

NORTHWEST ENERGY EFFICIENCY ALLIANCE

Market Research Report

Residential Energy Efficient Lighting Consumer Research

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Residential Energy-Efficient Lighting Consumer Research

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Executive Summary

The barriers to the successful promotion of CFL bulbs and fixtures have been known for several years. These include the following:

- High first costs,
- Unavailability,
- Lack of awareness of technology, benefits, and cost effectiveness,
- Incompatibility with existing fixtures, dimmers, and timers or photocells,
- Performance problems,
- Unattractiveness, and
- Fear of fluorescent technology.

Over the past few years, improvements in CFL technology, manufacturing, and distribution have reduced or minimized several of these barriers. Smaller, more attractive CFLs have appeared on the market. In fact, some of the newest CFLs with lower wattage are virtually identical in shape and size to incandescent bulbs. Some manufacturers are even producing “dimmable” CFLs and CFLs that have dusk-to-dawn lighting capabilities. In addition, most of the performance problems have been overcome. CFLs are available today that:

- Start immediately,
- Have an attractive, warm light color,
- Produce no audible hum,
- Produce no perceptible flicker,
- Do not interfere with remote controls, and
- Start and operate brightly at cold temperatures.

Despite these significant improvements, CFL sales are still low. The purpose of this study is to perform market and consumer research in the Pacific Northwest residential energy efficient lighting market to aid the Alliance in determining future program opportunities. The goal is to identify currently perceived barriers and determine if there are any features of CFL bulb or fixture products that are most appealing to customers. Based on these features, particular consumer “hooks” may be able to be identified that can be utilized to increase CFL bulb and fixture sales. These “hooks” could be utilized by the Alliance in their CFL promotional efforts.

ES.1 Approach

The approach taken to address these goals utilized several market and consumer research techniques. These included an assessment of the CFL market utilizing secondary and primary market research, interviews with several groups of consumers utilizing focus groups, and analysis of consumer purchase decisions utilizing consumer conjoint analysis.

The secondary and primary market research reviewed much of the previous research on this topic and expanded on this review of previous research with telephone interviews of market actors. These market actors included manufacturers, wholesalers, retailers, contractors, and utility program representatives. Retailers were sub-categorized into large home improvement stores, large mass merchandisers, small retailers, and grocery and drug store chains. Further, to investigate markets for both new construction and existing homes undergoing remodel work, telephone interviews were conducted with lighting and electrical contractors.

To provide additional insight and to explore a variety of consumer-related issues and perspectives on energy efficient lighting, four focus groups were held with homeowners in the Northwest. A key to obtaining meaningful information from these focus groups was to have real products with real pricing information on hand that the participants could examine and test. Each focus group session began with a discussion on how lighting is used in the home with probes for links to comfort, safety, convenience, and energy bills. Past experiences with energy-efficient lighting products (good and bad) were explored to ascertain whether such experiences were likely to help or hinder subsequent purchases. Recent lighting purchases were discussed generally, first, and then specifically to probe for specific examples of energy and non-energy related drivers in the decision-making process.

The final market and consumer research technique utilized was a consumer conjoint analysis. Conjoint analysis was used to determine which lighting attributes in the CFL purchase decision process consumers value most and value least. This type of analysis also provides a means to estimate how modifying features in these attributes changes what consumers choose to buy. The conjoint survey was performed through a website with survey participants solicited through email and postcard solicitation and through links from energy and utility related websites in the Northwest.

ES.2 Key Findings

Each of the market and consumer research efforts came up with similar findings in terms of the most significant positive features and significant barriers still facing the CFL market. One of the most important, if not the most important, positive feature of CFL bulbs and fixtures is the long life of the bulb. In the conjoint survey, there was a large difference in utility value between long and short bulb life in both the bulb and fixture surveys. In the

market research, nearly all of the interviewees indicated that long bulb life was one of the most popular and important characteristics of CFLs. It was viewed positively more from the perspective of less maintenance in changing bulbs than from the money one would save with avoided cost from not buying as many incandescent bulbs. Long life was viewed as particularly positive when placing the CFL in a hard to reach spot. Within the focus groups, the short life of incandescent bulbs, especially in hard to reach fixtures, was viewed as a major inconvenience. However, focus group participants were often skeptical about the long-life claims of CFLs. Warranties helped alleviate some of the skepticism, and some kind of trusted independent testing to back-up the long-life claim, such as by Underwriter's Lab, would also reduce the skepticism.

The level of energy savings from CFLs was viewed as a positive but not necessarily significant feature. In the conjoint survey, the operating cost attribute had a relatively small difference in utility value between the low and high operating cost features. In the market research, the level of energy savings was not overwhelmingly mentioned as a key component in the purchase decision. However, in the market research, one of the most effective marketing displays was an electric meter display that spun at different rates for the CFL and incandescent bulbs. This visual representation of energy savings had a very positive impact on those who saw it. In the focus groups, participants were generally unaware of the magnitude of the energy savings from CFLs and, once they learned of it, they were impressed. The fact that the focus group participants had low awareness of the energy savings potential and the fact that the electric meter marketing display was received so positively may indicate more of a lack of knowledge on the significance of the energy savings rather than a disregard for the savings.

