure 3 shows the entrance page to the *Dialog*. Immediately under the PG&E banner are the general navigation tools that allow you to move between areas of the Lighting Exchange. Immediately under that in the middle of the page is the drop down menu that lets the user specify the topic area, in this case, *General Discussion*. To the right of the drop down menu are commands such as post and refresh which can be used to run a session. Post opens a form in the message window that allows a user to compose and post a new topic. *Refresh* allows the user to update to capture new messages. *Find* opens a message search form that allows the user to locate specific content. *Mark all read* allows the user to mark messages as being read. *Configure, help* and *close* provide additional functions and information.

The frame at the lower right-hand side is the content window that shows the topics that are available in the discussion area. In this case the discussion area is set to *General Discussion* so the window displays the topics *Applications, Techniques, Visual tasks*, etc. For other discussion areas the window will contain other topics. The number of items in the topic is identified to the right of its listing. The topic, R*esearch*, has been expanded to show the topics under it.

The frame to the lower right is the message window. It is used as an area to display messages and to compose a message. Figure 4 illustrates a query about the relationship between productivity and the use of color corrected lamps and the resulting response. Notice that this query and response is one of the topics listed under *Research* in the content window.

There are other sites on the Internet where professionals can ask questions and receive responses. Most of the sites use list serve technology that is e-mail driven rather than browser based. At those sites users submit questions and respond to each other. There is no way of knowing the quality of the technical responses coming from other users. A technically inadequate response may be corrected by others or may go uncorrected. The unique feature that separates the *Dialog* from these Internet sites is the fact that the site is moderated. This means that the responses are reviewed for technical accuracy. Most of the list serve sites have archives but they may or may not be well indexed or maintained. The history of the dialog is very much a part of this site's design.

Tools

The last area of the Lighting Exchange is the tools area which has search tools and calculation tools (See Figure 5). The search tools area allow the user to search by lamps, ballasts and / or manufacturer. The calculation tools currently include the retrofit calculator and an economics calculator.

If the user decides to search by lamp they can do so by conducting a general search for a lamp, a search for an accent lamp, or a search by model. Figure 5 shows the current version of the screen for the general lamp search. The lamp search allows the user to impose a range of criteria on the search including manufacturer, operating position, performance data, and lamp type.

In order to illustrate the use of the search function, we searched for straight tube 2ft T-5 lamps from all manufacturers (note that in the trial version we are using, the database is only partially populated). Figure 6 shows the resulting output using the test data. The search returned data from one manufacturer and three products. At this point the user has options to print the information, get manufacturer information about the product, get statistics or sort the list.

There are other Internet lighting search products. The main competitors for the Lighting Exchange product are the manufacturer Web sites and a Web site that will return a list of manufacturers who make specific types of lamps and ballasts (inter.Light). If one uses the manufacturer Web sites one has to go to each site sequentially to search for lamps and ballasts. The inter.Light site does not provide specific product information. It identifies manufacturers who have a category of product but leave it to the user to go to the manufacturer's site to retrieve that information. The inter.Light site is a commercial site supported by subscription fees.

The tools section of the Lighting Exchange includes a retrofit calculator and an economics calculator. The retrofit calculator can be used to estimate the annual savings from switching from less efficient to more efficient lamps and ballasts. The economics calculator can be used to do comparative evaluations of different lighting configurations.

When using the retrofit calculator the user identifies the project (Figure 7). The user then defines the hours of operation for a seven day week using a matrix (Figure 8). Different hours of operation can be assigned to each day of the week. The user can identify additional parameters such as overtime hours that may influence annual usage. The user provides information about the existing system including the light source, the luminaire, and the desired light output. The software then provides some recommended lamp and ballast types along with an estimate of the annual cost savings (Figure 9).

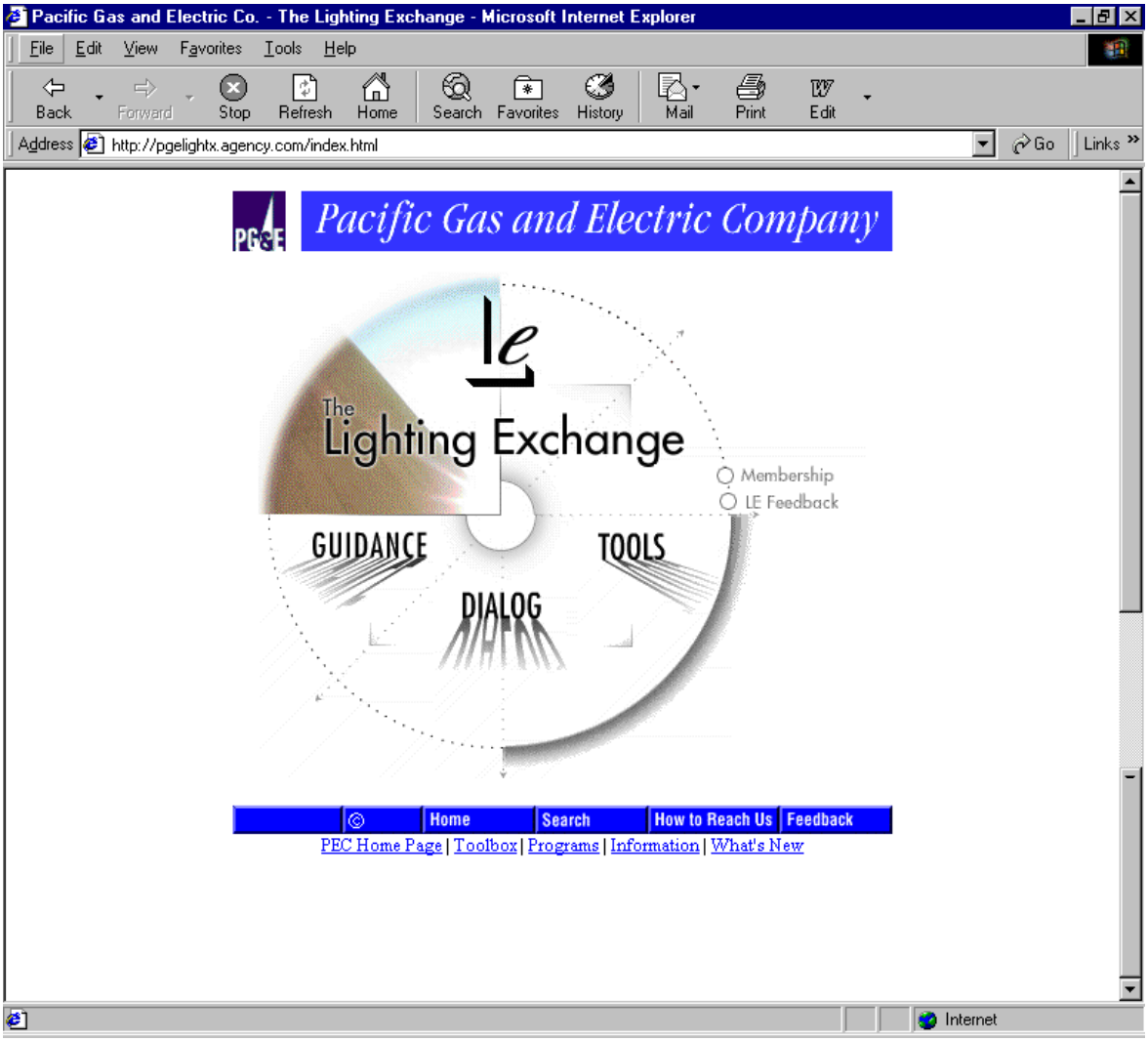


Figure 1 Main page for the Lighting Exchange

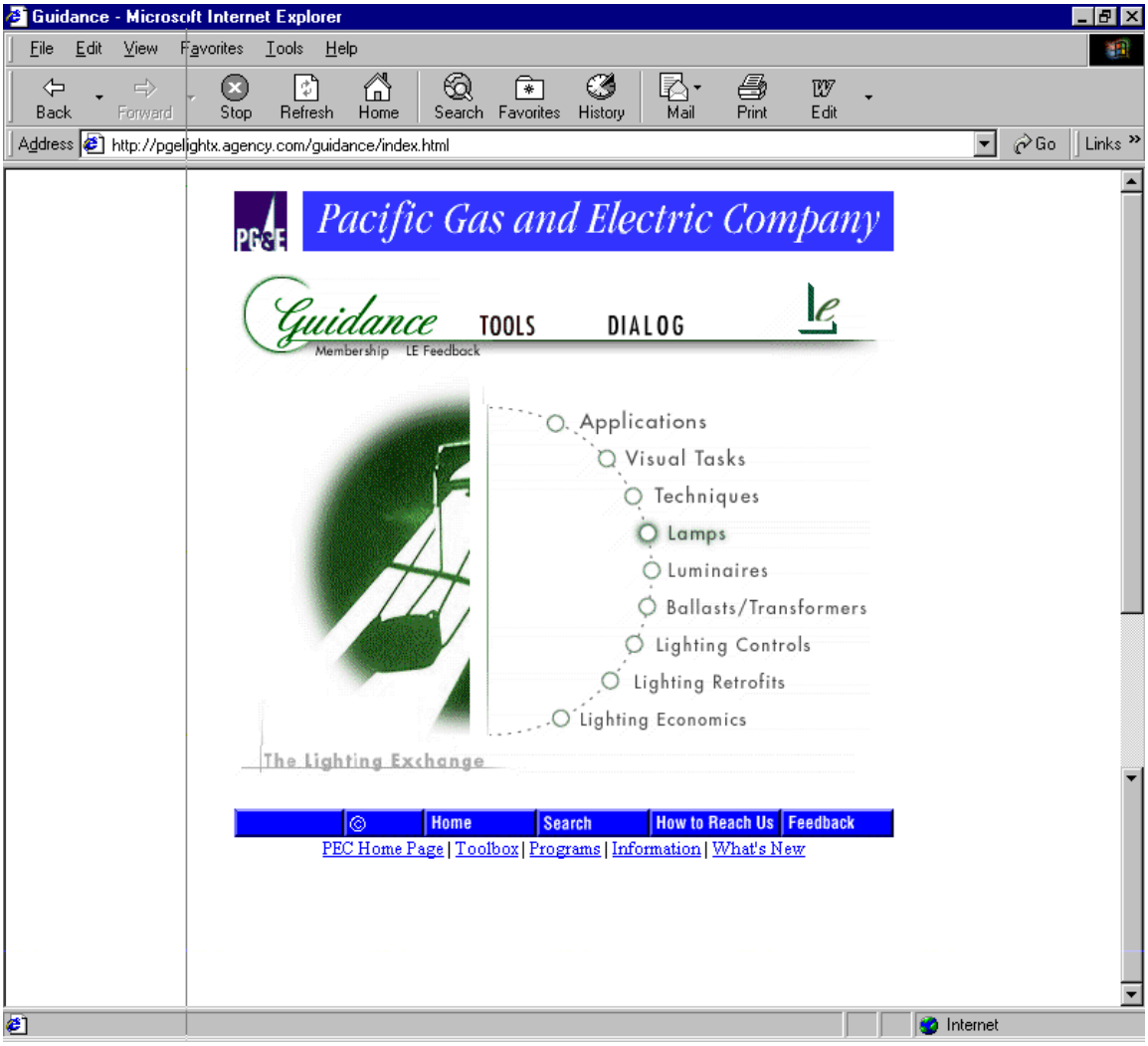


Figure 2 Entrance to the Lighting Exchange Guidance

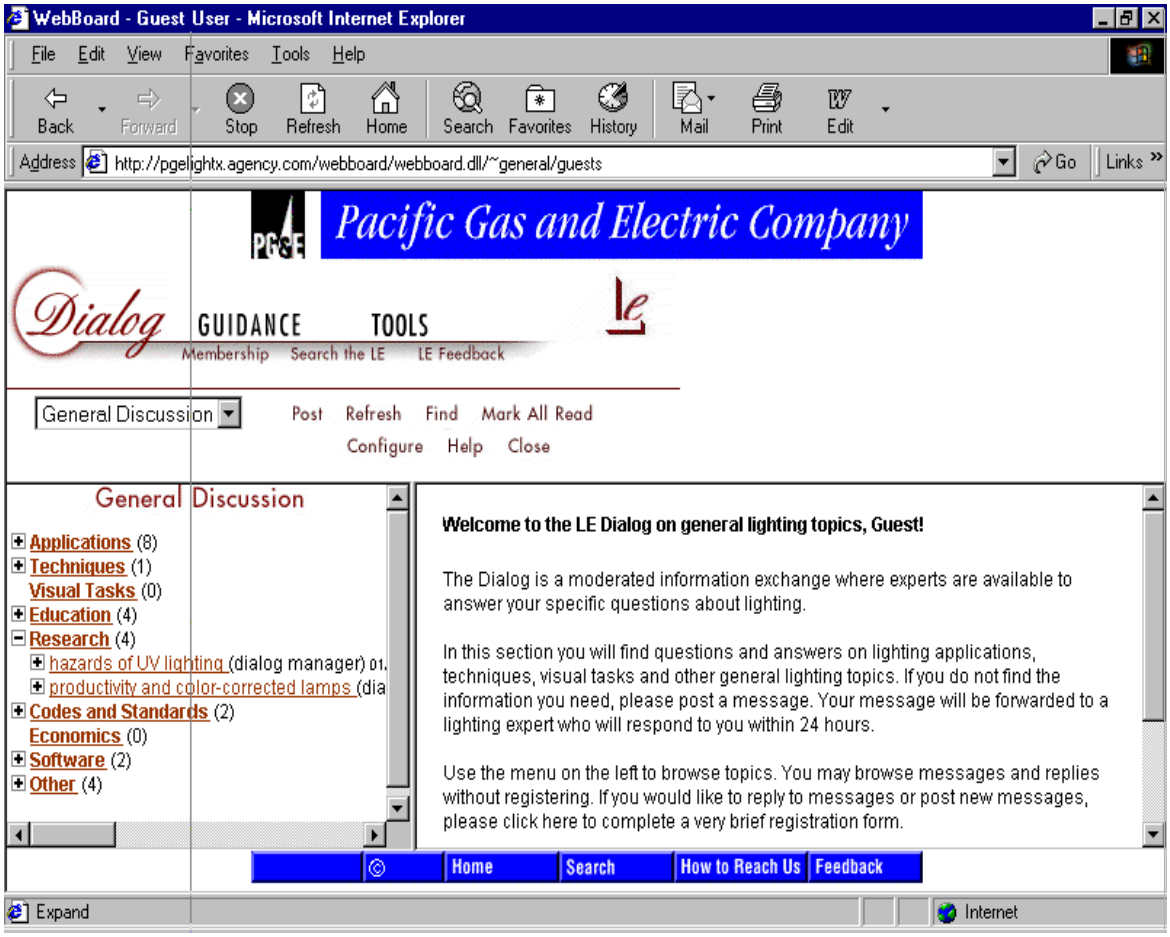


Figure 3 Entrance to the Lighting Exchange Dialog

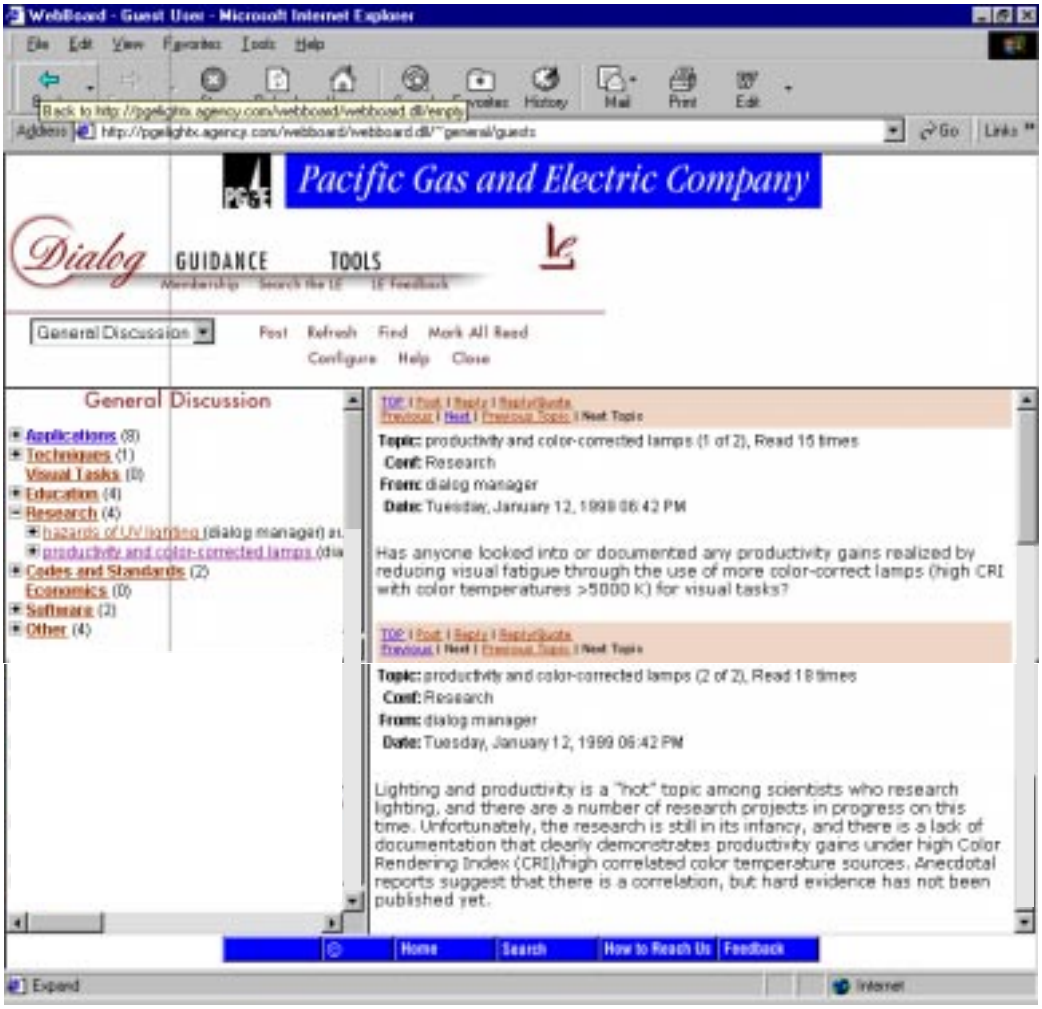


Figure 4 Example of a question and the resulting response in the Lighting Exchange Dialog