The safety issue of low heat from CFLs, especially in a torchiere application, was a highly regarded attribute. In the conjoint survey, the CFL torchiere was the dominant preference over both halogen and incandescent torchieres. Both the market research and the focus groups reiterated the importance of this feature. Although the most popular use of the low heat feature of CFLs is for safer torchieres, other applications were identified such as putting brighter light output CFL bulbs in fixtures that have heat limitations or delicate designer shades.

Interesting bulb shapes and smaller sizes are positive attributes. Current CFLs on the market with either small, interesting shapes or with the size and shape of a standard incandescent bulb are viewed positively by consumers. In the conjoint bulb survey, the small CFL shape had a very high utility whereas the bulkier, older style circular shape had a very low utility value. The market research results indicated that consumers are attracted to interesting shapes such as spiral or twister shapes. The focus groups indicated a preference for the "A" bulb shape; however, participants also were intrigued with a variety of other shapes.

The quality of light from CFLs was a key positive attribute that came from the focus groups. Moreover, focus group participants noted that light quality was often an emotional issue, contributing to the mood or ambiance of the room. This attribute could not be modeled within the web-based conjoint survey (although it could be with a one-on-one conjoint survey with actual bulbs and fixtures to use as examples). Light quality was also mentioned in the market research literature and interviews. For example, several respondents noted that consumers like bright lights.

On the barrier side, two of the long-term barriers still significantly hinder CFL acceptance. The most important is lack of awareness of the current technology, benefits, and cost effectiveness. The second is the high first cost of CFL bulbs. This second barrier appears to be eroding with the continued falling of CFL prices. Bulbs with a high first cost had a very low utility in the bulb conjoint survey while the low cost alternatives in the conjoint bulb survey were well received. In the conjoint fixture survey, purchase price was not a highly significant attribute. The market research supports this with the finding that, with fixtures, the extra cost of an energy efficient model over a standard model is not as great as with CFL bulbs. Furthermore, focus group participants were very impressed with the low cost of several of the newly available CFL bulbs. For example, participants indicated that a CFL price of \$5.95 or lower was an attractive option.

The most significant barrier is consumer awareness. This barrier was not modeled through the conjoint survey. However, the interviews with market actors identified low consumer awareness as likely the greatest reason for slow CFL sales. The focus group results demonstrated this and showed that, once consumers gain awareness, there is significant CFL acceptance. For example, most of the focus group participants expressed limited knowledge about CFLs at the beginning of the sessions, then surprise and interest as they learned more about CFLs. Finally, by the end of the session, most had favorable opinions of CFLs.

Overall, product availability for bulbs has improved significantly over the past few years but appears to be still limited for fixtures. Grocery stores continue to be the one primary lighting product source where CFLs are only minimally available.

ES.3 Recommendations

CFLs and ENERGY STAR fixtures appear to be close to becoming significant alternatives to incandescent and halogen bulbs and fixtures in the residential sector. Many of the earlier barriers such as performance problems, incompatibility, unavailability, unattractiveness, and even high first cost are being minimized. Many CFL features such as long life, lighting quality (color), low heat production, energy savings, and even bulb appearance are now being viewed as positive qualities that consumers desire. Assuming that price continues to decline

to a level of about \$5 to \$7 for new CFL bulbs, the primary remaining barrier is consumer awareness. Once consumers are fully aware of the benefits of CFLs, their market share should grow substantially. An additional important remaining barrier is the general unavailability of CFLs in grocery stores, which is the number one place where consumers buy replacement bulbs.

The recommendations that follow are primarily designed to improve consumer awareness and trust in CFL lighting. These recommendations have been reviewed and reflect the comments and input of the Alliance Board subcommittee on lighting and the Lighting Advisory Committee:

- 1) *Conduct a regional consumer-based campaign that incorporates media (i.e., broadcast and print advertising), public relations, special promotions/events and cooperative advertising with “in-store” efforts to promote and make visible the benefits of energy efficient lighting.* Major elements of this campaign may include:
 - a) Advertising. An example of a “hook” message could be to emphasize how CFLs are “new and improved.” The popular appearance of the twister CFL can be featured as the symbol of energy efficient lighting (with a call to action to look for the ENERGY STAR label to find these products).
 - b) In-store/retail displays of CFLs and fixtures would bring the products to life and enable the consumer to see, operate, and learn about the benefits of energy efficient lighting.
 - c) To enhance the consumer awareness of products in retail further, the program would encourage manufacturers to make their products more easily visible to the consumer (via packaging) and provide more graphical information on packaging.
 - d) A low-risk opportunity can be provided for the consumer to “try out” a CFL, offering a limited time subsidy and unconditional guarantee. A particular product line (i.e., subcompact CFLs) could be the focus of this offer. This could be funded and administered directly through the program or in combination with the manufacturers and retailers.
 - e) Other recommended elements include educational outreach (also see recommendation #3 for utility promotional support), efforts to strengthen and support ENERGY STAR lighting specifications to include meaningful product testing and manufacturers’ warranties and access to customer service support.
- 2) *Consider a separate market strategy for ENERGY STAR fixtures.* Recognizing the differences in market acceptance of energy efficient fixtures and CFLs (primarily related to lack of product availability), the program should consider approaches other than mass retail to increase the availability of ENERGY STAR fixture products. The Consortium for Energy Efficiency (CEE) is conducting market research on approaches that will increase the availability of residential energy efficient fixture products. Based on this research (completion planned for early June) and the recommended approaches, CEE intends to launch a new national initiative.

Market strategies to promote ENERGY STAR fixtures should consider the outcome of this research and subsequent development of program approaches should be consistent with the CEE initiative.

- 3) *Provide opportunities for utilities to promote energy efficient lighting to residential customers in conjunction with recommendation #1.* Utilities can play a major role in promoting consumer awareness of the consumer-friendly qualities of CFL lighting: long life, lighting quality (color), low heat production, energy savings, and bulb appearance. Program activities that could be offered by utilities include a strong, well-defined outreach program to schools (the portability and lowering-cost features of the CFL make the show-and-tell demonstration easy and affordable), special discounts or rebates on “preferred” products or applications that yield greater energy savings, and expanded consumer education through normal outreach and communications channels, including bill stuffers, newsletters, websites, community events.

1

Introduction

The Northwest Energy Efficiency Alliance (Alliance) has been offering two regional market transformation programs to promote compact fluorescent lighting (CFL) in the residential sector. These two programs are LightWise and ENERGY STAR[®] Residential Lighting Fixtures. LightWise seeks to expand the regional market for residential CFLs by lowering the cost of the bulbs with a buydown incentive to participating manufacturers. The ENERGY STAR Residential Lighting Fixtures program offers incentives to the manufacturers of energy-efficient hardwired lighting fixtures and compact fluorescent torchieres to encourage the distribution and sale of these products. The ENERGY STAR program also includes a consumer awareness campaign, as well as efforts to support revisions of residential building codes to include standards for energy-efficient fixtures in bathrooms.

Utilities have promoted the use of CFLs since the mid-1980s. Over this period, promotional approaches have included coupons (instant rebates), mail-in rebates, leasing, door-to-door sales, giveaways, and manufacturer incentives. Alliance efforts are directed toward manufacturer incentives and represent the region-wide expansion of a similar program offered by several Northwest utilities in 1996.

In the past, utility and customer acceptance of CFLs has been hindered by lack of customer awareness, high first cost, and lighting quality concerns. Both the Alliance LightWise and ENERGY STAR Residential Lighting programs attempt to address these barriers through 1) promotional efforts designed to expand awareness, 2) manufacturer rebates to reduce cost, and 3) approval of participating bulbs, fixtures, and manufacturers to insure low total harmonic distortion and good color rendition. However, the annual progress evaluation reports find that, while the program is influencing the achievement of market penetration for CFLs in the Northwest region, it has not achieved the goal of market transformation.

The purpose of this study is to perform market and consumer research in the Pacific Northwest residential energy efficient lighting market to aid the Alliance in determining future program opportunities. The goal is to identify currently perceived barriers and determine if there are any features of CFL bulb or fixture products that are most appealing to customers. Based on these features, particular consumer “hooks” may be able to be

identified that can be utilized to increase CFL bulb and fixture sales. These “hooks” could be utilized by the Alliance in their CFL promotional efforts.

The tasks taken to address these goals utilize several market and consumer research techniques. These include an assessment of the CFL market utilizing secondary and primary market research, interviews with several groups of consumers utilizing focus groups, and analysis of consumer purchase decisions utilizing consumer conjoint analysis.

The remainder of this Report covers each of these market and consumer research techniques. It is comprised of the following sections:

- Section 2 - The Compact Fluorescent Lighting Market: Secondary and Market Research,
- Section 3 - Consumer Research: Residential Lighting Focus Groups,
- Section 4 – Consumer Conjoint Analysis, and
- Section 5 – Summary and Recommendations.

2

The Compact Fluorescent Lighting Market: Secondary and Market Research

2.1 Overview

This Section summarizes the market research available to date on compact fluorescent lighting products, as it is applicable to the Northwest United States. In this section, we describe the products available in the market, the market actors, and some emerging market opportunities.

2.2 Research Methods

A number of existing reports were reviewed for this study. In addition, the existing material was supplemented by conducting in-depth interviews with a number of key market actors. The remainder of this subsection describes the various sources used to collect data.

Review of Previous Research

The following reports were reviewed for this study.