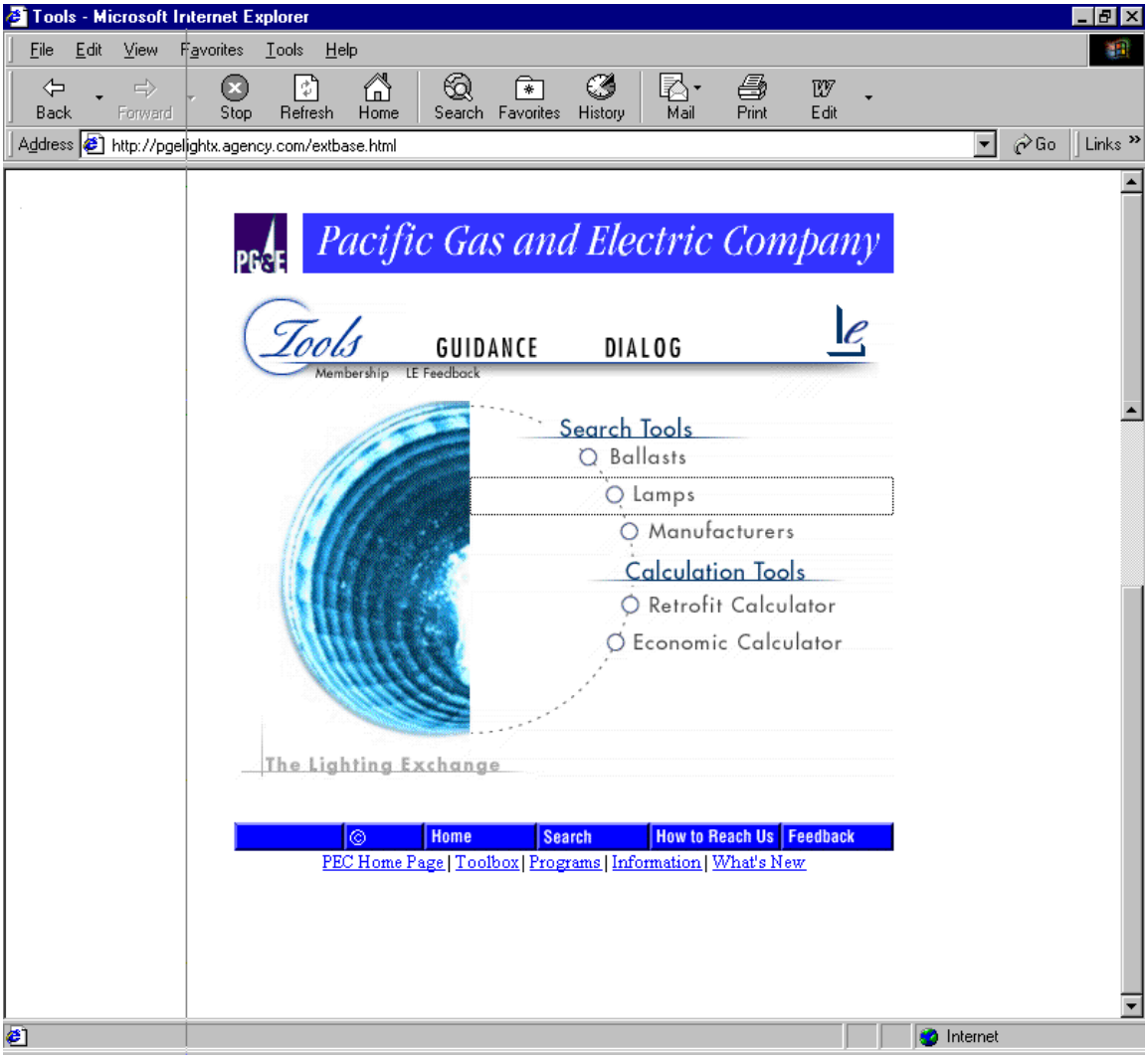


Figure 5 Lighting Exchange Tools Main Page

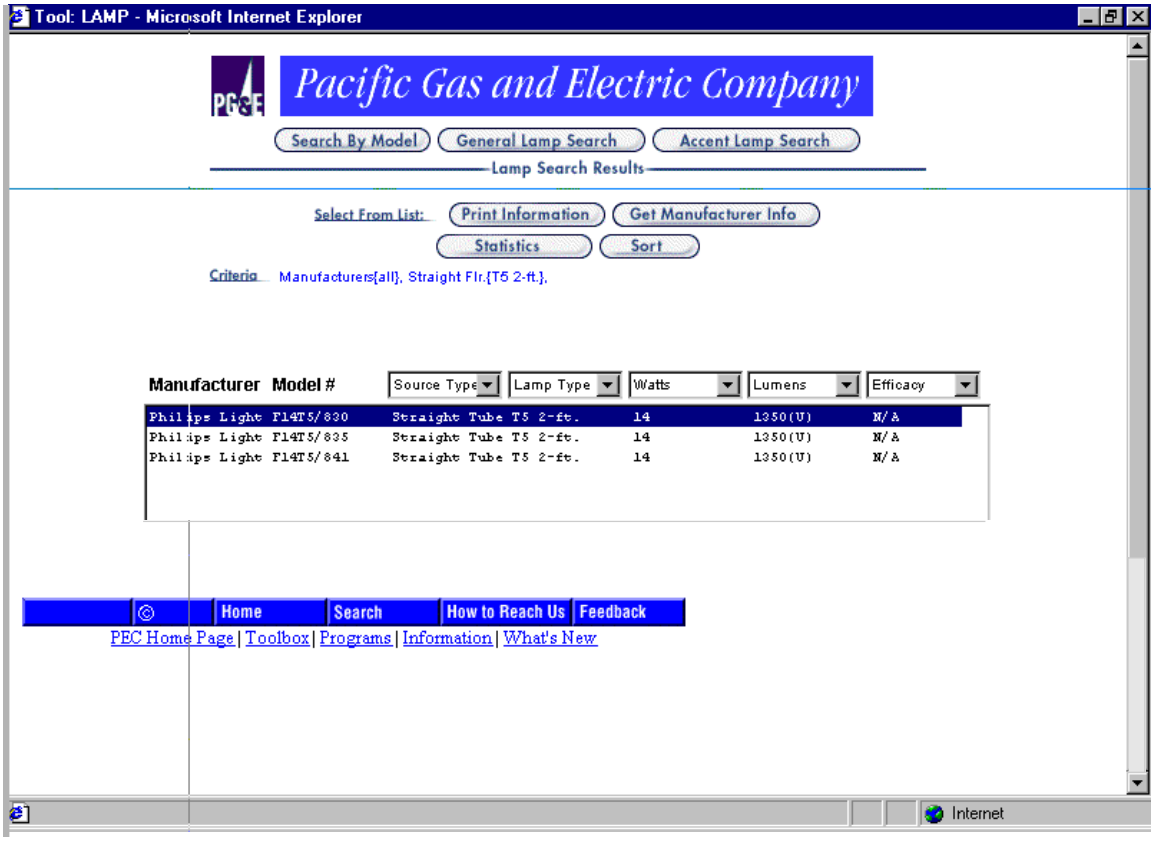


Figure 6 Example of an output from lamp search

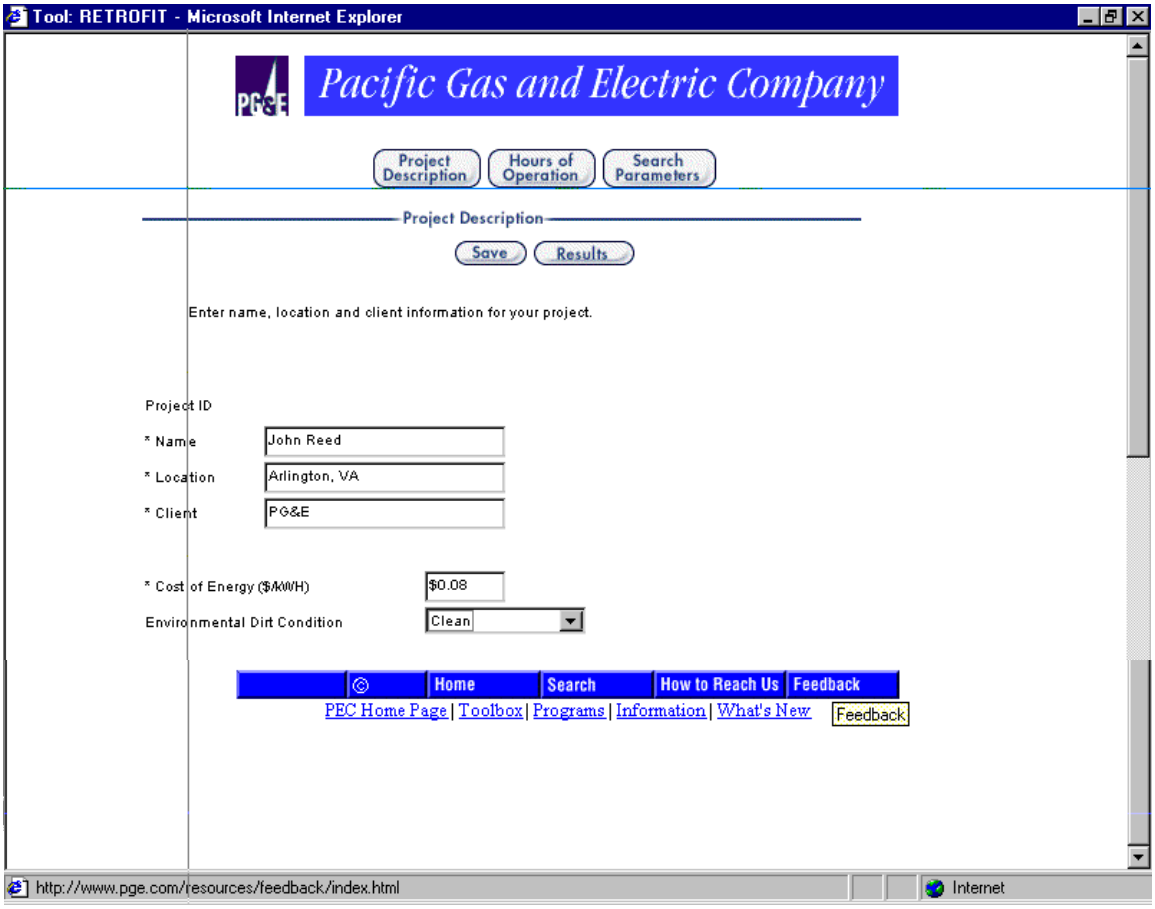


Figure 7 Identifying a project using the retrofit calculator

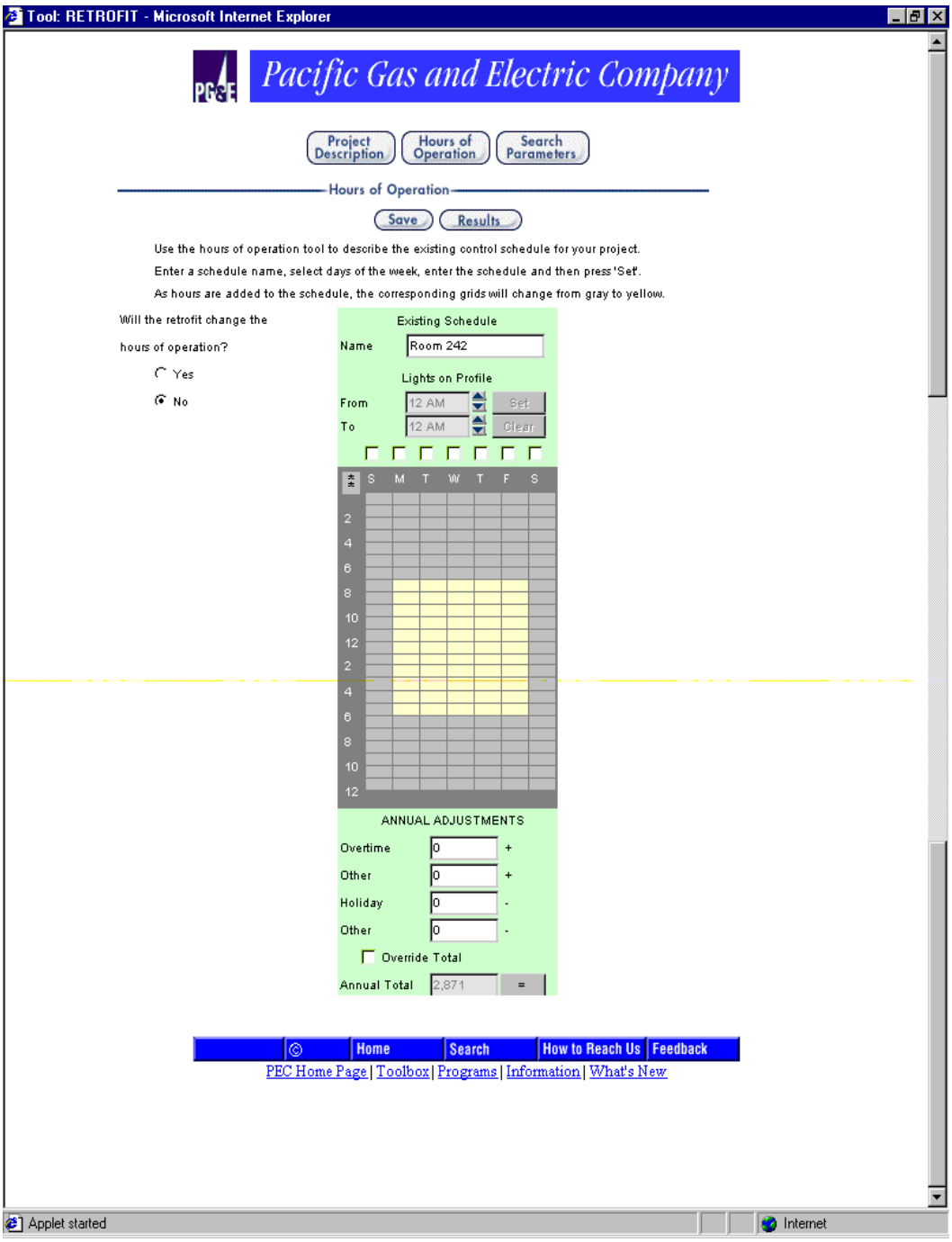


Figure 8 Establishing hours of operation using the retrofit calculator

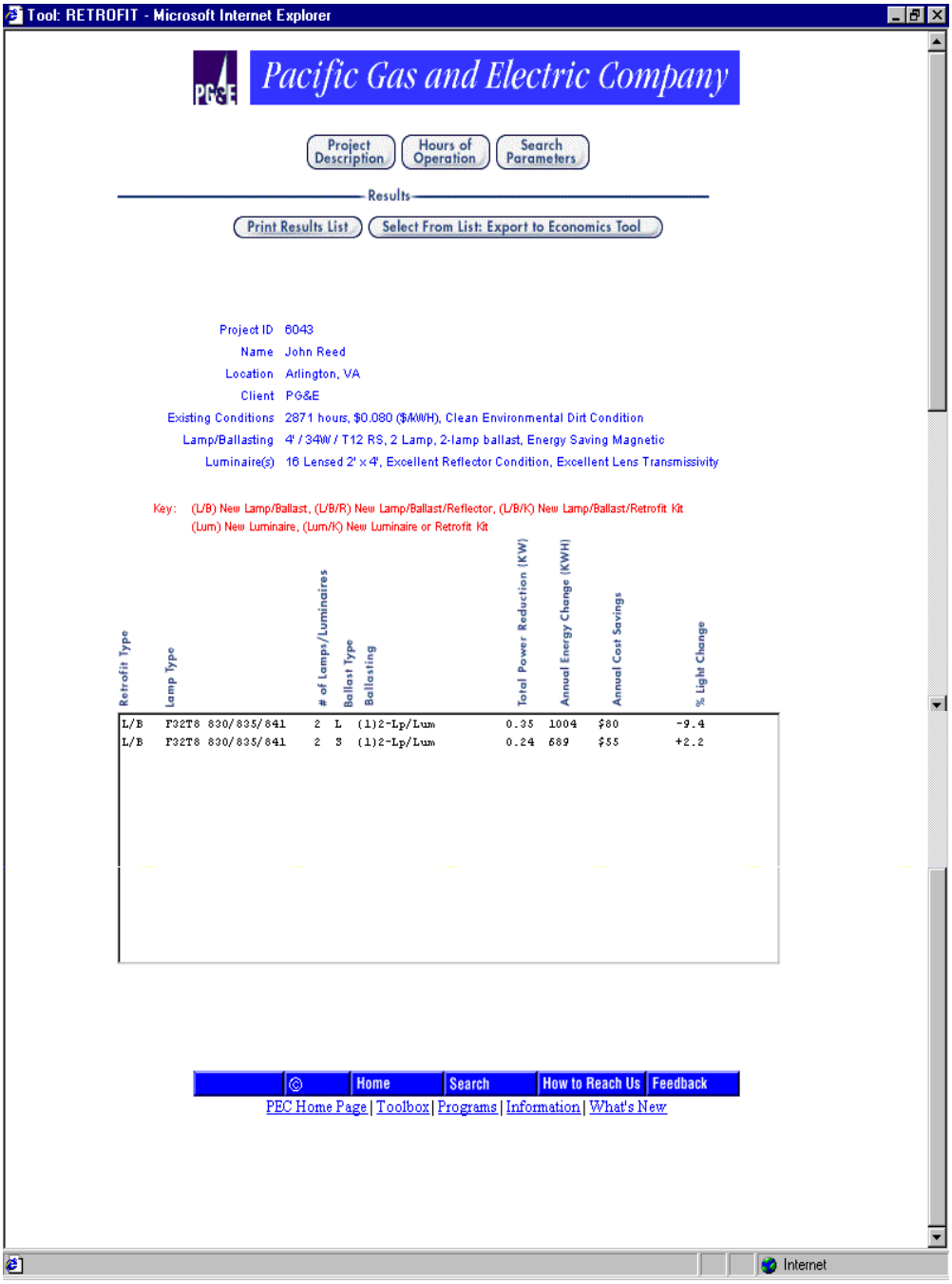


Figure 9 Sample output from the retrofit calculator

Chapter 3. The Lighting Exchange Program as a Tool for Transforming Markets

Introduction

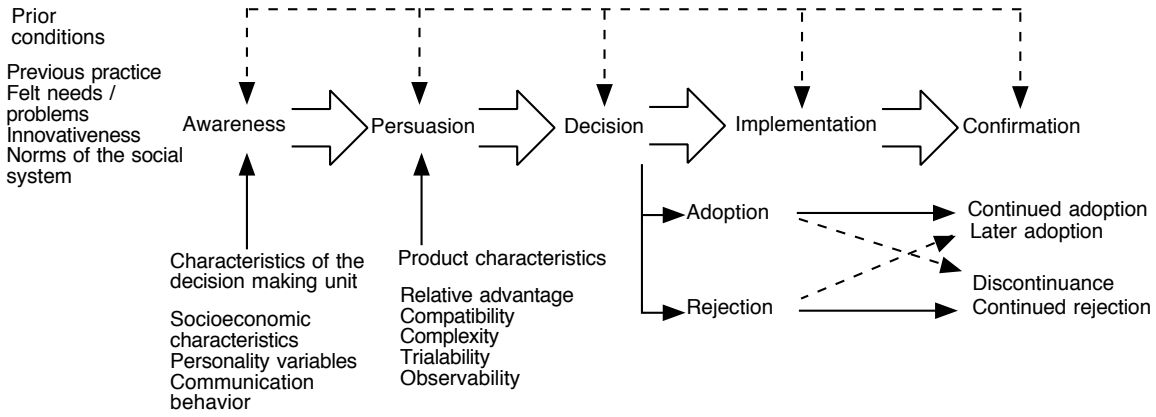
In this chapter we discuss the conceptual and theoretical underpinnings that we used to guide our thinking in this assessment. We discuss a concept, diffusion of innovation, that describes a process for transferring information and getting clients to act on it.