- ***Phase I Baseline Assessment for the Statewide Residential Lighting and Appliance Program (Draft).*** This report, completed by Xenergy in November 1999, presents a market characterization and baseline assessment of California's residential lighting and appliance markets.
- ***California Statewide Lighting Program Retail Market Overview.*** Completed in August 1999 by ECOS Consulting and ICF Consulting, this paper provides an overview of the distribution channels for residential lighting products, describes the key market actors, and identifies issues for further research in this area.
- ***ENERGY STAR Residential Lighting Fixture Program: Market Progress Evaluation Report.*** This report was completed in August 1999 by Pacific Consulting Services and Shel Feldman Management Consultants. It evaluates the progress of the ENERGY STAR Residential Fixtures Program and discusses market effects related to manufacturers, retailers and consumers.
- ***ENERGY STAR Residential Fixtures Program: Baseline Assessment.*** This report, completed in November 1998 by Pacific Consulting Services and Shel

- Feldman Management Consultants, provides a characterization of the residential lighting fixtures market, identifies market barriers, and estimates baseline conditions.
- **ENERGY STAR Fixtures Program Baseline Data Analysis.** Completed in May 1998 by Pacific Consulting Services, this report benchmarked equipment availability and price at state and regional levels.
 - **LIGHTWISE ANNUAL Program Progress Report.** Completed in August 1998 by Portland Energy Conservation, Inc. and Ecos Consulting, this study presents a summary of the programs accomplishments and recommendations for improving the program.
 - **LIGHTWISE Market Progress Evaluation Report.** Completed in December 1998 by the Gilmore Research Group, this report presents findings of market research based on surveys with retailers and consumers.
 - **LIGHTWISE Market Progress Evaluation Report.** Completed in September 1999 by Dethman & Associates and the Gilmore Research Group, this report was the second in a series of reports that evaluated the progress of the LightWise program.
 - **Residential Market Effects Study: Refrigerators and Compact Fluorescent Lights.** This work, completed by Hagler Bailly Consulting, Inc. in April 1998, looked at market effects in San Diego Gas & Electric's and Pacific Gas & Electric's market transformation programs.
 - **NEES Residential Lighting Program Evaluation.** Opinion Dynamics and RER evaluated the results of the 1996 program for the New England Electric System. Market conditions were assessed using in-store surveys and interviews with market actors.
 - **Baseline Study of the Northeastern Residential Lighting Market.** Opinion Dynamics Corp. and RER conducted this study in 1998 of the Northeast residential lighting market for the Northeast Energy Efficiency Partnership. The study provided a baseline of the northeast residential lighting market using national shipments data, in-depth interviews with market actors, in-store stocking audits, reviews of manufacturer product catalogs, and extensive consumer research.
 - **NSP Residential Lighting Market Assessment.** RER recently conducted this study for Northern States Power. The report presents a market baseline and market effects study of NSP's compact fluorescent bulb program.
 - **A Look at Residential Energy Consumption in 1997.** This report, completed in November 1999 by the Energy Information Administration, provides detailed information on residential appliance and lighting use in the United States by demographic characteristics.
 - **U.S. Energy-Efficient Technology Procurement Projects: Evaluation and Lessons Learned.** Prepared by the Pacific Northwest National Laboratory

- in February 1999, this report evaluates three U.S. energy-efficient technology procurement projects for the purpose of gleaning key lessons learned.
- ***Draft Program Design – PY 2000 for the California Residential Lighting and Appliance Program.*** Prepared for the California investor owned utilities by Richard Heath and Associates in November 1999, this document presents the proposed plan for the California Residential Lighting and Appliance Program for the year 2000 and beyond.
 - ***Halogen Torchiere Market Transformation: A Look at Progress to Date and Future Strategies.*** Completed in September 1999 by ECOS Consulting, this paper summarizes key developments in the establishment of a U.S. market for halogen torchieres and the subsequent emergence of safer, energy efficient alternatives.
 - ***Lighting the Way to Energy Savings: How Can We Transform Residential Lighting Markets?*** Completed in December 1999 by the Natural Resources Defense Council, this study identified strategies and recommendations on how utilities can transform the residential lighting market.
 - ***Residential Lighting Market White Paper.*** Prepared by the staff of Pacific Consulting Services in the fall of 1999, this white paper summarizes current lighting fixture market trends and provides direction to the Alliance to aid them in their deliberations over the future of the Residential Lighting Fixture Program.
 - ***LIGHTWISE Program: Whitepaper for Decision-Makers.*** Completed in October 1999 by Dethman & Associates and the Gilmore Research Group, this white paper presents information on the progress of the Alliance LightWise program, the potential the program has to further enhance the compact fluorescent lighting market, and the decisions that need to be made regarding the future of LightWise.

Market Actor Interviews

To supplement the secondary research, a number of in-depth interviews were conducted with key market actors including manufacturers, wholesalers, retailers, contractors and utility program representatives. Based on previous research, lighting retailers were categorized into the following major groups:

- Large home improvement stores,
- Independent home improvements stores,
- Hardware stores,
- Large mass merchandisers,
- Grocery and drug store chains, and
- Lighting specialty stores.

Furthermore, in order to investigate markets for both new construction and existing homes, we interviewed lighting or electrical contractors who worked in both sectors. Survey responses from homebuilders were available from previous research conducted for the Alliance. Table 2-1 lists the market actors interviewed for this project.

Table 2-1: In-depth Market Actor Interviews

Actor	Targeted	Completed
LightWise field representatives	3 to 4	4
Manufacturers	3 to 4	4
Distributors	3 to 4	3
Large home improvement stores	3 to 4	4
Large mass merchandisers	3 to 4	4
Small retailers	3 to 4	5
Grocery and drug stores	3 to 4	3
Lighting contractors	6 to 8	6
Utility lighting program managers	3 to 4	3
Other industry professionals	0	2
Totals	30 to 40	38

The interviews with the LightWise field representatives were conducted first. These program representatives work east of the I-5 corridor in the Northwest promoting the Alliance LightWise program. Responses from these interviews provided valuable information that was used in preparing the interview guides for the remainder of the market actors.

The sample of market actors was chosen mostly from previously interviewed individuals in other Alliance studies. The interview questions were designed to collect data on market barriers, product distribution channels, promotional strategies, market segments, new products and product attributes that are particularly appealing to consumers. The interview guides are available in Appendix A.

2.3 Compact Fluorescent Lighting Products

In addition to the reports listed above, we examined manufacturer’s catalogs and Internet sites to determine what compact fluorescent lighting products are currently available, where they are available, and what opportunity exists for expanding the number of Alliance-approved compact fluorescent light bulbs (CFLs) and fixtures.

CFLs

Product Description

CFLs are designed to last longer than incandescent bulbs. Most last 6,000 to 10,000 hours compared to 750 to 1,000 hours for incandescent bulbs.¹ In addition, a CFL produces 45 to 65 lumens per watt, whereas a typical incandescent generates 13 to 17 lumens per watt.² There are many types of CFLs now available. CFLs come in many different sizes and shapes and some smaller manufacturers are even willing to produce ‘designer’ CFLs based on the size and shape needed. Spiral, circular, candle, and miniature are a few of the fluorescent lighting shapes available.

Most fluorescent bulbs require ballasts to provide proper starting voltage and regulate current during operation.³ CFLs are either self-ballasted or modular. Table 2-2 compares the characteristics of these two types of CFLs.

Table 2-2: Comparison of Self-Ballasted and Modular CFLs⁴

Self-Ballasted CFLs	Modular CFLs
These contain a bulb and ballast in one-piece.	These contain two separate components: a screw-based ballast and a replaceable CFL.
When the bulb fails, the entire unit must be replaced.	When the bulb fails, only the CFL must be replaced.
Expected lifetime is 6,000-15,000 hours.	Expected lifetime for bulb is 6,000-15,000 hours. Expected lifetime for ballast is 20,000-150,000 hours

In addition, CFLs ballasts may be either magnetic or electronic. Table 2-3 compares the features of these two types of ballasts. Some manufacturers produce dimmable electronic ballasts; this feature is currently not available with magnetic ballasts.

¹ Calwell, Chris, et. al. *Lighting the Way to Energy Savings: How Can We Transform Residential Lighting Markets? Volume 1 Strategies and Recommendations*. Natural Resource Defense Council, December 1999.

² Calwell, et. al. Op. Cit.

³ *Screwbase Compact Fluorescent Lamp Products: Energy-efficient alternatives to incandescent lamps*. Specifier Reports, Volume 7, Number 1, June 1999.

⁴ Specifier Reports, Op. Cit.

Table 2-3: Comparison of Magnetic and Electronic Ballasts⁵

Magnetic Ballasts	Electronic Ballasts
Contain a steel core and a copper coil	Contain a circuit board and electronic components
Less efficient and noisier	More efficient and quieter
Does not cause electromagnetic interference	Can cause electromagnetic interference
Weighs 120-453 grams	Weighs less than 226 grams
Magnetic preheat ballasts start the bulb with a few seconds of flickering.	Electronic preheat ballasts start the bulb without flickering.

CFL ballasts use one of three methods to start: preheat, instant-start, or rapid-start. Each of these is described in more detail below.