A model for information and technology transfer

The challenge for PG&E is to make their target audiences, building professionals, aware of the Lighting Exchange, and then to get them to use the lighting exchange in their day-to-day business activities. Fortunately, there are good models that can help us understand how to accomplish this.

Figure 10 illustrates a widely accepted model of the diffusion of innovations (Rogers, 1995). This model is based on a long research tradition and is programmatically oriented. The model defines a process by which market actors adopt a new innovation such as the Lighting Exchange.

The first step in the process is that actors in a market must become aware of an innovation. Once awareness of an innovation is established, a market actor can at any point enter a persuasion stage during which the actor seeks and processes information in order to decide whether to adopt the innovation. The timing of the active portion of this stage is highly dependent on the individual and the context in which the individual is operating. At several points in time, the market actor may make a decision not to adopt, to postpone adoption, to postpone the search for information, to continue the search for information, or to adopt the new innovation. The persuasion stage is followed by a decision stage wherein the actor decides to adopt the idea. However, deciding to adopt and implementing the decision are separate acts that may occur at very different points in time. Therefore, we identify a separate implementation stage in which the actor enacts the decision. Finally, we know that actors frequently reevaluate or confirm their decisions to adopt and / or their implementation of the adoption.



Source: Rogers, 1995.

Figure 10 Model of innovation diffusion

The time frames for adopting an innovation can be compressed or fairly lengthy. For example, awareness of an innovation may precede the decision to adopt by months and / or years. Rogers (1995) has data showing awareness preceding the adoption of hybrid seed corn by about 1.7 years for early adopters and by as much as 3.1 years for later adopters. Further, the decision to adopt and the implementation of the decision are separate acts and may be separated in time (Reed, Erickson, Ford and Hall, 1996; Hall, 1998). Homeowners who commit to increasing the efficiency of their homes may delay implementation by as much as 6 months to 2 years.

Factors influencing the rate of diffusion of an innovation

There are a variety of factors that influence the rate of adoption of innovations that have a strong similarity to market barriers described in the market transformation literature (Eto, et. al., 1996). The rate of adoption of a product or innovation is determined by the nature of the social system, by the channels used to communicate about the innovation, by the attributes of the product or innovation, by the type of innovation decision, and by the extent of promotional efforts.

The adoption of new innovations does not occur in a vacuum. Prior practice, for instance, the use of Internet search services, may weigh heavily in determining whether or not someone adopts a new tool such as the Lighting Exchange. In the language of market transformation, this is a form of bounded rationality.

Norms within a social system, such as company expectations about computer use, ease of access to the Internet, and the practices of colleagues, also influence adoption decisions. This is undoubtedly what Eto, et. al. had in mind when they identified organizational practices or customs as market barriers.

A careful reading of the diffusion of innovation literature makes it clear that market barriers may only be revealed in response to the appearance of an innovation in the market place.

The actual characteristics of the product are an important key to whether an innovation may be adopted. The literature identifies five key attributes of products or services (innovations), relative advantage (for example, initial cost), compatibility (with existing culture and practice), complexity, trialability, and observability. Of these, relative advantage and observability are known to be the most important.

Relative advantage is the degree to which technologies, products or services, are perceived to be better than similar products and services. The literature identifies key dimensions of relative advantage to include "degree of economic profitability, low initial cost, a decrease in discomfort, social prestige, savings in time and effort, and immediacy of the reward" (Rogers, 1995). Scholars have found that economic profitability may explain considerably less than half of the variance associated with relative advantage.

The Lighting Exchange tools have a number of characteristics that may place them at relative advantage. For example, the Lighting Exchange product database, if implemented as planned, will provide a single comprehensive source of product data. It will be unmatched by any other sources of data. The cost of using it is minimal. Users may find that it provides significant savings to them in terms of time and effort. They may also find that using the Lighting Exchange will result in better designs which may lead to a form of immediate reward.

There are other product related issues. Complexity is a barrier to acceptance. The simpler the device or the idea, the more likely it is to be adopted. People are interested in ease of use. To gain rapid acceptance, innovations must be easy to understand and easy to use. The Lighting Exchange is accessed through a browser which is familiar to Internet users. There are no special requirements that create complexity with which users are not familiar.

The potential for adoption is also increased with observability and trialability. Innovations are more likely to be adopted when people can see and / or experience them through sensory stimulation. This is why you see signs at the edge of fields identifying the type of seed used to plant that field. A product that is easily tried is likely to be more rapidly adopted than one which is not. The Lighting Exchange has the potential for a high degree of observability and a high degree of trialability. This bodes well for the potential adoption of these tools.

The main point is that barriers to adoption may be inherent in the product. At least at the surface it would appear that the Lighting Exchange has few potential barriers.

It is especially important to note that methods and approaches that employ value added services (for example, owner value and customer comfort) are key strategies for success (Wight, 1996). If the characteristics of a product or innovation do not meet customer needs, then it is unlikely that the market will be transformed. Too often, it seems we are dealing with products and services searching for a market rather than creating a product or service to meet the needs of a market. A closer look at the value of products and services in markets is needed before any attempt is taken to understand whether or not the

market for the products and services is being transformed. Part of this assessment is to determine whether the product may meet the needs of the targeted clients.

Without going into a lengthy discussion of decision types, we would point out that the diffusion literature defines three types of decisions, optional, collective and authority. "Optional" defines the situation in which the decision is largely a personal one. The "collective" decision involves a group. The remaining decision type is the decision driven by authority – for example, a purchasing rule that dictates decisions be based on first cost, or a regulatory standard, such as a building code, that mandates the adoption of more efficient designs and technologies. The dynamics of a collective decision are very different than those for an individual decision. For the most part it appears that the use of the Lighting Exchange is likely to be a personal decision rather than one dictated by a group or one based on authority.

Finally, communication channels significantly influence the rate of adoption. The diffusion literature identifies two basic channels of communication, broadcast and interpersonal. A broadcast channel is a one-to-many communication path. A prime example is mass media. Interpersonal channels involve one-to-one communication, the message spreading like a contagion. Innovators and early adopters typically get information through broad channels, but the literature is clear, the transformation of the market does not kick in until the interpersonal channels really begin to work (Rogers, Moore). This means that professional and social networks are keys to getting others to adopt an idea.

We have significant evidence from the evaluation of another Web site of the role that one-to-one communication can play in the adoption process (Reed, et. al., 1999b). The site in question is primarily marketed through one-to-one contacts at an annual trade show. In each of the last three years, there has been a dramatic acceleration of the use of that site following the trade show. This example illustrates three things, the importance of the one-to-one contact, the importance of marketing, and the importance of tracking marketing efforts if our goal is to understand the adoption of an innovation within the market place.

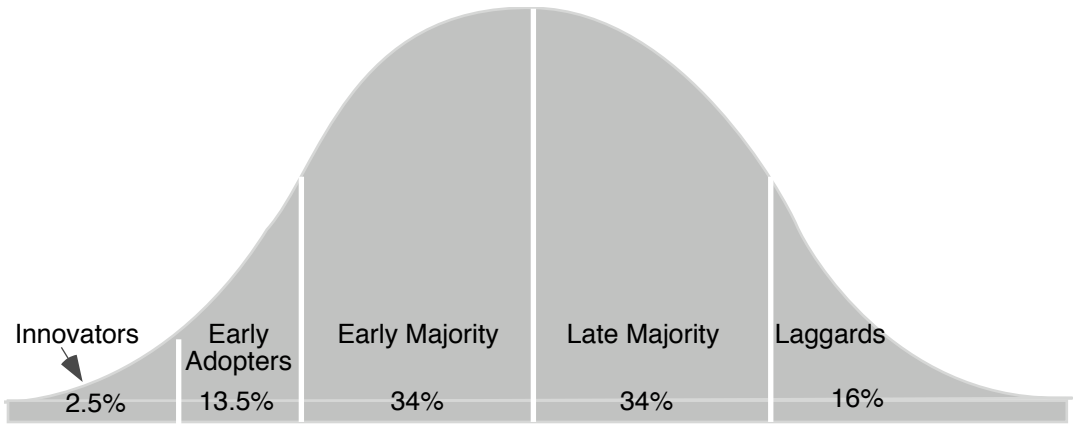
Types of adopters

Market transformation really represents a series of decisions by individuals and firms. The decision to adopt has to be made by each actor in the market, at least until the point at which actors have no alternatives but to adopt (e.g., the market is fully transformed). However, people and organizations differ in the speed with which they will accept innovations. Adopters are generally categorized into one of five groups: innovators, early adopters, the early majority, the late majority, and laggards (Figure 11).

The literature points out (Moore, 1993) that there are significant differences among the adopter groups and that these differences have important implications. *Innovators* are a very small group and they pursue technology aggressively. They purchase and use new technologies out of pure interest in the technology. *Early adopters* appreciate the potential benefits of technology and will utilize technology when they see that its benefits

match their own needs and desires. Both the innovators and early adopters typically learn about and make decisions about technology based on information received through broadcast channels. These groups can be especially important when there is an untried technology. Innovators are sufficiently tolerant so that they will use technology that is not reliable. Their feedback can be important for refining technology. PG&E may want to find these innovators and work with them in the early stages of promoting the Lighting Exchange technologies.

The *early majority* has an interest in technology but is driven by practicality. These people will wait and see if a technology delivers on its promises. They reference others in their own group, not the innovators or early adopters, before they buy. To reach some of the early majority, one has to "convert" some of the early majority. This is the point at which the interpersonal communication channels really take on importance. It is also the point at which many ideas and products fail. If ideas and products attract the early majority you get "take-off" (Rogers) or as Moore calls it, "a crossing of the chasm." In other words, the market is being transformed and the market for the product becomes more self-sustaining. This does not mean that marketing efforts may be abandoned.



Source: Rogers, 1995

Figure 11 Categories of adopters

The *late majority* differ from the early majority in one major respect. They are not comfortable with technology and will wait until a product has become the standard before purchasing. The *laggards* simply do not want to have anything to do with new technology and do not consider it. The laggards may adopt only when there is no alternative. As we shall see later in this report, the Internet has been widely adopted by building professionals but there is clearly a group of people who are late adopters and there is potentially a small group of people who may not use the Internet in their professional life for a long time to come.

Methodological issues in measuring market transformation

One of the difficulties faced by all efforts to assess change, including the diffusion of innovation, is the problem of measuring change. The best approaches for analyzing the diffusion of innovation rely on field experiments that include the collection of primary and secondary *time series* data for targeted and comparison areas. By tracking market interventions and changes in the target market area and by tracking changes in comparison areas where there have been no interventions, different interventions or lesser interventions and then comparing the two, one can establish causal links between the interventions and the effects. To accurately assess the effects of market interventions, time series data are needed.

Figure 12 illustrates an appropriate design. This design calls for a series of relevant measurements through time in a target and a comparison area, and measurements of program interventions. The differences between the measures at different points in time are the measures of change. Program interventions and other influences can be compared to changes in the market measures in the target and comparison areas to assess the overall effects of the interventions.

Because we are in the early stages of evaluation in this market transformation effort, there are no time series measurements that are available with which to conduct an evaluation. In this assessment, we have to content ourselves with an alternative design that rests on the use of one-to-one interviews and a "single-shot" survey. However, the survey provides us with an opportunity to establish a baseline from which to track the penetration of the Lighting Exchange in the market. Unlike many market transformation efforts which attempt to promote products that already exist in the market, this program is attempting to introduce new innovations. In addition, PG&E has control over the product so that it can change once it sees what the market response is.

Summary

Based on what we know from a theoretical perspective, it appears that the Lighting Exchange has good potential to penetrate the market. The Lighting Exchange appears to have the characteristics of products that have advantages in the market.

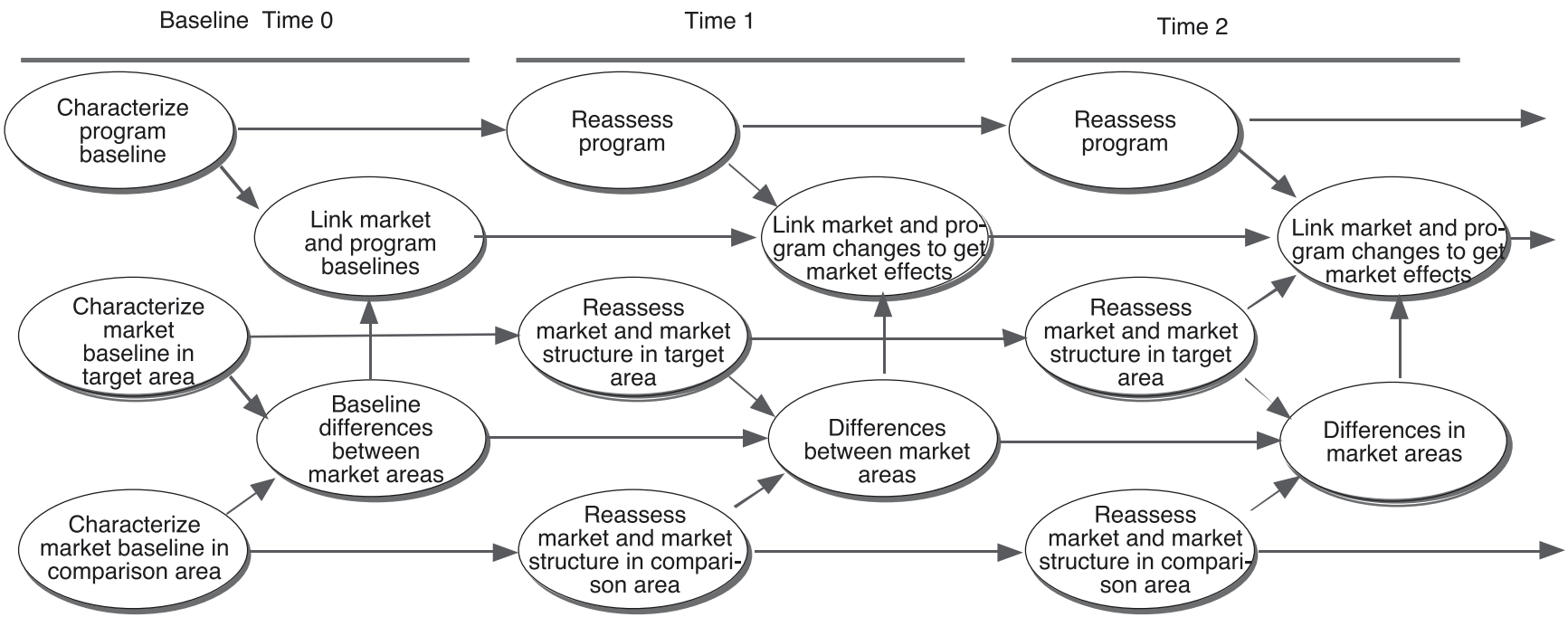


Figure 12 Model for a market transformation study

Chapter 4 Market Evaluation Methods and Sources of Data Used in this Study

Introduction

Because of the nature of a market baseline, an adequate characterization of the market requires data from many different sources. This is especially true when one is dealing with information tools that target many different audiences. Data are needed to define the scope of the target populations. The products must be described through analysis of documents and interviews. Each of these data sources contributes to an overall understanding of the market and the potential for a product to penetrate the market. This study utilizes data from a number of sources including one-to-one interviews with staff and selected buildings professionals, a review of the products, the development of a sampling frame, and a market actor survey. This chapter briefly describes the data sources and methods that are used.

One-to-one interviews with staff and building professionals

In conjunction with the start-up meeting, TecMRKT Works staff interviewed the project manager for the Lighting Exchange. In addition, interviews were conducted with each of the firms and organizations involved in developing the tools. These interviews lasted between an hour and two hours. In each case an effort was made to view the software or program that was being developed.

In addition, TecMRKT Works conducted 30 one-to-one interviews with building professionals in Northern California. For the most part, these interviews were conducted in person with representatives of firms that were randomly selected from firms that were identified as being active in commercial construction based on information obtained from F. W. Dodge. A few telephone interviews were conducted to verify certain types of information with persons who are knowledgeable about certain aspects of the market.

The interviews were conducted from March 20, 1999 through April 2, 1999, several weeks after the project initiation meeting. The interviews were completed in conjunction with the interviews for the Daylighting Design project. The length of interviews ranged from 30 minutes to an hour and a half. The portion of the interview devoted to discussing the Internet and the Lighting Exchange typically lasted 10 to 15 minutes.

The formal parts of the interviews were based on a protocol that was designed in advance (See Appendix B). The protocol was used as a guide and checklist. The interviews were done in a conversational style in which the interviewer pursued issues as they arose rather than strictly following the protocol.

Review of existing materials

TecMRKT Works completed a review of the materials that were available that describe the Lighting Exchange. In addition, we were able to review pre-delivery versions of the Lighting Exchange Tools. The products that are being delivered appear to be very close to the products we viewed. In addition, we reviewed some existing studies of the professional buildings market.

The construction of the sampling frame

One of the most difficult aspects of this project was establishing the sampling frame for the project. There is no list or set of lists that identify target audience membership. The target audiences were defined as architects, electrical engineers, lighting designers, energy consultants, contractors and others involved in commercial construction.

In 1998, there were 20,667 licensed architects in California. Of these, 78 percent were resident in California. In that same year, there were 8,098 licensed electrical engineers of whom 6,033 or 74 percent were California residents.

Because many architects may work exclusively in the residential sector, may work in allied occupations, may not be practicing architects, or may have retired, etc., the total number of architects is not a good estimate of the size of the architectural audience. Similarly, we know that many of the electrical engineers work outside the area of lighting design and for companies that are not involved in commercial new construction.

As a way of identifying companies that are directly involved in the commercial buildings market, we obtained the F. W. Dodge data for all construction projects that were in some stage of construction requiring a permit in California in 1997 and 1998. From the Dodge data, we identified a total of 42,500 commercial building projects for the two years or approximately 21,250 projects per year.

Because our goal was to identify projects where there was likelihood that the tools would be used, we selected all commercial, retail, office and warehousing projects that met the following criteria:

- New construction of 10,000 square feet or greater
- Projects that are additions or renovations to chain stores even if less than 10,000 square feet

- Projects in the category of office, retail, education, warehouse, manufacturing, leisure, transportation, municipal, religious or freight
- Projects in Northern California that are roughly north of a line drawn from Monterey to Fresno

After screening for these criteria, removing the duplicates, and cleaning the data, we identified 1908 projects of interest that were in some stage of completion in these two years. There were 919 architectural firms and about 100 electrical engineering firms of record for these projects. The number of projects completed by firms ranged from one to several hundred or more.

Table 1 shows the distribution of projects by type. The largest number of projects were offices, followed by retail stores, educational facilities, and warehouses.

Table 1 Projects meeting criteria by type in Northern California in 1997 and 1998

Project type	Percent of projects in Northern California
Office	42
Retail	21
Educational	10
Warehouse	7
Manufacturing	7
Leisure	6
Transportation	3
Municipal	2
Religious	1
Freight	1
Total	100

N = 1908

Table 3 shows the distribution of firms and the number of projects reported in the F. W. Dodge data. About 20 percent of the firms completed slightly more than half of the projects.

Table 2 Number of firms and number of projects in Northern California

Category	Number of projects	Number of firms	Percent	Number of projects	Percent
Small	1 – 2	784	83	927	48
Medium	3 – 5	113	12	417	22
Large	6 – 9	34	4	233	12
Extra Large	10 – 100	17	2	349	18
Total		948	101	1926	100

There are some significant limitations in the F. W. Dodge data. We know from our interviews that some firms have been involved in many more projects than are identified in the Dodge data. One likely explanation is that firms may be playing a supporting role and may not be listed as the firm of record. Another point is that the Dodge data is based on permitting applications and there may be numerous projects which are in the planning stages but for which permits have not yet been issued. There may also be projects that are planned but are delayed or not completed. Finally, F. W. Dodge may not necessarily obtain data for all projects.

As a source of sampling data, the F. W. Dodge data is somewhat problematic because it does not identify specific individuals except where the firm name carries the name of an individual who is a member of the firm. Thus, one of the problems in constructing a sampling frame based on this data is to identify individuals within firms from whom we could request an interview. Attempts at blind calling are almost always rebuffed.

We tackled this problem in several ways. First, we had a list of architects and their firms that we derived from the Construction Market Database (CMD), Inc.'s, *Profile on the Web Database* (http://www.cmdg.com/profile/search.html). We used the firm name from that database and matched it with the F. W. Dodge data. When we got a match we then recorded all names associated with that firm in our sample database.

As a second resource, we took the list of licensed architects and engineers from California and matched them to the F. W. Dodge data. Because licenses are issued to individuals and do not show company affiliation, we used the street addresses on the licenses and matched those with the addresses in the F. W. Dodge data. The license addresses vary with respect to whether they are a home address or a business location so we were able to match only some businesses in this way. Again, we recorded the name of any individual at an address as being associated with the firm located at that address.

Finally, from a previous PEC project we had two lists. The first was a list of all PEC participants and the second was an independent list of lighting designers that we generated thought contacts with lighting designers, the Yellow Pages, and Web sites.

We compared these two lists with the F. W. Dodge list. Where we were able to match a firm name, we copied those names to the sample database. We also included anyone from those lists who was from a firm that was not on the F. W. Dodge list but who was shown as being an architect, designer, or engineer.

The result was a sampling frame of approximately 2,200 firms. We believe this represents most of the firms who are active in Northern California. In many instances we had the names of multiple individuals within a firm. However, there is a catch. The architect lists identified licensed architects and did not list architecturally trained employees who are unlicensed. Most firms have a small number of licensed architects who are usually supported by one or more architecturally or technically trained staff. The ratio of licensed staff to trained but unlicensed employees may be several to one. A firm with 15 employees may have two or three licensed architects and 10 – 12 technically trained personnel. Potentially all of those staff members are members of the target audience. Although the technical staff may not be the main decision makers, they may significantly influence decisions as a result of their recommendations, and it is these staff who are most likely to use the tools to do the analysis. The only method we had for capturing these staff was through the PEC records. Many of these staff attend events at the PEC.

The construction of the telephone surveys

The survey instrument included questions about the respondents discipline and the type of firm, the type of designs the firm does, the firm's partners and clients, project decision makers, practices related to building and lighting design, decision criteria for different types of decisions, and a series of product related questions about current use of existing products and the potential for using the products, for example, the Internet products, being developed by PG&E. In addition we asked firmographic and demographic questions. A complete copy of the survey is included in Appendix C.

Multiple drafts of the survey were completed. The survey contains a very complex set of skip patterns. Once the survey was loaded into the CATI system it was reviewed by numerous reviewers to insure that the skip patterns were correct. Minor modifications were made to the survey after completing the first few interviews.

Survey administration

As part of the market assessment, TecMRKT Works contracted with the Pine Company to conduct the telephone baseline survey. The survey was conducted in May of 1999.

Ten attempts were made to contact a respondent before the respondent was dropped from the sample. Because we had multiple names of individuals at firms, survey takers were allowed to substitute the name of another person at the firm if they could not reach the person initially selected.

The survey is quite detailed and, depending on the respondent, took from 18 to 40 minutes or more to complete if the respondent did not take many of the skips. Respondents were screened to identify the types of decisions with which they were involved and then were asked questions specific to their decision making involvement of lighting and architectural design.

Table 3 shows the disposition of the sample. During the interviews we found that members of the target audience were very difficult to reach. The number of calls that went to the full ten attempts, 646, is a good indicator of the problems of reaching these individuals.

Processing and analyzing the data

The data from the CATI system were moved directly to SPSS. The raw data from the open-ended questions were placed in an Excel spread sheet. The responses for each open-ended question were reviewed and a series of categories established. Each response was then reviewed and assigned to as many as three content codes. These data were then merged into the SPSS data set.

Table 3 Disposition of the survey sample

Result	Number
Completed interviews	201
No such person	203
Disqualified because didn't meet requirements of the sample	78
Language problems	4
Computer tone on the telephone line	42
Disconnected telephone number	279
Initial refusal	293
Terminated at some point in the interview	42
Wrong number or type of business	69
Number of respondents receiving the maximum attempts	646
Sample problems (i.e., no number, no identifiable person, etc.)	364
Sample total	2,221

The primary modes of analysis were to produce frequency distributions, crosstabulations, means, medians, and multi-variable frequency distributions. Care was taken to select the appropriate cases for the analysis being considered.

Chapter 5 Characteristics of the Actors in the Sample

Introduction

The purpose of this chapter is to briefly describe the characteristics of the sample. The sample was drawn so that the respondents represent firms. An attempt was made to complete the survey in such a way that no firm was represented in the survey more than once.

Characteristics of the individuals in the sample

Eighty-nine percent of the respondents are male and 11 percent are female. Table 4 shows the distribution of the sample by years of experience and years in current position. The median number of years of experience in the field is 20 years and the median number of years in their current position is 10 years.

By profession, the largest group in the sample is architects (see Table 5). They are followed by electrical engineers and then by lighting designers and energy consultants. The ratio of architects to engineers in the sample is about the same as the ratio for the same two groups reported earlier in the licensing data. This suggests that at least those two groups are correctly represented in relation to each other. There is a smattering of persons representing other disciplines.

The respondents have a broad array of titles and responsibilities (Table 6). By title, the largest group are owners / partners. This reflects the fact that many architectural firms are small. The next largest group by title are architects. Engineers and senior engineers are about

Table 4 Percent of years of experience and years in current position

	Years of experience	Years in current position
less than 10	7	40
10 to 19	35	37
20 to 29	30	15
30+	27	7
Refused	1	1
Total	100	100

N = 201

Table 5 Percent of respondents by profession

	Percent
Architect	51
Electrical Engineer	19
Lighting Designer	11
Energy Consultant	10
Civil / Mechanical / Structural Engineer	4
Interior Designer	2
Electrical Contractor	2
Other	1
Electrician	<1
Total	100

N = 201

15 percent of the sample. Eighty-eight percent of those in the sample supervise another person.

The most typical level of education is a bachelor's degree (Table 7). An equal number of people have education beyond the bachelor's degree. Seventeen percent of the respondents had less than a college education.

Table 6 Occupational title of respondents

	Percent
Owner / Partner	34
President	11
Senior Manager	2
Manager	8
Senior Engineer	7
Engineer	8
Senior Architect	3
Architect	15
Senior Designer	2
Designer	4
Other	6
Total	100

N=201

Table 7 Respondent's level of education

	Percent
High school or less	2
Associates degree	4
Some college	11
Bachelor's degree	41
Bachelor's degree plus some additional education	15
Master's degree	20
Master's degree plus additional education	4
Ph.D. or equivalent	2
Refused	1
Total	100

N=201

Characteristics of the Firms

The types of firms represented in the sample somewhat mirror the occupation of the respondents. More than half of the firms represented in our sample are architectural firms (Table 8). Another 19 percent are engineering firms. Lighting and interior design firms make up about 10 percent of the total

More than two-thirds of the firms have a single location although eleven percent had offices in four or more locations (Table 9).

Table 8 Principal business of respondent's firm

	Percent
Architectural design	43
Engineering-Electrical / Lighting	16
Engineering-HVAC and other	3
Other	9
Lighting Design	7
Energy Consulting Firm	3
Contractor-Electrical / HVAC and other	3
Interior Design	3
Manufacturer	2
Property Owner / Management	1
Total	100

N=201

As the reader might surmise from the employment information, the number of projects completed by the firms in this sample range from a few to nearly a thousand. About a third of the firms (Table 11) had ten or fewer projects in the last twelve months. More than a fifth had 80 or more.

We had anticipated that some firms might do a significant amount of business outside of Northern California. However, the data suggest that for most firms the majority of their projects are in Northern California.

The median number of employees belonging to firms represented in the sample is less than ten. Fourteen percent of the firms represented in the sample had 100 or more total employees.

Firms in the sample most commonly had completed low-rise office and retail structures other than big box stores and educational buildings. More than half of the firms had completed warehouse structures. Just under a half had completed big box retail structures and manufacturing facilities. Over a third of the firms had completed health facility projects and office buildings of four stories or more. Eighty percent of the firms were involved with low-rise office projects.

Table 9 Number of offices that the respondent's firm has

	Percent
1	69
2	13
3	7
4	2
5-9	3
10+	6
Total	100

N = 201

Table 10 Percent of total company employees and employees in respondent's office

	Employees firm wide	Employees at respondent's office
Less than 10	54	58
10 to 19	16	18
20 to 29	8	8
30 to 49	4	4
50 to 99	4	7
100 to 499	7	4
500+	7	1
Refused	<1	<1
Total	100	100

N= 201

Table 11 Location and number of projects

	Total projects	Northern California Projects
less than 10	32	38
10 to 24	29	28
25 to 79	17	16
80+	22	18
Total	100	100

N = 201

One of the issues that arises in this market is the relationship between firms. Building professionals do not necessarily work directly for building owners but may take direction from other building professionals. We asked the respondents how often they worked for a variety of different clients. Nearly all of the firms had worked directly for a building owner. Almost two thirds had completed projects with developers and over half had completed projects with general contractors and almost half with architectural firms. Slightly more than a third of the firms had done work for retail chains and slightly less than a third had completed projects with engineering firms.

Table 12 Percentage of firms that completed at least one project of the building type

Type of structure	Percent of firms completing at least one project
Low-rise office 1 - 3 floors	80
Other retail	66
Educational buildings	59
Warehouses	53
Big box retail	48
Manufacturing facilities	42
Health and hospital facilities	39
Higher-rise office 4+ floors	35
Other public buildings	57
Other commercial / industrial structures	62

N=201

Summary

This chapter describes individuals and the firms represented in the sample.

Table 13 Percent of firms having different types of clients

Client	Percent of firms at least one client which is
Building owner	87
Developer	64
General contractor	59
Architectural firm	46
Retail chains	34
Engineering firm	28
Other	28

N = 201

- The largest group in the sample is architects and the next largest group is engineers.
- The most frequent occupational title among the respondents is owner / partner which reflects the many small firms in the sample as well as the way in which the sampling frame was constructed.
- The most common level of education is the bachelor's degree. About the same number of people have additional education through and including a master's degree with some additional education.
- The size of the firms range from the vary small with one or two employees and a few projects through large firms with multiple offices, hundreds of projects, and hundreds of employees.
- The firms in the sample primarily do business in Northern California.

- The firms complete projects for a broad range of building types. The type of structure common to most firms are low-rise offices, educational buildings and retail stores that are not of the big box type. The number of firms completing big box projects is about 48 percent of the total sample.
- Nearly every firm works directly for building owners but most complete projects for a wide variety of other actors including developers, contractors, retail chains and other architectural and engineering firms.

Chapter 6 The Use of the Internet by Market Actors

Introduction

This chapter describes what we have learned about the target markets by analyzing data concerning market actors' current use of the Internet. This chapter addresses several basic questions.

- What percentage of building professionals currently use the Internet?
- What are the characteristics of building professionals who use the Internet and how do they differ from those who do not use the Internet?
- For those who use the Internet, how much do they use the Internet?
- What types of information do current users seek when they use the Internet?
- What percentage of users use similar sites such as the PG&E PEC site and the inter.Light site?

Access to the Internet is not a barrier to the potential use of the Lighting Exchange

The use of the Lighting Exchange is dependent on access to and use of the Internet by building professionals. If building professionals are not yet Internet users then this potentially constitutes a barrier to the use of the Lighting Exchange. Thus, an important question is to what extent Internet use is now a part of the practice of building professionals and the extent to which building professionals use the Internet in their daily activities.

In the one-to-one interviews, building professionals repeatedly told us that an important use of the Internet and e-mail was transferring files electronically between design groups. Everyone we talked to in the one-to-one interviews said that they were using e-mail and the Internet.

In the survey we asked respondents about their use of e-mail and the Internet. Eighty-nine percent of the respondents said that they use e-mail and 85 percent said that they use the Internet in relation to their work.

We examined the use of the Internet by profession. In doing so we limited the professions to four types for which there is sufficient data, architects, lighting designers including interior designers, electrical engineers, and energy consultants. We included four engineers from other engineering disciplines (civil and mechanical) with the electrical engineers. We also included three structural engineers with the architects.

There is no statistically significant difference in Internet use by profession although architects are slightly less likely to be Internet users than others.

Similarly, we examined Internet use by the number of projects that the respondent's firm had completed in Northern California. There is no statistically significant difference by size of firm as measured by the number of projects.

Table 14 Percentage of Internet users by profession

Architects	Energy Consultants	Electrical Engineers	Lighting designers
82	89	88	93

N = 201

We also briefly explored the characteristics of those who do not currently use the Internet. Of the 15 percent of respondents (30 cases) who are not currently Internet users, 70 percent of these or 10 percent of all respondents say that they will be Internet users within the next two years. The remaining 30 percent (five percent of all users) say that they are not likely to become Internet users within the next two years.

When we examined those who said that they were not likely to become Internet users (nine cases), we found that the median number of total projects for their firms was slightly smaller (see Table 16), and that their median levels of experience were much greater than the median for respondents from all firms. We also found that these individuals were owners or officers within their firms.

Table 15 Percentage of Internet users by number of projects completed in Northern California

Less than 10	10 to 24 projects	25 to 79 projects	80+ projects
84	84	84	89

Chi square = .838 and p > .83 n = 149

Those who are not currently Internet users but intend to start using the Internet in the next two years are also typically from smaller firms and have both greater years of experience in their current position and greater overall experience than respondents in the sample as a whole. In contrast to those who did not see themselves becoming Internet users in the near term, there is more variation in the characteristics of the respondents in this group. This group includes people from larger firms and individuals with less experience. There was a tendency for these individuals to be at the higher levels within their companies.

Table 16 Selected characteristics by Internet Use Status

	Median for those who are not likely to become users in the next two years	Median for those likely to become users in the next two years	Median of all respondents
Total number of projects for the firm	10.0	13.5	12.0
Number of projects in Northern California	7.5	12.0	20.0
Years in current position	22.0	13.0	10.0
Years doing this kind of work	37.0	24.0	20.0

Patterns of use and the content users access on the Internet

Figure 13 shows the hours per week of use of the Internet for those who claim work-related use of the Internet. The majority of respondents, 52 percent, use the Internet a small amount, from one to three hours per week, in relation to work. At moderate levels of usage, 25 percent and 12 percent of respondents say that they use the Internet four to five hours per week and six to nine hours per week respectively. About 11 percent of users say they use the Internet fairly heavily, ten or more hours per week. Thus, typical users say they use the Internet for three to seven percent of a 40-hour work week.

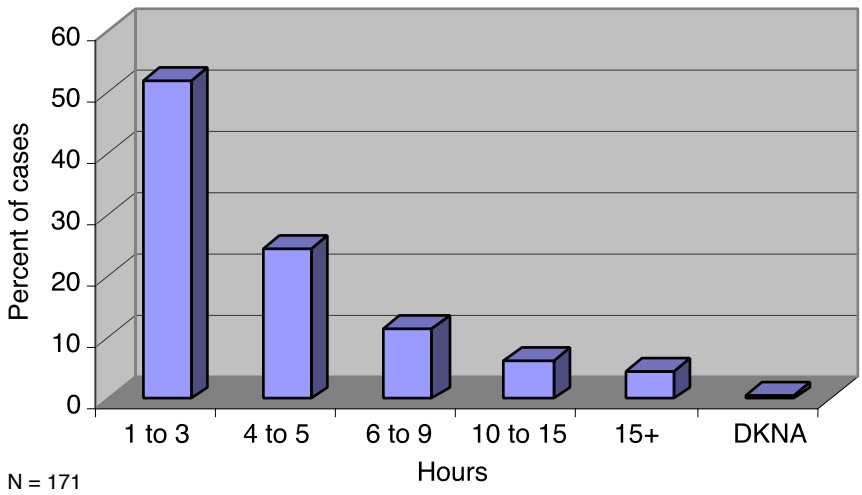


Figure 13 Hours of Internet use per week in relation to work

We asked current Internet users how they use the Internet. Eighty-nine percent of these respondents (Table 17) say that they seek product information and 86 percent visit manufacturer Web sites. Sixty-seven percent replied that they seek design information while over half said that they use the Internet to keep abreast of information in their field. Fifteen percent said they use the Internet to participate in professional discussion lists.

If the current reasons for using the Internet are an indicator of future use patterns, the fact that so many users seek product information suggests that the search tools in the Lighting Exchange are likely to receive considerable use. By the same token, if participation in professional discussion lists is an indicator of potential interest in the Lighting Exchange Dialog, then these data suggest that interest in the Dialog will be more limited.

Table 17 Internet users reasons for using the Internet

	Percent
Locate product information	89
Visit manufacturer Web sites	86
Locate design information	67
Get information about current events in your field	55
Seek information about competitors	30
Participate in professional discussion lists	15
Other reason	24

N = 170

Figure 14 shows the distribution of reasons for using the Internet by profession for current users. By looking at the distribution of professions in each column we can see how professions vary in their use of the Internet. This graphic shows us that energy consultants are less likely to go to manufacturer sites and to seek product data than other professions. This may be because they tend to deal with older buildings rather than new construction and because they tend to be more repetitive in what they do.