- **Preheat Ballasts.** A preheat ballast, also called a switch start ballast, preheats the bulb electrodes for a few seconds, then opens a starter switch allowing the voltage to be applied across the bulb to strike the arc. The ballast stops supplying the electrode heating voltage after starting the bulb. Several manufacturers produce CFLs with preheat ballasts including Lights of America, Lumatech, Phillips and Osram Sylvania. Both electronic preheat ballasts and magnetic preheat ballasts are widely available.
- **Instant-Start Ballasts.** An instant-start ballast supplies a high initial voltage to strike the arc. Unlike a preheat ballast, an instant-start ballast does not heat the electrodes either before or during operation, thus minimizing power usage. Another benefit of instant-start ballasts is that they start almost as quickly as incandescent bulbs. One drawback, however, is that instant-start ballasts tend to have a shorter bulb life than preheat ballasts, especially if they are switched on and off frequently. Only electronic instant-start ballasts are produced.
- **Rapid-Start Ballasts.** A rapid-start ballast is similar to a preheat ballast in that it preheats the electrodes before starting. However, a rapid-start ballast only preheats the electrodes for one to two seconds, whereas a preheat ballast can take several seconds to preheat. A rapid-start ballast continues to heat the electrodes even after the bulb is started, resulting in small power losses. One benefit of rapid-start ballasts over preheat ballasts is that a rapid-start ballast starts the bulb with only a brief delay and no flickering. Manufacturers are currently working on technologies that “more precisely control the starting process in order to extend bulb life.” A few manufacturers produce rapid-start ballasts, both electronic and magnetic.

⁵ Specifier Reports, Op. Cit.

Availability

CFLs are now available in nearly every place that consumers report buying incandescent bulbs. CFLs are being sold in home improvement stores, hardware stores, and even some mass market retailers such as Wal-Mart. However, CFLs are being sold in only a small number of grocery stores around the country. Thirty-one percent of the incandescent bulbs sold from May 1998 to April 1999 were sold in grocery stores. In comparison, less than 1% of the CFLs sold during the same time period were purchased in grocery stores. Table 2-4 presents a similar breakdown of light bulb sales by store type for a variety of retailers.⁶

Table 2-4: National Light Bulb Sales

Store Type	Incandescent	CFL
Grocery Stores	31.0%	0.9%
Mass Merchandisers	30.0%	11.7%
Hardware Stores	9.0%	20.6%
Home Improvement Stores	24.0%	66.5%
Drug Stores	6.0%	0.2%

Most retailers that we interviewed have begun stocking new compact fluorescent lighting products in the last six months. These new products range from new designs and styles to products by new manufacturers and new product lines. For example, one new product is a dimmable CFL torchiere described by a utility program manager as “very attractive.”

Compact Fluorescent Fixtures

Product Description

Like CFLs, the number and styles of dedicated compact fluorescent fixtures have increased significantly over the last few years. In addition, compact fluorescent fixtures are even more energy efficient than CFLs. They have fewer performance compromises, offer a more attractive appearance, and they offer more predictable long-term energy savings than screw-based CFLs.⁷ Residential lighting fixtures can be broken into three basic groups: indoor portable fixtures, indoor hard-wired fixtures, and outdoor fixtures. Each of these is described briefly below.

Indoor Portable Fixtures. Indoor portable fixtures represent approximately 20% to 25% of the lighting energy use in a typical home. There are many types of portable fixtures; some of these are table lamps, wall lamps, desk lamps, and floor lamps.

⁶ Calwell, et. al. Op. Cit.

⁷ Calwell, et. al. Op. Cit.

- **Table Lamps.** Table lamps are generally bought in discount department stores, furniture stores and lighting specialty stores and are available in a large assortment of colors, shapes, and sizes. However, they are rarely sold as dedicated pin-based fixtures. Instead, manufacturers have focused on developing screw-based CFLs to fit in table lamps.
- **Wall Lamps.** Wall lamps, like table lamps, are available in many different styles. Therefore, manufacturers have focused on developing screw-based CFLs to fit in wall lamps instead of designing dedicated fluorescent fixtures.
- **Desk Lamps.** Compact fluorescent desk lamps, on the other hand, are beginning to be manufactured. Since desk lamps are used primarily to illuminate only a small area, lower wattage CFLs have great potential in this type of portable fixture. Two manufactures are pursuing ENERGY STAR endorsement for their desk lamps and many other small manufacturers currently produce compact fluorescent desk lamps. Typically, these are magnetically ballasted designs with low-light-output twin bulbs (13-watts or less) or short linear fluorescent bulbs. Desk lamps are most commonly found in office supply stores and mass-market retailers.⁸
- **Floor Lamps.** Floor lamps are freestanding lamps that direct light upwards or both upwards and downwards, similar to table lamps. Compact fluorescent floor lamps were extremely rare until recently, when compact fluorescent torchieres began to capture some of the market in floor lamps. There are several manufactures that produce compact fluorescent torchieres, including Lights of America, Good Earth, Energy Federation, Inc., and Energy Federation, Inc. Some companies have Internet websites where consumers can purchase compact fluorescent torchieres.