Architects are the most likely to use the Internet to get design information followed by electrical engineers. Lighting designers and energy consultants are the least likely to use the Internet as a source of design information. The differences by profession, in terms of getting design information, is statistically significant ($p = .027$). Other relationships were not significant at the .05 level.

Energy consultants and lighting designers are more likely to use the Internet to get information about current events in their field than are architects and electrical engineers. Architects are more likely to seek information about competitors than other groups. All groups are about equally unlikely to participate in discussion groups.

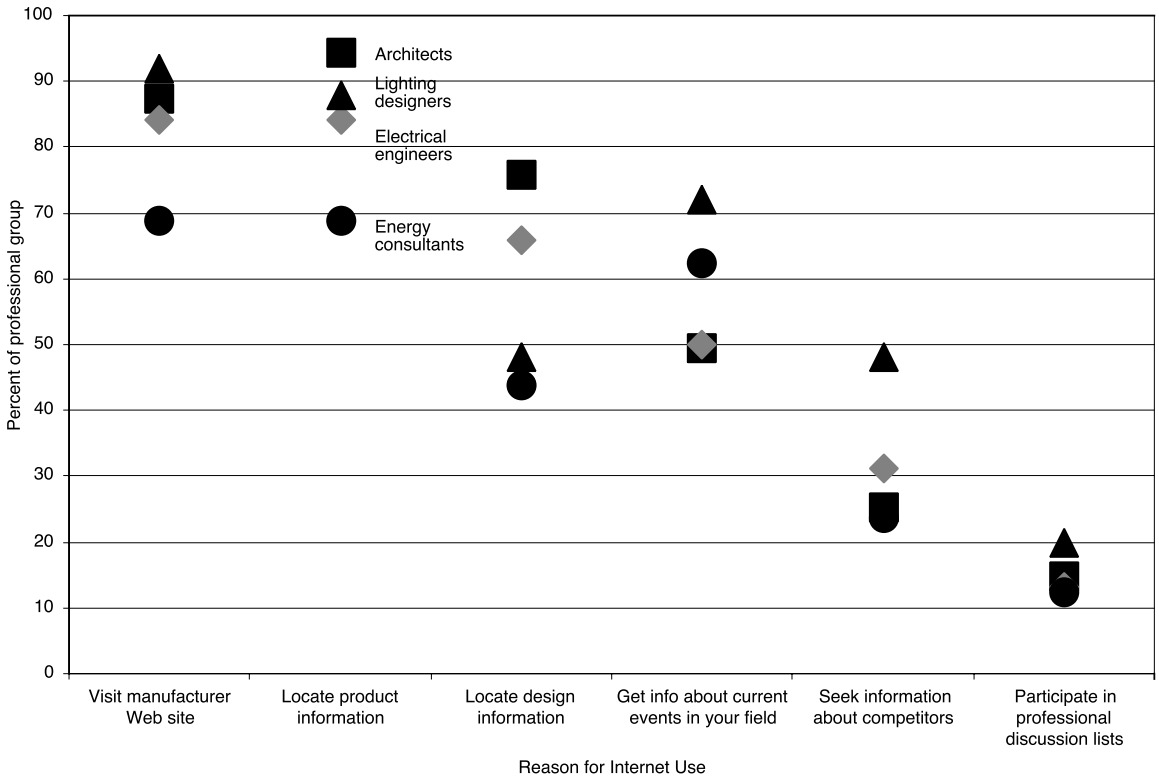


Figure 14 Percent of professionals by types of Internet service used

We can also look at current patterns of Internet use by size of firm as measured by the number of projects completed. Several things are immediately obvious from Figure 15. Smaller firms are more likely to use the Internet to obtain information from manufacturers and locate product information than larger firms. This may be because larger firms have library resources that smaller firms do not have. It is also clear that the larger firms are less likely to use the Internet to find design information and to obtain information about current events in their field. All groups are equally likely or perhaps unlikely to seek information about competitors. As we have already pointed out, participation in discussion lists is generally low but professionals from the smaller and larger intermediate size firms are more likely to participate than are members of other size firms.

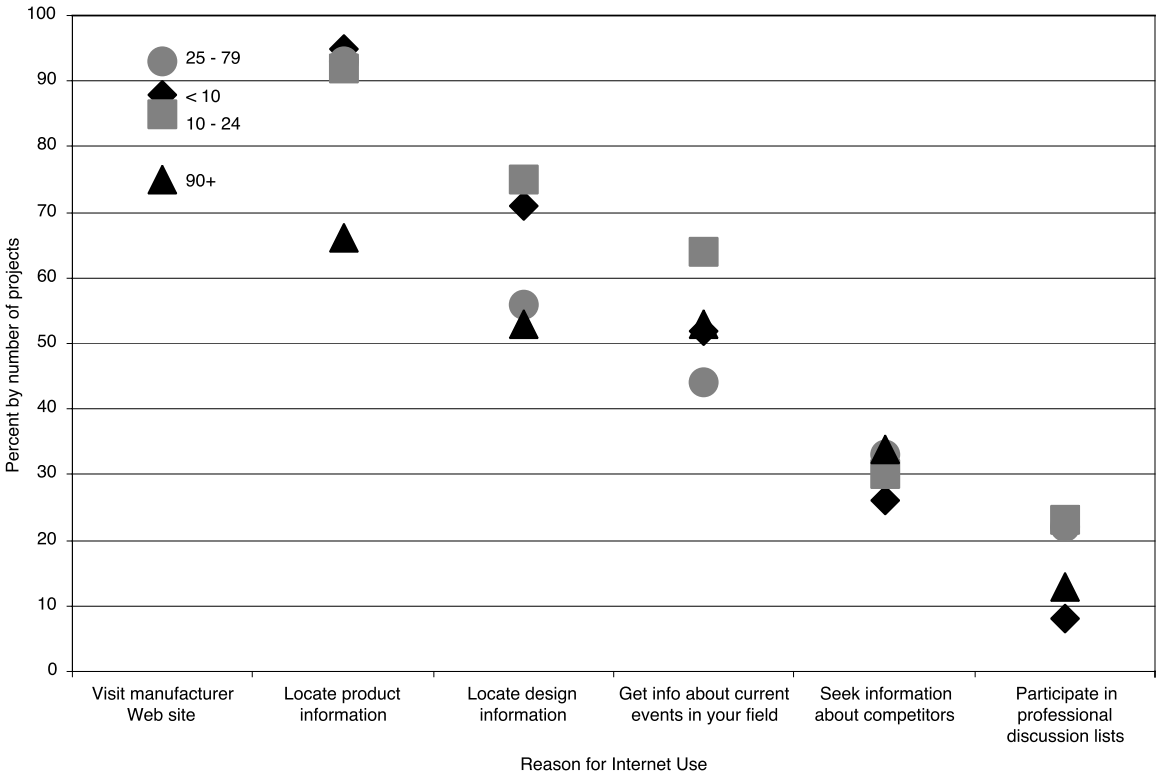


Figure 15 Types of Internet use by size of firm

Use of existing sites

Another way of measuring Internet activity levels is to see how potential users make use of analogous sites. In the survey we asked the respondents specifically about two sites, the inter.Light site and PG&E's Pacific Energy Center site.

The inter.Light site is designed as a product locator site. Users search the inter.Light database for a specific type of product and the search returns a list of manufacturers with products of that type. If there are hyperlinks to the manufacturer, the user can go to the manufacturer's site and search for the product. It is the closest analog that we have to the product search capabilities that will be available through the Lighting Exchange.

We asked those who used the Internet in relation to work if they were aware of the inter-Light site. About 20 percent of Internet users in the survey said that they were aware. Of those who were aware of the site, 65 percent said that they had used the site. This is about 10 percent of the total sample.

It is difficult to make a concrete judgement about the level of awareness for this site. We do know that the level of awareness in this audience is about four times higher than in a similar audience in the Northwest. We also know that this site has been heavily promoted for three years running at Light Fare and we know that in recent months the site has been receiving about 500,000 hits per month. The site has been in existence for about four years.

The awareness of PG&E's Pacific Energy Center site is somewhat higher than that of the inter.Light site. Forty-five percent of the respondents were aware of the site and of those who are aware of the site, 56 percent or about 21 percent of all survey respondents said that they had used the PEC site.

Table 18 shows the distribution of those who have visited the site by the number of visits. Nineteen percent of the users have visited the site five to ten times and 16 percent said that they visited the site more than ten times.

Table 18 Number of visits to the PG&E/PEC Web site

	Percent
1	14
2 to 4	51
5 to 10	19
10+	16

N = 43

We examined who the users of these two sites may be (Table 19). For the inter.Light site it is the lighting designers who are most aware of the site and it is the lighting designer and energy consultants who are most likely to use it. Architects and electrical engineers are least likely to use the site. The difference is probably inherent in the roles of the different groups. In various studies we have had people tell us that typically, lighting designers are more aesthetically oriented and often look for the out of the ordinary types of fixtures. The inter.Light site has recently been trying to add more data about unusual fixtures. Engineers are more oriented to the electrical aspects of a project and may be more oriented to the specifications. The inter.Light site is really more specification oriented and this could explain the differential in use although not the differences in awareness.

For the PEC site, it is the energy consultants who are most aware of the site and most likely to use it. Architects are least likely to use the PEC site. The PEC tends to be more technically oriented than aesthetically oriented and this could account for some of the differences.

Table 19 Awareness and use of the inter.Light and PEC sites by survey respondents

	inter.Light site				PEC			
	Percent Unaware	Percent aware but do not use	Percent aware and use	Number of cases	Percent Unaware	Percent aware but do not use	Percent aware and use	Number of cases
Architect	92	2	6	87	63	23	14	87
Electrical engineer	74	10	16	38	55	16	29	38
Lighting designer	60	20	20	25	40	16	44	25
Energy consultant	75		25	16	25	25	50	16

The chi-square for the inter.Light site is 22.608 with 8 df and p = 0.004. The chi-square for the PEC is 19.612 with 8 df and p =0.012

Summary

Based on these observations we draw several conclusions:

- Internet use is substantial in the building professions with 85 percent of respondents saying they use the Internet for work related purposes.
- There are no statistically significant differences in use of the Internet by profession.
- There are no statistically significant differences by size of firm as measured by the number of projects completed in Northern California.
- If non-Internet users carry through with their intentions to become Internet users, more than 96 percent of the target audiences will be Internet users within two years.

Based on these data, we conclude that access to the Internet is not a barrier to the potential use of the Lighting Exchange. A further implication of this is that the PEC can focus on creating awareness of the tools and training users on them rather than focusing on general Internet training.

In terms of how the Internet is used, we can draw the following conclusions:

- High percentages of the target audiences say they access product information (89 percent) and visit manufacturer sites (86 percent) when they use the Internet.
- Only about 15 percent say that they participate in discussion groups.

The fact that the market audience already searches for product information and visits manufacturer sites bodes well for the success of the Lighting Exchange search tools. The lack of use of discussion groups suggests that the PG&E may have to market the Dialog fairly heavily. It is clear from other studies that marketing will be essential in order for the Lighting Exchange to be successful.

There at least two indicators of awareness of PG&E Internet activity:

- The target audience is highly aware of the PEC Internet site and about 21 percent of the target audience has visited the site.
- Seventy percent of those who have visited have visited four times or more.

Thus, PG&E already has some presence on the Internet upon which it can build.

About 10 percent of the target population has used the inter.Light search site. The inter.Light site is a product referral site which is directly analogous to the Lighting Exchange Search Tools site. However, this site does not provide product data as is planned for the Lighting Exchange.

There are differences by profession in who is aware of the two sites and who uses them. Energy consultants are most likely to be aware of and use the PEC site. Architects are the least likely to use it. Lighting designers are the most aware of the inter.Light site but energy consultants are the most likely to use it. Energy consultants are the next most aware but they do not use the site very much.

Chapter 7. What Market Actors Say about Their Potential to Use the Lighting Exchange

Introduction

In this chapter, we examine what market actors say about whether they will use the Lighting Exchange. We attempt to answer six questions.

- What do market actors say about how interested they are in using the Dialog and Tools in the Lighting Exchange?
- Are there differences in levels of interest in the Lighting Exchange by selected characteristics of the actors?
- What motivates market actors' interest in the Lighting Exchange?
- What might prevent market actors from using the Lighting Exchange?
- What content interests do market actors have that might be embodied in the Lighting Exchange?
- Do the content interests vary with the characteristics of the actors?

Actors' interest in the Lighting Exchange

We asked the participants directly about their interest in a product search site and a moderated discussion list operated by PG&E. Respondents were asked if they thought such sites would be of significant interest, some interest, little interest, or no interest to them. For both types of sites, almost 80 percent or more of the respondents said that the sites would be of some or significant interest. In Table 20, we can see that the product search site elicited slightly more positive interest than did the moderated discussion list.

Table 20 Levels of interest in two types of Internet services

	Product search site	Moderated discussion list
	N = 190	N = 191
Of significant interest	35	26
Of some interest	51	50
Depends	2	2
Of little interest	8	13
Of no interest	4	8

N = 149

We examined the data to see how interest in the two sites might vary by other selected characteristics such as profession and size of firm. We found no significant differences in interest by either profession or size of firm. As a result, we have not shown these results in a table.

For those who expressed positive interest in the Dialog on the Lighting Exchange site (moderated discussion list), we asked what motivated their interest in the tool. Respondents offered their responses without the aid of pre-established categories. When we coded their responses (Table 21), we found that the most often cited reason for using the site was to capture both general information and technical data. Respondents also see the site as a way of gaining information to improve their designs and in particular they see the site as offering the opportunity to identify a range of solutions from among which they can choose.

Many respondents also see the site as a form of continuing education. A potentially positive feature of the site for many people is the opportunity to get multiple points of view and expertise. Closely related to this is the opportunity the site presents to keep abreast of design trends and new products. Many respondents feel that if the site is well done, it will save them time by providing a central repository of information.

Table 21 Motivations for using site such as the Lighting Exchange Dialog

Category	Percent of response
Get general information and / or technical data	37
The potential to improve designs and to see alternative solutions to the same problem	26
Improve personal knowledge and skills	20
Access to expertise from several sources	18
Ease of use and the ability to locate information via a single site	11
The ability to save time	11
To keep up with trends and technology in the field	11

N = 161

We asked those who expressed little or no interest in the moderated discussion site about their lack of interest. The following reasons were mentioned by two to five respondents.

- A few people said that discussion lists just did not fit with what they do.
- A similar number said that they simply do not have a need for it.
- At least a couple of respondents felt that they were too busy to use it.
- Several people felt that the responses would be too specific to be of general interest or that it would be a waste of time.
- Another group said that they hired consultants to provide them with "that type of information."
- At least two respondents said they had their own in-house expertise and did not need the information.
- Perhaps the most honest and pointed comment was that, “We’re driven by the market, not by what should be done. We consult, that's about it!”

Those who expressed positive interest in the Lighting Exchange product search site expressed a number of motivations for using it. The primary attraction of the site was the perceived ability to get information quickly (Table 22). Many of the respondents saw it

as a way to reduce the amount of time they spend getting information. From their responses, it is clear that a number of potential users are comparing the current situation where they have to visit multiple sites or use catalogs and situations with a single well organized electronic site. They view the on-line search capability as a way of increasing their ability to get things done. In other words, they see the potential for reducing search costs. However, this does not mean that the savings from reducing search costs will necessarily be invested in locating additional information. The savings may be used to do other tasks.

Table 22 Motivations for using a site such as the Lighting Exchange Search

Category	Percent of response
Obtain information more quickly	47
Obtain a broader range of information, more information and better information	46
Product research	12
Improve the quality of the design	10
Understand energy usage	4
Do not have to keep catalogs and other types of information	3
Personal education	3
Other	5

Almost as many respondents indicated that the site might increase the range of information that they consider and increase the quality of the information they use, especially in terms of the information being up-to-date. Having to deal with multiple sources of information imposes limits on the number of sources which respondents can search, which in turn limits the number of options to which they are exposed. Many respondents believe that this site has the potential to increase the number of sources, and therefore the number of choices they have within a particular equipment type because they will obtain more information at a lower cost than before.

Several people thought that the search tool might lead them to do more comparative product research. That is, the tool might encourage consideration of different types of equipment options and in turn they suggested that this might lead to improvements in the overall quality of designs.

A small percentage of respondents mentioned energy usage as an issue. Several people saw the site as an opportunity to rid themselves of the chore of having to maintain catalog libraries. A few respondents saw the site as a way to educate themselves.

We asked those who expressed little or no interest in the Lighting Exchange search capabilities for their reasons for their lack of interest. There were essentially two responses to this question. The first, which was offered by about ten respondents was

that the site was not relevant to them. The second offered by about five respondents was that they had other sources of similar information.

Finally, we asked a general question of respondents concerning what they might like to see on an Internet site oriented to building professionals. We got a list of sixteen items most of which most were mentioned between two and four times.

One person requested equipment pricing information on the search site. It is probably not realistic to believe that this is an option.

Four people suggested hyperlinks to manufacturer and other allied sites such as Neola Park. Another suggestion was that the building codes be included on the site or that links be provided to them. There was a request for weather data to be included in the site but this interest could be served by providing a link to an existing site. The PEC site does have some links to other sites but the suggestion is that more would be desirable.

The need for Title 24 information and / or a Title 24 calculator was mentioned by four people.

With regard to tools, the need for payback analysis tools was identified with the HVAC area specifically cited in this regard. The PEC currently has the Cool Tools Package which can be used to assess HVAC system requirements. The Lighting Exchange is to include a retrofit calculator and an economics calculator.

Three different people mentioned the need for the PG&E service entrance design standards to be available and the need for an associated list of engineering contacts within PG&E. There is some unhappiness among at least some building professionals with respect to their interactions with PG&E involving the design and implementation of hook-ups. This is an issue that came up in the one-to-one interviews and one where at least a few people have strong feelings.

It was suggested that rebate information ought to be available. In fact, this is already on the PG&E site.

It was suggested that the Web site could provide lists of professionals. Also mentioned was the need for energy efficiency information and alternative energy information.

Finally, it was suggested that the site might provide viewcam-type views of interior spaces.

Content Interests of Users

We asked the respondents to identify the types of information in which they would be interested if PG&E were to provide an Internet product search site. Respondents were provided with a fixed set of categories. Table 23 shows the distribution of respondents by type of product. There are fairly high percentages of respondents, about 75 percent interested in fixtures, controls, and lamps. About sixty percent of respondents were interested in ballasts and glazing. A smaller percentage expressed interest in sustainable materials.

Table 23 Percentage of respondents interested in types of information

	Percent
Fixtures	81
Lamps	72
Controls	71
Ballasts	60
Glazings	57
Sustainable materials	48

N = 171

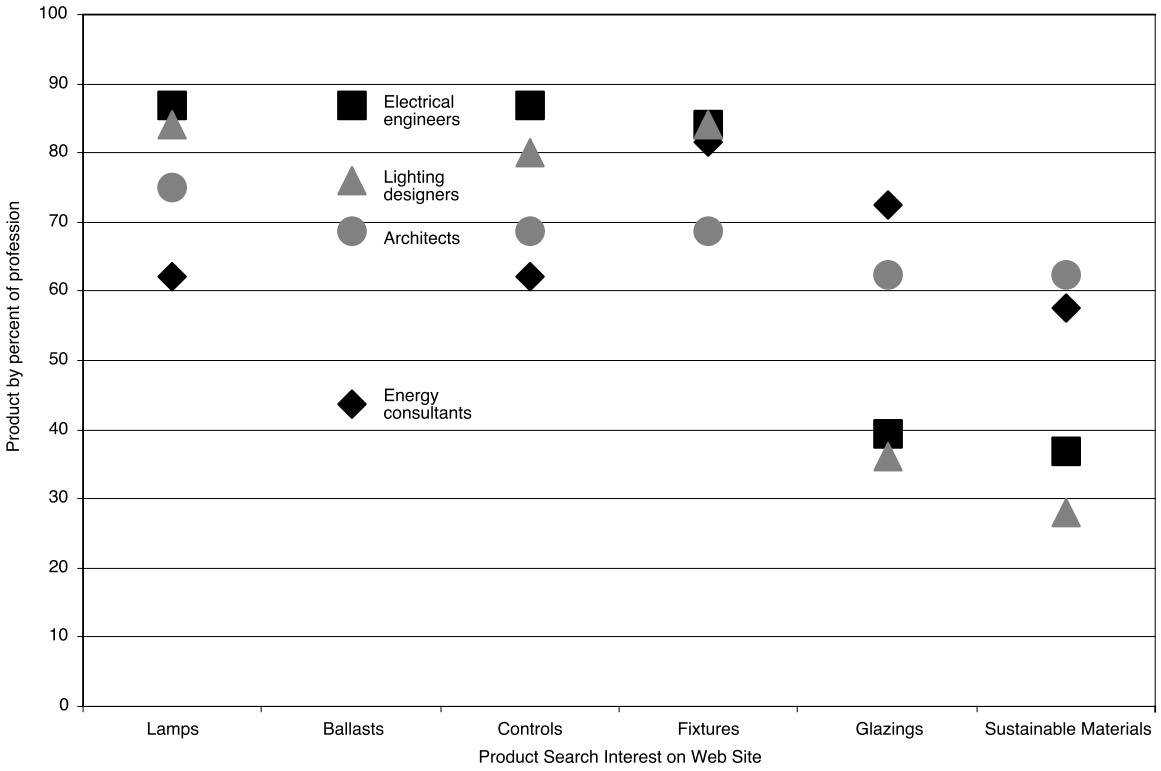


Figure 16 Professional interest in different categories of product presented on a Web site

As we expected, we found that professionals differed in the types of products that were of interest to them on a Web site (Figure 16). Electrical engineers were most interested in lamps, ballasts, controls and fixtures and least interested in glazing and sustainable materials. Lighting designers exhibited a similar pattern of interest although they had a greater interest in fixtures than in lamps, ballasts and controls. Again, this may reflect

their aesthetic interests. Lighting designers expressed lower overall interest in a product Web site than did the engineers.

The percentage of architects interested in having the different product categories on the Web site was about the same (60 to 75 percent) across each of the categories of content. Energy consultants were most interested in glazing and sustainable materials, strongly interested in fixtures, interested in controls and expressed the lowest level of interest among the professionals in lamp and ballast product information. The latter finding may be explained by the fact that energy consultants often work with retrofit projects where they may tend to repetitively specify the same lamps and ballasts.

Summary

Based on the data in this chapter we conclude that:

- Eighty percent or more of the respondents expressed interest in concepts that embodied the Lighting Exchange search tools and the Lighting Exchange Dialog.
- There was slightly greater interest in the product search tools than in the Dialog.
- This difference in interest is consistent with the revealed preferences with respect to the types of materials that users currently seek on the Internet.

We examined what motivated potential use of these two sites.

The key motivations for interest in the Dialog are the potential to:

- Obtain general information, technical data, and insight into trends in the field.
- Get alternative solutions and diverse feedback from experts.

The key motivations for potentially using the product search tools were to:

- Reduce the time and effort expended for information searches from current levels.
- Perform searches that yield a greater number of options for the same or nearly the same level of effort.
- Use searches to research significantly different alternatives that might lead to better designs.

There were differences in the levels of interest and content interests of the target audiences with respect to products that might be included in the product search tools.

Based on the data in the survey and the commentary in the interviews, we believe that the product search tools have the potential to become an extremely important resource in the building professions. The Dialog is also likely to meet with success.

However, these products will need to be marketed to building professionals before they will become widely used.

Chapter 8 Tracking the Transformation of the Market

Introduction

One of the goals of the research is to identify methods for measuring the transformational impacts of the Lighting Exchange Tools. In this chapter we sketch out a methodology for measuring change.

Conceptual underpinnings

A basic design for conducting a market transformation assessment for a project such as this one is presented in Chapter 3 (see Figure 12). This design calls for a series of measurements to be made over time starting with a market and program baseline and a market characterization in a comparison area. This document represents the Time 0 measurements for the market and program baseline in Northern California. If the market transforming effects of this program are to be assessed based on this model, then periodic data collection activities are required once the programs are in the field and marketing efforts are underway.

There are two issues that need to be resolved with this design. The first is whether the measurements should be based on a panel design in which the same respondents are contacted at later points in time or whether measurements are to be drawn from a new sample each time. The study would be stronger with a panel design because changes are tracked for specific firms and individuals and direct linkages can be made between changes in behaviors and adoption and use of program products. In a discrete sample design (different sample at each point in time), these linkages will have to be inferred. The panel design requires tracking and contacting the same respondents at subsequent points in time. This can be an expensive and time consuming process. In a panel design there is also the issue of respondent willingness to be interviewed more than once or twice and there is the issue of dealing with attrition among respondents.

The second issue with this design is the identification of a comparison area. From other studies we know that firms in the Northwest are quite similar to those in Northern California but the Northwest Energy Efficiency Alliance and the Lighting Design Laboratory are operating in that area and may very well encourage the adoption of these or similar tools. The Lighting Design Lab has its own Web site and the inter.Light Site, which is a competitor site, is based in the Northwest. Thus, the Northwest is probably not a good area for comparison. Other areas of the country that might be used for comparison purposes are Texas or the Washington, D.C. area. There is high growth in both of these areas and both have similar types of high technology industries and large numbers of architects.

It should be kept in mind that these tools may impact the market outside of California. Architecture is practiced regionally, nationally, and internationally. To the best knowledge of the investigators, there are presently no plans to limit the distribution of the tools to Northern California. If the tools are well received, it is likely that building professionals outside of California will become aware of the tools and some may become users of the tools. These cases need to be taken into account.

What needs to be measured and tracked

In order to determine if the Lighting Exchange Tools are influencing the market, the following categories of data need to be collected either continuously or at discrete points in time in the future:

- Awareness of the Lighting Exchange Tools and similar tools
- Contacts with sources of information and training with respect to the tools
- People / firms that have tried Lighting Exchange Tools
- People / firms that are regularly using the Lighting Exchange Tools
- Proportion of projects in which people are using the tools
- Motivations for using the tools
- Characterization of selected professional design practices in key selected areas (see below)
- Objective measures of building efficiency from California Title 24 data
- Firmographics

These data can be collected through a tracking system and participant and non-participant surveys. Table 24 lists the categories of data by the participant status.

Why the data are important

Part of what needs to be known in order to evaluate the market transformation effects of the tools is the amount of marketing that is done and the audiences to which marketing efforts are targeted. Individuals and firms must be aware of the tools in order to adopt them. It is also important to know (by tracking if possible) what information and training people may have received with respect to the tools and the source of that information. One of the features of the Lighting Exchange is a registration system. The registration information is vital for efficient follow-up. This information can be analyzed and compared to the baseline to understand who the adopters are and who is responding to any marketing efforts on a continuing basis.

At various future points in time, surveys can be used to determine:

- who is aware of the tools
- why people have or have not adopted the tools
- how much the tools are being used

Because of the flexibility of the Internet, periodic on-line surveys of users can be conducted. Ultimately the question is one of whether the tools cause design practices to change. Questions about design practices can be repeated from survey to survey and changes in the levels of practice can be tracked against use of the tools. If the tools are influencing the market, then there should be greater levels of change in practice among those who have used the tools than among those who have not.

In our companion study of the Daylighting Design Tools, we collected a great deal of information about building and lighting design practices. That data is not presented in this study. However, the data are available for these respondents. In future surveys of Lighting Exchange users and non-users it is important to inquire about a selected set of those practices. This will allow a comparison to be made with the current baseline and it will allow a comparison of the change in practices of users and non-users. Also, it may be useful to investigate the use of Title 24 filings as a way of tracking changes in the building industry. Assuming that the Lighting Exchange is successful, the hypothesis is that Lighting Exchange users will have modified their practices more than non-users.

Table 24 Categories of data to be collected by participant status

		Data to be collected continuously or at intervals		
	Data in the current baseline (This report)	Users (N. California and elsewhere)	Non users (N. California)	Non users in a comparison area (Texas / Virginia)
Awareness of Lighting Exchange and similar tools	Yes	Internet or telephone survey	Internet or telephone survey	Internet or telephone survey
Contacts with sources of information and training with respect to tools		Internet or telephone survey		
People / firms who have tried the Lighting Exchane	Assumed to be zero	Registration system	N/A	N/A
People / firms that are regularly using the Lighting Exchange Tools (percent of projects)	Assumed to be zero	Registration system	N/A	N/A
People / firms are regularly using similar tools (percent of projects)	Yes	Internet or telephone survey	Internet or telephone survey	Internet or telephone survey
Motivations for using the Lighting Exchange Tools	Yes	Internet or telephone survey	N/A	N/A
Motivations for using the similar tools	Yes	Internet or telephone survey	Internet or telephone survey	Internet or telephone survey
Professional design practices in key selected areas	Yes	Internet or telephone survey	Internet or telephone survey	Internet or telephone survey
Extent to which practices have been influenced by Lighting Exchange Tools	Not applicable	Internet or telephone survey		
Title 24 data for efficiency of buildings	Not applicable	Data from Title 24 compliance	Data from Title 24 compliance	Not applicable
Firmographics	Yes	Internet or telephone survey	Internet or telephone survey	Internet or telephone survey

Chapter 9 Key Findings and Lessons

In this report we have attempted to assess the market potential for the PG&E's Lighting Exchange. The Lighting Exchange is a set of Internet tools that provide information and analytic capabilities to professionals in the building sector. The goal of the Lighting Exchange is:

- to increase the availability of data related to lighting design
- to reduce the amount of effort required of building professionals to obtain the data they need
- to increase the range of design and equipment options that are considered
- to improve the energy efficiency of commercial buildings

This report provides information about the market and the market potential for tools provided through the Lighting Exchange. The Lighting Exchange is comprised of several tools. The product search capability, Lighting Exchange Search, allows users to obtain manufacturer data for lamps, ballasts, controls, and fixtures. In addition the Lighting Exchange Tools provides a retrofit calculator and an economic calculator designed to allow design professionals to evaluate their options.

The Lighting Exchange includes a moderated discussion list, Lighting Exchange Dialog, which allows users to ask questions and exchange information about equipment and design options and to receive technically correct and comprehensive responses very quickly. The responses are stored in a database that allows users to access the responses to previously asked questions. The database serves as a repository of information about good design practice.

Key findings about the market

Internet use is substantial in the building professions with 85 percent of respondents saying they use the Internet for work related purposes.

If non-Internet users carry through with their intentions to become Internet users, more than 96 percent of the target audiences will be Internet users within two years.

Based on these data, we conclude that access to the Internet is not a barrier to the potential use of the Lighting Exchange. A further implication of this is that the PEC can focus on creating awareness of the tools and training users on them rather than focusing on general Internet training.

High percentages of the target audiences say they access product information (89 percent) and visit manufacturer sites (86 percent) when they use the Internet.

Only about 15 percent say that they participate in discussion groups.

The fact that the market audience already searches for product information and visits manufacturer sites bodes well for the success of the Lighting Exchange search tools. The lack of use of discussion groups suggests that the PG&E may have to market the Dialog fairly heavily. It is clear from other studies that marketing will be essential in order for the Lighting Exchange to be successful.

The target audience is highly aware of the PEC Internet site and about 21 percent of the target audience has visited the site.

Seventy percent of those who have visited the PEC Internet site have visited four times or more.

Thus, PG&E already has some presence on the Internet upon which it can build.

About ten percent of the target population has used the inter.Light search site. The inter.Light site is a product referral site which is directly analogous to the Lighting Exchange Search Tools site. However, this site does not provide product data as the Lighting Exchange will.

There are differences by profession in who is aware of the two sites and who uses them. Energy consultants are most likely to be aware of and use the PEC site. Architects are least likely to use the PEC site.

After examining the data concerning market preferences related to the Lighting Exchange, we concluded that:

- Eighty percent or more of the respondents are interested in concepts that are embodied in the Lighting Exchange search tools and the Lighting Exchange Dialog.
- There is slightly greater interest in the product search tools than in the Dialog.
- This difference in interest is consistent with the revealed preferences with respect to the types of materials that users currently seek on the Internet.

Thus, we conclude that the target audiences are strongly predisposed to use the Lighting Exchange. These predispositions are supported by the target audience's stated motivations for using the Lighting Exchange.

The key stated motivations for using the dialog are to:

- Obtain general information, technical data, and insight into trends in the field.
- Get alternative solutions and diverse feedback from experts.

The key motivations for using the product search tools were to:

- Reduce the time and effort expended for information searches from current levels.
- Perform searches to yield a greater number of options for the same or nearly the same level of effort.
- Use searches to research significantly different alternatives that might lead to better designs.

These findings indicate people perceive that these tools will provide benefits. We believe that the product search tools have the potential to become an extremely important resource in the building professions. The Dialog is also likely to meet with success but perhaps less quickly.

We did attempt to assess market barriers in relation to these products. We found few if any barriers to their adoption. Respondents told us that they want tools that:

- reduce the amount of time spent searching
- provide information about more options
- are easy to use

These tools would appear to have these characteristics.

PG&E will have to market the tools. The tools will have to work effectively and provide useful information in order for people to continue to use them.

PG&E needs to consider how the tools will be maintained in the future. Product data changes rapidly and the challenge will be to maintain current data in the search capability.

It is also possible that the search capability could become a victim of its own success. The inter.Light site currently gets 500,000 hits per month. The Lighting Exchange could quickly equal that. This suggests a need for site planning as well as policy discussions about who may access the site.

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Appendix B Interview Protocol

Lighting Controls Issues

Have you done commercial projects (offices and other types of buildings) with significant amounts of side lighting? How many in the last year?

If yes, do you incorporate advanced lighting controls (e.g., lighting sensors and dimmers) into those projects? About what percentage of your projects incorporate advanced controls?

If yes, what determines if advanced lighting controls are used?

What kinds of lighting controls do you use on your projects? Occupancy sensors? Daylighting controls?

If you think of projects as having stages such as concept, design, construction, commissioning, etc. At what stage in the project is the decision to use advanced controls usually made?

Who decides whether controls will be used?

What criteria are used to decide what kind of controls to use and how to place them? What types of analysis are done to help decide if controls are used? Do you use try to estimate lighting levels by some method or do you follow some rules of thumb? Are software packages used? Which ones?

If there were tools or information that could help you do a better job of evaluating the use of lighting controls in projects, what would you like to have? How would they work?

What are there barriers to more extensive use of advanced lighting controls either in terms of using controls in more projects or using more controls in existing projects?

If cost or customers perceptions of cost are a problem, is there data or information that would help overcome those issues? What about other issues such as lighting quality, maintenance cost, reliability issues, user problems?

Where do you currently get information about advanced lighting controls?

If no, can you tell me why you don't use lighting controls

If there are cost issues, what data might be helpful in overcoming the problems?

If you were going to search for data about advanced lighting controls where would you look? What kind of data would you look for?

Daylighting prospector

This tool is designed to help identify opportunities to use lighting controls in existing or new buildings. It uses an estimate or an actual reading of natural lighting reaching the roof of a building, information about the orientation of the building, and either an estimate or a reading of the natural lighting at a location inside the building, that then allows the user to evaluate the cost effectiveness of lighting equipment and control options for that location. The program is designed to let you try different equipment options and configurations. The program is designed to be user friendly and allow multiple runs with changes..

Could you see your firm making use of such a tool in its projects? Under what conditions might you use it? Who would use it? What level of personnel would use it?

If you had someone using the tool for a modest sized office building, say 30,000 square feet, and it takes a few minutes per location within the building to evaluate lighting control options, how many labor hours would you be willing to put into using the tool to evaluate the building?

Who in the firm would use the tool?

Thinking about some of your recent projects, what reasons would you have not for not using such a tool?

What should be in the outputs of such a tool? How would the outputs be used? Who do you imagine might use the outputs?

Equipment lists by location?

Comparisons of energy use with and without controls?

How would you use the outputs? Mostly as a basis for design? For use with clients to convince clients that they should use controls? What?

Desktop Radiance related questions

Still thinking about buildings that use side-lighting, I would like to explore structural and façade design practices that may influence the entry of natural light into the building.

Think back over the kinds of buildings that you have been involved with recently? How much attention do you give to orientation of the building? Typically what drives the orientation of the building. What factors are a priority?

What about the size and placement of windows? What factors really drive the decision making? What are the priority factors?

What about glazing choices? What currently drives your practice in this area? What technologies are you currently specifying

Do you typically consider or talk with clients about architectural elements such as light shelves, shading devices? Under what circumstances do you talk about this with clients?

When you make decisions about issues of orientation, window size and placement, and glazing choices what types of analysis do you use to support your decisions?

When all of these elements are considered what are the most important factors? Where do issues of the quantity and quality of external light fit into the list?

Are the levels of interior illumination analyzed at this stage? If so, what tools are used to do this? What is the purpose of the analysis?

Do you use physical models? For what purpose do you use them? How often are they used? Do you ever use physical models to analyze the light and shadow effects of natural light on interior spaces?

Do you use 2D and 3D CAD in this office? Who is responsible for the CAD? What CAD package is used? Do you have full-time staff devoted to CAD operations? Do staff use CAD directly?

Do you use 3D renderings or imaging software? When and under what circumstances do you use them? What software do you use?

Desktop Radiance is a software package that works with Autocad files to produce 3D renderings of interior spaces. Desktop Radiance produces accurate estimations of illumination levels that can be used as a basis for lighting design. In this sense it differs from other products in this category such as Lightscape. It also allows one to quickly compare the effects of different configurations and designs?