Indoor Hard-Wired Fixtures. Unlike portable fixtures, indoor hard-wired fixtures are connected permanently to household wiring and have no visible cords or switches. Because of these characteristics, consumers typically view hard-wired fixtures as permanent since they would typically need an electrician to replace one. Indoor hard-wired fixtures can be subcategorized by style or by mounting method. Perhaps the largest groups are recessed fixtures, surface-mounted fixtures, suspended fixtures, and wall-mounted fixtures.

- **Recessed Fixtures.** Recessed fixtures are most commonly mounted flush with the ceiling surface. Since many installations of recessed fixtures are in insulated ceilings, the heat generated by the use of these fixtures may present a problem. In addition, because ballast performance and longevity are reduced by high temperatures, manufactures will have to make many advances in technology before fluorescent recessed lighting will be able to provide sufficient light output. The Northeast Energy Efficiency Partnership (NEEP) has begun to encourage fixture manufacturers to produce fluorescent recessed lamps that can overcome these design constraints.

⁸ Calwell, et. al. Op. Cit.

- **Surface-Mounted Fixtures.** There are two types of surface mounted fixtures. Surface-mounted fixtures that have a single diffuser that disperses light in all directions are currently available with compact fluorescent lamps. The other type of surface mounted fixtures is track lighting. Currently, compact fluorescent track lighting is rare, primarily due to the use of small “heads” that typically do not accommodate the larger CFLs and their reflectors.
- **Suspended Fixtures.** Until recently, linear fluorescent suspended fixtures were one of the few residential fluorescent fixtures available. For many consumers these shop lights, as they are commonly referred to, may still symbolize residential fluorescent lighting. This preconception is unfortunate since more decorative suspended fluorescent fixtures are now available.
- **Wall-Mounted Fixtures.** Compact fluorescent scones and linear wall-mounted fluorescent fixtures are widely available. Vanity lights, on the other hand, are rarely found as dedicated compact fluorescent fixtures.

Outdoor Fixtures. Outdoor fixtures are typically wired directly to household wiring and represent approximately 10% of residential energy use.⁹ While many compact fluorescent outdoor fixtures have a dusk-to-dawn feature, none are available at this time with motion sensors.¹⁰

When choosing an outdoor lighting fixture, there are several characteristics that consumers consider important. One report suggested that consumers consider home security, durability, light output, and having a motion sensor as some of the most important features.¹¹ However, one program manager noted that people care less about light quality for outdoor lights than they do with indoor lights, and for consumers who leave their porch light on all night, CFLs are an excellent choice.

Availability

Residential lighting fixtures are sold in a wide variety of retail stores ranging from large home improvement stores and hardware stores, to home furnishing and lighting specialty stores. Mass merchandisers and department stores also usually carry lighting fixtures. Some consumers also get their lighting fixtures from their homebuilder or electrical contractor. Research done by ECOS Consulting and ICF Consulting shows that, in California, 79% of hardware/home improvement stores carry both torchieres and hardwired fixtures while 65%

⁹ Calwell, et. al. Op. Cit.

¹⁰ Even though the characteristic of having a motion sensor is important to 44% of the people surveyed, it is doubtful that manufacturers will produce them. One reason that : A recent testing of screw-based CFLs by the National Lighting Product Information Program (NRDC) shows that there is a large variation in average lifetimes. The tests also show that a CFL will have a longer life if it is left burning for longer periods of time and if they are left off for longer periods of time.

¹¹ Regional Economic Research, Inc. *NEEP Residential Lighting Study Final Project Report*. April 1998

of mass merchandisers carry only torchieres.¹² All four of the large home improvement stores that we interviewed carried torchieres, indoor fixtures, and outdoor fixtures. In addition, compact fluorescent torchieres, compact fluorescent outdoor fixtures, and compact fluorescent indoor fixtures were each sold by three of the four large home improvement stores. However, we found that while most hardware stores, lighting specialty stores, and mass merchandisers carry torchieres and/or other lighting fixtures, only a few carry some type of compact fluorescent torchiere or fixture.

Emerging Technologies

NRDC recently published a summary of new products under development or recently introduced to the market.¹³ The following describes these briefly.

- ***Two-wire Dimmable Fluorescent Bulbs and Fixtures.*** These products are designed to be used with common residential dimmer circuits, thus eliminating the need for additional wiring. Philips and TCP produce a dimmable screw base CFL, and at least nine manufacturers are making two-wire dimming ballasts.
- ***Bulb-Sensing Ballasts.*** These ballasts are able to accommodate a wide range of bulb types, thus reducing the confusion in matching bulbs to ballasts.
- ***Metal Halide Residential Products.*** Metal halides have not been popular in residential applications due to their slow start-up, intense light, and radiation hazards. However, recently manufacturers have been working on modifications that make these lights more attractive for residential use. For example, one fixture combines incandescents that start immediately and shut off automatically with metal halides that continue to burn efficiently for long periods.
- ***Higher Output CFLs.*** These products provide bright light and are able to replace the halogen torchieres and high watt incandescents.
- ***Higher Output Linear Fluorescents.*** Currently available only in Europe, T5 fluorescent tubes are thinner and brighter than T8s. In fact, the brightness is so intense that the light needs to be used indirectly or glare can be a problem.
- ***LEDs.*** These lights produce only a single light color; therefore, traditionally they have been used for indicator lights. By combining several of different colors, however, they can be made to approximate white light. Another development is the combination of high-output blue LEDs with white phosphors.
- ***Halogen Infrared-reflective Coating (HIR) and Ceramic Filament Designs.*** These technologies use optical coatings and ceramic filament materials to increase the efficiency of light filaments.
- ***Remote Source Lighting.*** Generating light from a central location and distributing it via tubes or optic cables is the idea behind this technology.