Do you think you would be likely to use a product such as radiance? Under what circumstances? What would you expect the characteristics of the package to be?

Do you use facilities that allow you to test physical models with respect to solar orientation? How often? Why? If you don't use these facilities, why don't you use them? If such facilities were available to you at no cost, would you use them. How often?

Big Box Section

Do you ever get involved in the design of large retail or warehouse structures that are typically referred to as "box" or "big box"? Such buildings usually have a few windows at the front and the rest of the building is roof and walls.

If yes, what types of clients have you done these types of buildings for, individual owners, developers, chain stores?

Can you tell me a little bit about how the design process works in relation to the client?

How much control do you have over the designs when you do these types of buildings? Does the client provide fairly rigid specifications? How much latitude is there in the design work?

Have you done any such buildings with skylights or have you considered skylights as an option in such buildings?

(Considered it) If you have considered it but not done it, what caused you not to do it?
If you have done skylights, what type of skylighting system did you use?

How extensive was the use of skylights?

What led to the decision to use skylights

What sorts of analysis was done to support the use of skylights in the design?

Did your analysis include an examination of lighting fixtures and lighting controls to compliment the skylighting?

Did you use any special software or programs in the analysis

If you were going to do more skylighting what kinds of tools and information would you like to have?

For those who have not done it or just considered it?

Do you think there is potential to get clients to consider skylighting in "box" buildings? What would it take to convince clients that skylights would be a good idea?

If you had a tool that would allow you to evaluate skylighting options what would you want the tool to do?

Spacing

Structural support

Patterns of light and shadow within the building

Lighting layout and controls

Comparisons of different approaches to skylighting

SkyCalc is a tool for evaluating the potential for skylighting. What SkyCalc does is allow one to determine the number and placement of skylights using different skylighting designs buildings to get \ levels of illumination at the floor level. This information is integrated with lighting and controls information to provide cost effectiveness calculations.

Would such software be of use to you? How often would you use it? How would you use it?

Are there reasons why you wouldn't use it?

Internet use

Do the members of this firm use the internet for work related purposes? What proportion of the staff use it? Who typically uses it?

What sorts of things do the staff use the internet for?

Professional discussions groups?

Search for manufacturer information?

Search for design information?

Search for other types of data?

Training

Do you have a vision of how the internet might be used in the future?

Do you have ideas for ways in which Internet services could aid you professionally?

The PEC is establishing a website that will provide a single location to get product information from lighting equipment vendors. Do you think you might use such a site? How often do you think you might use such a site? What information would you want to get from such a site?

The PEC is establishing a moderated list service where professionals will be able to ask design questions and receive timely answers that have been reviewed for technical correctness. There will also be a library of previous asked questions and the response to them? Do you think you would use such a service? How often? Under what circumstances?

Can you think of other internet services that would aid you professionally?

The firm

Roughly what proportion of your business (in dollar volume) would you characterize as new construction and what proportion would you characterize as additions, remodels/renovations?

New construction

Remodels / renovations

What proportion of your work would you describe as low rise office, high rise office, commercial retail that might be described as "big box."

For the projects you have done recently, have you been the primary designer or have you worked with plans provided by the client?

Do you team with other firms? What is the composition of the team? Does it vary by the type of project? Do you usually team with the same firms? How are the responsibilities divided? Who typically interacts with the clients?

I would like to get some idea of what role your company plays in projects and what aspects might be done by others. With respect to the projects you have done since January 1997, have you

Specified or help to specify the building foot print position or orientation?

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Specified or helped to specify the placement and or size of openings

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Specified or helped to specify glazing materials?

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Design or help to design lighting systems?

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Specify lighting fixtures and control systems?

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Supervise the installation of the lighting systems

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Install lighting fixtures and controls

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Oversee or complete the commissioning of lighting system and controls

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Re-commission lighting systems or controls

☐ Never ☐ For some projects ☐ All projects or nearly all projects

Appencix C Questionnaire

PG&E Market Baseline Survey Questionnaire

Respondent Information (pre-filled)

1. Name: _____ ___ _____
2. Title/Position:_____
3. Company name: _____
4. Address 1: _____
5. Address 2: _____
6. City: _____ State: _____ Zip _____
7. Telephone: (___) ____ - ____ Telephone 2: (___) ____ - ____
8. Fax:(___) ____ - ____

Contact log

Date month, day, year	Time in (24 hour clock)	Time out (24 hour clock)	Result: 1. Complete, 2. Callback, 3. No answer, 4. No contact, 5. Wrong number, 6. Refusal, 7. Moved known, 8. Moved unknown, 9. Other (describe) Write in call back date and time
mm dd yy	h h m m	h h m m	
9.a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _____ _____
10.a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _____ _____
11.a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _____ _____
12.a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _____ _____
13.a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _____ _____
14.a.___ ___ ___	b. __ __ __ __	c. __ __ __ __	d. _____ _____

Good (morning / afternoon). My name is _____. I am calling on behalf of Pacific Gas and Electric Company. May I speak with Mr./Ms. _____.

- ❑ Yes → Continue with survey
- ❑ Is at a different phone number → Obtain new number and call (_____) _____
- ❑ Not in at this time → Schedule call back Date ___/___/1999, Time: ____am/pm
- ❑ No longer works here → Thank them and terminate call
- ❑ Other: → Reason: _____
- ❑ No answer → Leave message

Good (morning / afternoon)Mr ./ Ms. _____. My name is _____.

I am calling on behalf of PG&E. I would like to speak to << >>

If asked reason for call reply as follows:

> We are trying to obtain some information that will allow us to provide better services to the building design community.

If person is not available, establish when would be a good time to call back or (if you think it will work) give them a call back number.

If the person is no longer at this firm, ask for the next person on the list from that firm if available. Otherwise terminate and substitute a new case.

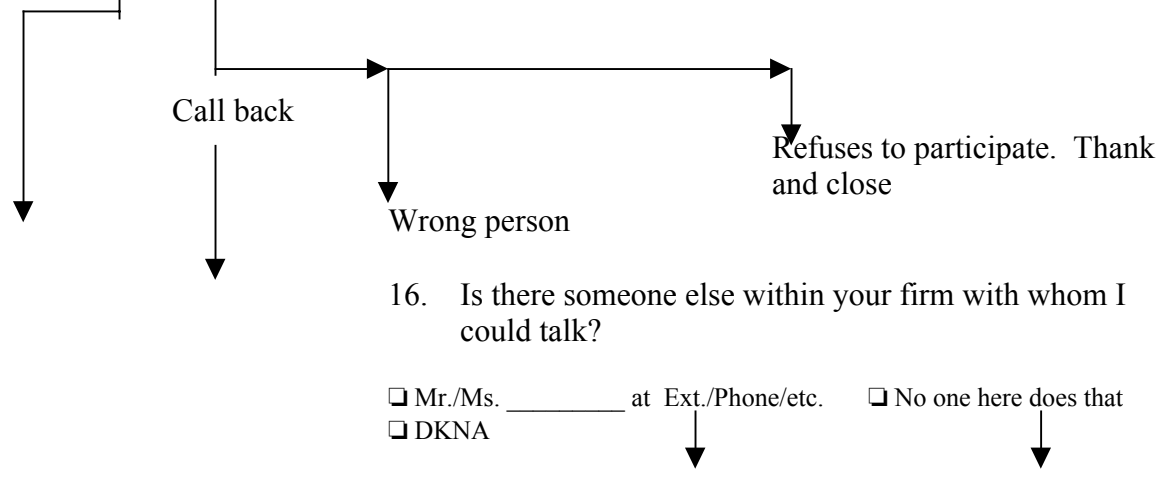
- If the person you are calling

I am calling on behalf of the Pacific Gas and Electric Company. PG&E is trying to get a better understanding of current design practices among building professionals and how building professionals interact with each other. Also, PG&E is developing and implementing some no cost software and Internet tools for buildings professionals and would like your help in understanding who the most likely users of these tools might be and how they might meet user needs. These tools, which will be available at no cost, include a 3D rendering package, a tool for evaluating the potential for skylighting, a tool for evaluating the potential for daylighting, an Internet tool to locate products particularly lighting and glazing products, and a tool that will permit professionals to give and receive advice from other professionals.

According to our records you and your firm are involved with the design and / or construction of commercial projects located in Northern California. I would like to complete a 15 minute survey about the building design market and the use of these new no-cost services. The survey focuses on your practices and how your firm might use the tools. Your responses will be anonymous.

May I proceed?

15. ❑ Yes ❑ No ❑ DKNA



16. Is there someone else within your firm with whom I could talk?

❑ Mr./Ms. _____ at Ext./Phone/etc. ❑ No one here does that
❑ DKNA

I am sorry to have bothered you. We must have gotten your name in error. Thank you for your time and patience.
Terminate and record data in log

If transferred to another person or making a new call, go back to Good (morning/afternoon).

❑ Call back

I would be more than happy to call back. Can you suggest a time?

Hour_____AM/PM Month _____ Day _____

Thank you very much for speaking with me. I will call again.

Terminate and transfer information to call log

Next page

Professional responsibilities

I'd like to start by asking you a couple of questions about you and your firm?

- If the CATI system has an occupation in the occupation field start here. Else skip to 18.

Our records indicate that your are an <<***occupation*** >>

17. Is that correct? ❑ No ***Go to 18*** ❑ Yes ***Go to 19***

The CATI system should fill one of these.

Architect	Electrical engineer	Title 24 specialists
Interior designer	Lighting designer	Building contractor
Graphics CAD specialist	Lighting contractor	Facility manager
Energy consultant	Electrical contractor	Electrician
Lighting specifier		

18. What is your profession? _____

Do not prompt? Code into one of the following. If unsure, use this list to probe.

❑ Architect	❑ Electrical engineer	❑ Title 24 specialists
❑ Interior designer	❑ Lighting designer	❑ Building contractor
❑ Graphics CAD specialist	❑ Lighting contractor	❑ Facility manager
❑ Energy consultant	❑ Electrical contractor	❑ Electrician
❑ Lighting specifier	❑ Other	

19. What is the principal business of your firm? _____

(Interviewer: enter what the person says then code one of the following. You may use the following categories to probe. If not sure, leave the answer for later coding. If the respondent indicates that they are a contractor or engineering firm, ask what kind. If the respondent indicates that the firm is manufacturing, distributor or retailer, ask if they manufacture or sell building related equipment or if they manufacture or sell something else.)

❑ Architectural design
❑ Interior Design
❑ Lighting Design
❑ Engineering
Would that be?
- ❑ Electrical / Lighting
- ❑ HVAC
- ❑ Both

❑ Contractor
Would that be?
- ❑ General
- ❑ Electrical
- ❑ HVAC
- ❑ Both

❑ Property Owner / Management
❑ Manufacturer

❑ Developer
❑ Distributor
❑ Retailer
❑ Other; _____
_____
_____

During the last 12 months can you tell me roughly how many different commercial and industrial projects your firm has completed? 20. # _____.

(If the respondent says that there are no commercial and industrial projects, that they only do residential. Thank them and close the interview.)

About how many of these were in Northern California (*Interviewer: We define Northern California as that part of California that is north of a line from Monterey to Fresno*)? 21. # _____

I am going to read a list of different types of building projects. For each type, can you to tell me approximately what percentage of your firm's projects are of that type. If you have no projects or just an occasional project of a type just indicate "none."

What percentage of your projects are . . .	None	Percent	DKNA
22. Low rise office structures from 1 – 3 floors	❑	_____%	❑
23. Higher rise office structures of four or more floors	❑	_____%	❑
24. Big box retail structures including retail food stores (*if they ask what "Big Box" means, say 10,000 square feet or more with minimal sidelighting)*	❑	_____%	❑
25. Other types of retail	❑	_____%	❑
26. Warehouses	❑	_____%	❑
27. Manufacturing facilities	❑	_____%	❑
28. Educational buildings	❑	_____%	❑
29. Health facilities / hospitals	❑	_____%	❑
30. Other public buildings	❑	_____%	❑
31. Other _____	❑	_____%	❑

Building professionals may take direction and report to many different kinds of firms such as developers, retail chains, independent retailers, building owners, general contractors, etc. I am interested in finding out who typically directs your work and to whom you typically report. This may be different than who writes the checks. For example, you might get paid by a retail chain but provide services to a general contractor. In this case it is the contractor that directs the work. If you never or almost never work for the type of firm mentioned you can say none.

In what percentage of your projects do you work directly for. . .	None or almost none	Percent	DKNA

32.	a developer	❑	_____%	❑
33.	a retail chain store	❑	_____%	❑
34.	a building owner other than a developer	❑	_____%	❑
35.	a general contractor	❑	_____%	❑
36.	an architectural firm	❑	_____%	❑
37.	an engineering firm	❑	_____%	❑
38.	Some other type of firm, please specify _____?	❑	_____%	❑

Can you tell me what percentage of your firm's projects are completed for :

What percentage are completed for . . .		None or almost none	Percentage	DKNA
39.	a known tenant	❑	_____%	❑
40.	lease or occupancy by an unknown tenant	❑	_____%	❑

Developers, owners, tenants, architects, electrical engineers, general contractors, and lighting designer are all important decision makers in building projects. I am going to list some important decisions that are made during the construction process. Thinking about the projects that your firm does, please tell me who the key professional typically is for each type of decision. Then please tell me what other professionals play key supporting roles in that type of decision. (*Interviewer: you may read the list once or twice to help the respondent get the idea? After that, just ask the question?*)

		a. For your projects, who typically is the primary decision maker with responsibility for determining:	c. What other professionals or firms play key supporting roles in determining:
41.	the exact orientation of the building	❑ Developer ❑ Owner ❑ Tenant ❑ Architect ❑ Lighting designer ❑ Interior designer ❑ Electrical engineer ❑ Electrical contractor ❑ HVAC engineer ❑ General contractor ❑ Other contractor ❑ Other _____ ❑ No one / Don't do this ❑ Don't know	❑ Developer ❑ Owner ❑ Tenant ❑ Architect ❑ Lighting designer ❑ Interior designer ❑ Electrical engineer ❑ Electrical contractor ❑ HVAC engineer ❑ General contractor ❑ Other contractor ❑ Other _____ ❑ No one ❑ Don't know
42.	the size and placement of windows	❑ Developer ❑ Owner ❑ Tenant	❑ Developer ❑ Owner ❑ Tenant

		❑ Architect	❑ Architect
		❑ Lighting designer	❑ Lighting designer
		❑ Interior designer	❑ Interior designer
		❑ Electrical engineer	❑ Electrical engineer
		❑ Electrical contractor	❑ Electrical contractor
		❑ HVAC engineer	❑ HVAC engineer
		❑ General contractor	❑ General contractor
		❑ Other contractor	❑ Other contractor
		❑ Other _____	❑ Other _____
		❑ No one / Don't do this	❑ No one
		❑ Don't know	❑ Don't know
43.	the glazing material	❑ Developer	❑ Developer
		❑ Owner	❑ Owner
		❑ Tenant	❑ Tenant
		❑ Architect	❑ Architect
		❑ Lighting designer	❑ Lighting designer
		❑ Interior designer	❑ Interior designer
		❑ Electrical engineer	❑ Electrical engineer
		❑ Electrical contractor	❑ Electrical contractor
		❑ HVAC engineer	❑ HVAC engineer
		❑ General contractor	❑ General contractor
		❑ Other contractor	❑ Other contractor
		❑ Other _____	❑ Other _____
		❑ No one / Don't do this	❑ No one
		❑ Don't know	❑ Don't know
44.	the use of architectural elements such as light shelves and shading devices	❑ Developer	❑ Developer
		❑ Owner	❑ Owner
		❑ Tenant	❑ Tenant
		❑ Architect	❑ Architect
		❑ Lighting designer	❑ Lighting designer
		❑ Interior designer	❑ Interior designer
		❑ Electrical engineer	❑ Electrical engineer
		❑ Electrical contractor	❑ Electrical contractor
		❑ HVAC engineer	❑ HVAC engineer
		❑ General contractor	❑ General contractor
		❑ Other contractor	❑ Other contractor
		❑ Other _____	❑ Other _____
		❑ No one / Don't do this	❑ No one
		❑ Don't know	❑ Don't know
45.	the use of skylights	❑ Developer	❑ Developer
		❑ Owner	❑ Owner
		❑ Tenant	❑ Tenant
		❑ Architect	❑ Architect
		❑ Lighting designer	❑ Lighting designer
		❑ Interior designer	❑ Interior designer
		❑ Electrical engineer	❑ Electrical engineer
		❑ Electrical contractor	❑ Electrical contractor
		❑ HVAC engineer	❑ HVAC engineer
		❑ General contractor	❑ General contractor

		❑ Other contractor	❑ Other contractor
		❑ Other _____	❑ Other _____
46.	lighting location or placement	❑ Developer	❑ Developer
		❑ Owner	❑ Owner
		❑ Tenant	❑ Tenant
		❑ Architect	❑ Architect
		❑ Lighting designer	❑ Lighting designer
		❑ Interior designer	❑ Interior designer
		❑ Electrical engineer	❑ Electrical engineer
		❑ Electrical contractor	❑ Electrical contractor
		❑ HVAC engineer	❑ HVAC engineer
		❑ General contractor	❑ General contractor
		❑ Other contractor	❑ Other contractor
		❑ Other _____	❑ Other _____
		❑ No one / Don't do this	❑ No one
		❑ Don't know	❑ Don't know
47.	lighting specifications	❑ Developer	❑ Developer
		❑ Owner	❑ Owner
		❑ Tenant	❑ Tenant
		❑ Architect	❑ Architect
		❑ Lighting designer	❑ Lighting designer
		❑ Interior designer	❑ Interior designer
		❑ Electrical engineer	❑ Electrical engineer
		❑ Electrical contractor	❑ Electrical contractor
		❑ HVAC engineer	❑ HVAC engineer
		❑ General contractor	❑ General contractor
		❑ Other contractor	❑ Other contractor
		❑ Other _____	❑ Other _____
		❑ No one / Don't do this	❑ No one
		❑ Don't know	❑ Don't know
48.	Dimming controls	❑ Developer	❑ Developer
		❑ Owner	❑ Owner
		❑ Tenant	❑ Tenant
		❑ Architect	❑ Architect
		❑ Lighting designer	❑ Lighting designer
		❑ Interior designer	❑ Interior designer
		❑ Electrical engineer	❑ Electrical engineer
		❑ Electrical contractor	❑ Electrical contractor
		❑ HVAC engineer	❑ HVAC engineer
		❑ General contractor	❑ General contractor
		❑ Other contractor	❑ Other contractor
		❑ Other _____	❑ Other _____
		❑ No one / Don't do this	❑ No one
		❑ Don't know	❑ Don't know

Now I am going read the same list of decisions and ask for what percentage of your projects you firm plays the primary role for that type of decision.

For what percentage of your projects does your firm have the primary responsibility for determining:	None	Percentage	DKNA
49. the exact orientation of the building	❑	_____%	❑
50. the size and placement of windows	❑	_____%	❑
51. the glazing material	❑	_____%	❑
52. the use of architectural elements such as light shelves and shading devices	❑	_____%	❑
53. the use of skylights	❑	_____%	❑
54. lighting location or placement	❑	_____%	❑
55. lighting specifications	❑	_____%	❑
56. Dimming controls	❑	_____%	❑

If 49 is greater than "none" then go to 57 else go to 63

I am going to read a list of criteria that people use in making decisions about building orientation. As I read each criterion, please rate the importance of the criterion on a scale of 1 to 10 where 1 means not at all important and 10 means a most important criterion in terms of your decision making.

For building orientation, how important is:

	Criterion	Score	DKNA
57.	Meeting code requirements	_____	❑
58.	Visual presentation of the building	_____	❑
59.	Maximizing the use of the available ground space	_____	❑
60.	Solar orientation	_____	❑
61.	Access and egress to the building	_____	❑
62.	Parking	_____	❑

(63) If 51 is greater than "none" then go to 63 else go to 70

I am going to read a list of criteria that people use in making decisions about the choice of glazing materials. As I read each criterion, please rate the importance of the criterion on a scale of 1 to 10 where 1 means not at all important and 10 means a most important criterion in terms of your decision making.

For glazing materials, how important is:

	Criterion	Score	DKNA
63.	Meeting code requirements	_____	❑
64.	Aesthetics	_____	❑
65.	Maximizing the amount of glazing	_____	❑
66.	Daylight or visual transmittance	_____	❑
67.	Cost	_____	❑
68.	Insulating ability	_____	❑
69.	Heat reflectivity	_____	❑

(70) If question 55 is greater than "none" then start at 70 else go to 87.

You said you or your firm plays a primary or key role with respect to lighting specifications. Could you tell me for what percentage of your firm's projects you or someone in your firm does each of the following. If almost none, just say none.

For what percentage of your firm's projects do you or someone in your firm:		None or almost none	Percentage	DKNA
70.	analyze the amount of artificial illumination needed in relation to task needs	❑	_____%	❑
71.	recommend or implement measures for reducing glare	❑	_____%	❑
72.	analyze lamps and fixtures in relation to color quality needs	❑	_____%	❑
73.	use physical or computer models to assess internal light and shadow effects.	❑	_____%	❑
74.	work with others on the design team to examine potential façade design elements to control natural light	❑	_____%	❑

75.	commission or inspect lighting systems or controls	❑	_____%	❑

I am going to read a list of criteria that people use in making decisions about lighting specifications. As I read each criterion, please rate the importance of the criterion on a scale of 1 to 10 where 1 means not at all important and 10 means a most important criterion in terms of your decision making.

For lighting specifications, how important is:

		Score	DKNA
76.	Meeting the code requirements	_____	❑
77.	Initial equipment cost	_____	❑
78.	Reliability	_____	❑
79.	Ease of maintenance	_____	❑
80.	Visual appearance of the fixture or equipment	_____	❑
81.	Energy efficiency	_____	❑
82.	Color of the light	_____	❑
83.	Potential for glare	_____	❑
84.	Ability to work with control systems	_____	❑
85.	Life time of the components	_____	❑
86.	Functional lighting requirements	_____	❑

Lighting controls:

(87) If question 56 is greater than "none" then start at 87 else go to question 105.

Previously you said that you have used dimming controls. For what percentage of the projects that your firm has completed in the last year did you use the following. If the answer is almost none, just say none.

for what percentage of the projects that your firm has completed in the last year did you use		None or almost none	Percentage	DKNA
87.	Motion sensors			
88.	bi-level or tri-level lighting			
89.	dimming ballasts with sensors in just a few special areas	❑	_____%	❑
90.	dimming ballasts with sensors in the main work areas	❑	_____%	❑

If 90 is greater than none go to 91 else go to 105

For those projects in which you have installed dimming controls for what percentage did you: (*You can say none or none or almost none*.)		None	Percentage	DKNA
91.	analyze different dimming equipment options	❑	_____%	❑
92.	establish control zones based on cost effectiveness calculations	❑	_____%	❑
93.	establish control zone boundaries based on common use areas	❑	_____%	❑
94.	examine potential sensors locations to see if they will work with carpet and furniture in the proposed locations	❑	_____%	❑
95.	establish a protocol for commissioning of sensors	❑	_____%	❑
96.	commission the sensors	❑	_____%	❑

I am going to read a list of criteria that people use in making decisions about lighting controls As I read each criterion, please rate the importance of the criterion on a scale of 1 to 10 where 1 means not at all important and 10 means a most important criterion in terms of your decision making in the last year.

For lighting controls, how important was:

	For lighting controls, how important was:	Score	DKNA
97.	Meeting code requirements	_____	❑
98.	Initial equipment cost	_____	❑
99.	Reliability	_____	❑
100.	Ease of maintenance	_____	❑
101.	Visual appearance of the fixture or equipment	_____	❑
102.	Energy efficiency	_____	❑
103.	User controlability	_____	❑

104. Do you think that the number of projects in which you will use dimming controls in the next two years will increase, decrease, or remain about the same?

❑ Decrease ❑ Remain about the same ❑ Increase ❑ DKNA

Why?_____

Go to question number 108

105. Have you recommended or considered using dimming controls in your projects?

❑ No ❑ Yes ❑ We just don't get involved with controls (**Go to 120**)

106. Have you talked to other users, manufacturer representatives, or attended seminars or classes in order to learn about dimming controls?

❑ No ❑ Yes

107. Have you obtained product information about dimming controls?

❑ No ❑ Yes

108. Have you attempted to sell customers on the potential for dimming controls?

❑ No ❑ Yes

109. What is the likelihood that you will use dimming controls in at least some of your projects within the next two yeas? Very unlikely unlikely neither likely or unlikely likely very likely

Very unlikely	Unlikely	Neither unlikely nor likely	Somewhat likely	Very likely	DKNA
❑	❑	❑	❑	❑	❑

I am going to read a list of things that might keep decision-makers from choosing dimming controls. For each item can you tell me whether it is not important, somewhat important, or a very important reason for not using controls?

		Not important	Somewhat important	Very important	DKNA
110.	First cost	❑	❑	❑	❑
111.	Equipment reliablity issues	❑	❑	❑	❑
112.	Potential for maintenance headaches	❑	❑	❑	❑
113.	Customers' lack of awareness of dimming controls	❑	❑	❑	❑
114.	Customers' lack of information about dimming controls	❑	❑	❑	❑
115.	Are there other reasons for not using controls? _____	❑	❑	❑	❑

Daylighting Prospector Questions

116. If PG&E made available at no cost a program that would allow you to estimate natural lighting levels for interior spaces and would also allow you to evaluate the cost effectiveness of various dimming and control options, would such a program be

- ❑ Of significant interest to you or your firm
- ❑ Of some interest to you or your firm
- ❑ Depends (Do not read)
- ❑ Of little interest to you or your firm, or
- ❑ Of no interest.
- ❑ DKNA

117. Can you tell me why?

_____

_____

Go to 120

118. Under what circumstances would the program be of interest?

_____

_____

Got to 120

119. What would your motivation be for using such a program?

_____

_____

120. Do you or anyone in your firm use CAD?

❑ No ***Go to 122*** ❑ Yes

121. Which 2D Cad programs do you use

- ❑ AutoCad
- ❑ Microstation
- ❑ Archicad

122. Do you use 3D CAD programs to generate images of interior or exterior building spaces

❑ No ❑ Yes

skip to130

123. What software do you use to generate the 3D images?

- ❑ 3D Studio
- ❑ Visio
- ❑ (Other)_____

For what percentage of projects do you use rendering to:

		None or almost none	Percentage	DKNA
124.	present **external** design features to clients and code officials	❑	_____%	❑
125.	present **internal** designs to clients	❑	_____%	❑
126.	to analyze such things such as **internal** light and shadow effects	❑	_____%	❑

127. Of the projects you render, what percentage do you do in-house _____

128. Do you think that your firm's use of renderings will increase, decrease or remain about the same over the next two years?

❑ Increase ❑ Decrease ❑ Remain about the same

129. Why?

_____

_____

Go to 132

130. What are the primary reasons why you don't use renderings?

_____ _____

131. Do you think your firm will use renderings in the future?

❑ No ❑ Yes

Skip to138

132. What do you think are the most important advantages of using renderings in your profession?

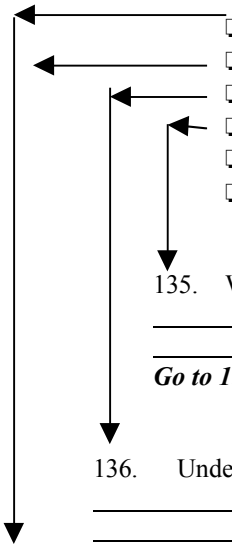
_____

_____

133. What are the most important disadvantages of using renderings in your profession?.

_____

134. If PG&E made available a rendering program without cost that works easily with Autocad and Autocad files and produces photographic quality renderings that provide accurate readings of the levels of illumination anywhere in the image, would this program be…



❑ of significant interest to you or your firm
❑ of some interest to you or your firm
❑ depends
❑ of little interest to you or your firm, or
❑ of no interest.
❑ DKNA

135. Why would this program be of little or no interest to your firm?

Go to 138

136. Under what cicumstances would the program be of interest?

Got to 138

137. What would be the primary reason you or your firm would use such a program?

138. Do you use physical models or mock-ups in your work?

❑ No ***If no go to 144*** ❑ Yes

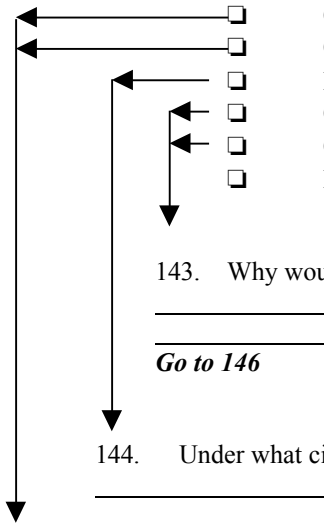
For what percentage of your projects do you :

		None or almost none	Percentage	DKNA
139.	use physical models to present designs to clients and local code officials	❑	_____%	❑
140.	use physical models to analyze such things as interior light and shadow effects	❑	_____%	❑
141.	use **mock-ups** to the effects of artificial and natural light in interior designs	❑	_____%	❑

Artificial Sky Questions

142. If PG&E were to provide in the San Francisco Bay area a facility where models of buildings or parts of buildings could be evaluated under artificial skies to see how they would perform in different solar conditions or different models under the same conditions,

.



❑ Of significant interest to you or your firm
❑ Of some interest to you or your firm
❑ Depends
❑ Of little interest to you or your firm, or
❑ Of no interest.
❑ DNNS

143. Why would this facility be of little or no interest to your firm?

_____

_____

Go to 146

144. Under what cicumstances would the facility be of interest?

_____

_____

Got to146

145. What would be the primary reason you or your firm would use such a facility?

_____

_____

SkyCalc Questions

(146) If question 53 is greater than none then 146 else go to 153.
Earlier you said that you or your firm had used some skylights in projects. In what percentage of the cases were:

		None or almost none	Percentage	DKNA
146.	skylights for a few selected or special spaces within the building	❑	_____%	❑
147.	general skylighting in a substantial proportion of the building designed to provide light in work spaces	❑	_____%	❑

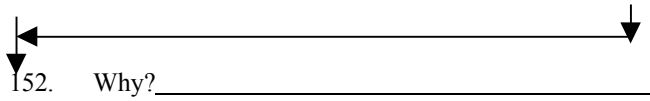
If 147 is greater than none then 148 else 153

In designing for the skylighting, For what percentage of your projects did you:

		None or almost none	Percentage	DKNA
148.	base the number, size and position of skylights on the location of structural elements	❑	_____%	❑
149.	determined size and number of skylights based on illumination requirements	❑	_____%	❑
150.	specify controls for electric lighting in response to natural light entering the space	❑	_____%	❑

151. During the next two years is your use of skylights in projects likely to increase, descrease, or remain about the same.

❑ Decrease ❑ Remain about the same ❑ Increase ❑ DKNA



152. Why?_____

Skip to 156

153. Have you investigated the use of skylights for large general work areas by talking to other professionals, manufacturer representatives, or attending classes?

❑ No ❑ Yes

154. Have you obtained product information about skylights?

❑ No ❑ Yes

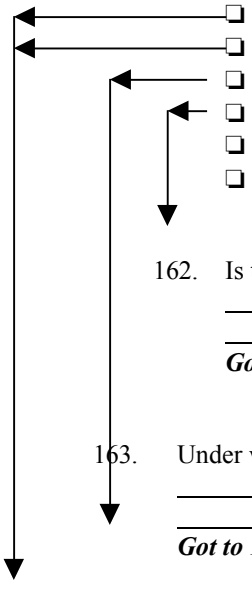
155. What is the likelihood that you will use skylight in large general work areas for at least some of your projects within the next two years? Very unlikely, unlikely, neither likely or unlikely, likely, very likely?

Very unlikely	Unlikely	Neither unlikely or likely	Somewhat likely	Very likely	DKNA
❑	❑	❑	❑	❑	❑

I am going to read a list of reasons why decision makers might decide not to use skylights. For each item can you tell me whether the reason is not important, somewhat important, or a very important reason for not using skylights

		Not important	Somewhat important	Very important	DKNA
156.	Customers perceive that first cost is too high	❑	❑	❑	❑
157.	Clients think skylights cause security problems	❑	❑	❑	❑
158.	Perceived to be a potential maintenance problem	❑	❑	❑	❑
159.	Too difficult to control the light	❑	❑	❑	❑
160.	Customers aren't aware of potential productivity improvements from usingskylighing	❑	❑	❑	❑

161. If PG&E were to provide a computer program that would allow you to determine the number and placement of skylights based on illumination levels and the number, type and placement of lighting fixtures with dimming controls in relation to skylights, would this program be. . .



❑ of significant interest to you or your firm
❑ of some interest to you or your firm
❑ depends (don't read)
❑ of little interest to you or your firm, or
❑ of no interest.
❑ DKNA

162. Is there some reason?

_____

_____

Go to 165

163. Under what circumstances would the program be of interest?

_____

_____

Got to 165

164. What motivates your interest in such a program?

165. Thinking back over the various issues we have discussed, can you think of any data or computer software tools that the PEC might supply that might aid in physical or lighting design?

Lighting Exchange Questions

166. Do you use e-mail in your work

❑ No ❑ Yes

167. How about the Internet, do you use it in relation to your work?

❑ No ***Go to question 173*** ❑ Yes

168. About how many hours a week do you use the Internet in relation to your work?

❑ 1 - 3 ❑ 4 - 5 ❑ 6 - 9 ❑ 10 - 15 ❑ 15+ ❑ DKNA

169. Please tell me if you typically use the internet, do you use it to… (*read all and check all that apply*):

a. ❑ visit manufacturer web sites
b. ❑ locate product information
c. ❑ locate design information
e. ❑ participate in professional discussion lists
f. ❑ get information about current events in your field
g. ❑ seek information about competitors

170. Are you aware of the inter-light site that has the database that allows you to search for manufacturers that have certain types of products?

❑ No ❑ Yes

Have you used the site?

❑ No ❑ Yes

171. What about PG&E's Pacific Energy Center Site, are you aware of it?

❑ No ***Go to question 174*** ❑ Yes

Have you used the site?

❑ No ❑ Yes

172. About how many times you have been there?

❑ Once ❑ 2 to 5 times ❑ 5 – 10 ❑ more than 10 times

SKIP to 174

173. Do you think that you are likely to become an internet user in the next two years?

❑ No ***go to 184*** ❑ Yes

174. If PG&E were to provide an Internet site where you could search for and retrieve the specifications for products meeting a certain set of criteria, what sorts of products would you want to be able to search for. . . (check all that apply)

❑ lamps
❑ ballasts
❑ controls
❑ fixtures
❑ glazing
❑ sustainable materials

175. If this site were to exist, do you think that it would be

❑ Of significant interest to you
❑ Of some interest to you
❑ Depends (do not read)
❑ Of little interest to you
❑ Of no interest.
❑ DNNS

176. Can you tell me why?

_____

_____

Go to 179

177. Under what circumstances would the site be of interest?

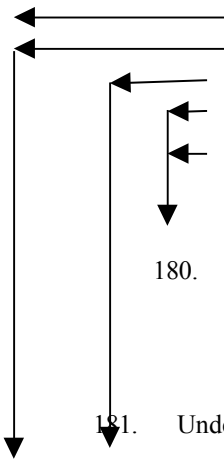
_____

_____

Got to 179

178. What is your motivation for using the site?

179. PG&E is working on a web site to provide a moderated discussion list for design information. The site allows a person to post design questions to which technical experts respond. All questionsand responses are reviewed by technical experts to insure that the responses are technically correct. The responses are also to be posted in a database that can be searched. Would such an expert site be:



- ❑ of significant interest to you
- ❑ of some interest to you
- ❑ depends (do not read)
- ❑ of little interest to you or your firm, or
- ❑ of no interest.
- ❑ DKNA

180. Can you tell me why?

Go to 183

181. Under what circumstances would the site be of interest?

Got to 183

182. What is your motivation for using the site?

Go to 183

183. Can you think of any internet services that you might find useful that PG&E might be able to provide?

Firmographics

184. About how many offices or locations does your firm have?

❑ 1 ❑ 2 ❑ 3 ❑ 4 ❑ 5-10 ❑ 10+ ❑ DKNA

254. For all locations of your company about how many full-time employees are there?

❑ <10 ❑ 10-19 ❑ 20-29 ❑ 30-49 ❑ 50-100 ❑ 100-499 ❑ 500+

185. About how many full time employees are at your office or location

❑ <10 ❑ 10-19 ❑ 20-29 ❑ 30-49 ❑ 50-100 ❑ 100-499 ❑ 500+

Personal Information

186. What is your job title?_____

(Interviewer: enter what the person says then code one of the following. If you are not sure use the following categories to probe. If not sure, leave the answer for later coding.)

❑ Owner / Partner
❑ President
❑ Executive vice-president
❑ Senior manager
❑ Manager
❑ Senior engineer
❑ Engineer
❑ Senior architect
❑ Architect
❑ Senior designer
❑ Designer
❑ Other:

187. Do you supervise the work of others?

❑ No ❑ Yes

188. How long have you been in your current position?

_____ Years

189. How long have you been doing this kind of work?

_____ Years

190. What is your highest level of education?

❑ high school or less
❑ Associates degree
❑ Some college
❑ Bachelor's degree
❑ Bachelor's degree and some additional education
❑ Masters degree
❑ Masters degree with some additional education
❑ Ph. D or its equivalent