¹² Ecos and ICF Consulting. *California Statewide Lighting Program Retail Market Overview*. August 1999.

¹³ Calwell, et. al. Op. Cit.

- **Electro-Luminescent (EL) Panels.** This technology uses a flat panel that emits light when an electric current is applied. They are efficient but have limited light output and that light output degrades over a lifetime of about eight years.

2.4 Market Actors

The market for residential CFL fixtures and bulbs involves the following economic decision-makers:

- Manufacturers,
- Distributors,
- Retailers,
- Builders,
- Contractors,
- Consumers, and
- Utility program personnel.

Each of these decision-makers influences the growth of the market and is described in more detail below.

Manufacturers

Manufacturers in the residential lighting industry are made up of bulb, ballast, and fixture manufacturers. The market consists of several large bulb manufacturers (and many small ones), approximately a dozen ballast manufacturers, and hundreds of fixture manufacturers.¹⁴ CFL products, which are constructed with a bulb and ballast, are produced by the top three bulb manufacturers, General Electric, Osram Sylvania, and Philips. The top three fixture manufacturers are Stiffel, Angelo Brothers, and Catalina. Fixture manufacturers use trade shows as their primary means of marketing their products and staying abreast of the market.¹⁵

Manufacturers interviewed for this study differed on their opinions of the lighting market. One bulb manufacturer stated this is a niche market but is growing steadily. Another reported that growth is occurring only in certain areas, for example in Texas and in the multifamily sector. Three of the bulb manufacturers interviewed reported they felt consumer awareness was still a large barrier and utilities could help a lot more in that area. On the other hand, one manufacturer did not want to participate with utility programs and did not mention customer awareness as a problem. He stated the major barrier is product quality. Specifically, he stated that they've had a lot of problems with ballasts humming, and that this

¹⁴ Heschong Mahone Group. *Lighting Efficient Technology Report, Volume III Market Barriers*. California Energy Commission, September 1999.

¹⁵ Pacific Consulting Services and Shel Feldman Management Consultants. *ENERGY STAR® Residential Lighting Fixtures Program Baseline Assessment*. November 1998.

is especially problematic with imported ballasts. He also mentioned that some don't work in cold weather.

The two CFL bulb manufacturers disagreed about pricing, with one stating that prices are already low and will continue to drop due to competition from imported products. The other reported that prices will remain stable unless utilities intervene with subsidies. All the manufacturers interviewed offered a guarantee with their products and advertised it on the package. Bulb manufacturers reported distributing their products through sales representatives, distribution companies, and mail order companies. In addition, for new construction, one reported having a sales engineer that called on architects. One bulb manufacturer reported wanting to use a utility program to introduce a new product. Fixture manufacturers reported a number of distribution channels, including sales representatives, working with utilities, shipping directly to showrooms and retailers, and providing drop ship services for their customers. For new products, they introduce them at trade shows, in catalogs, and through their sales representatives.

Distributors

Some bulb and fixture manufacturers distribute their product through distribution companies, while others use their own sales representatives and sell directly to retailers. For CFLs, distributors are more typically used for new construction channels. For lighting fixtures, lighting showrooms are one way distributors sell hardwired fixtures and high-end portable fixtures.¹⁶

Two of the distributors interviewed for this study sold only to contractors and the third sold to both retailers and contractors. The three distributors interviewed agreed the market for residential energy efficient lighting products is small now and is not expected to grow much. Two reported it as a niche market with custom built homes the main target. All agreed the major factor for the limited growth was the cost of the product, and one distributor further explained that payback is too long for these products and electricity prices are low.

Retailers

CFL bulbs are sold through a variety of retail locations. The major groups in the research are the following:

- Large home improvement stores (like Home Depot and Home Base),
- Independent home improvement stores (like Friedman Brothers),
- Hardware stores (like True Value),
- Lighting specialty stores (like Lamps Plus),

¹⁶ Pacific Consulting Services and Shel Feldman Management Consultants. Op. Cit.

- Large mass merchandisers (like Target and Wal-Mart),
- Grocery and drug store chains,
- Department stores,
- Office supply stores,
- Mail order catalogs, and
- Internet retailers.

Most CFLs are purchased from home improvement centers, while most incandescent bulbs are purchased in grocery stores. The issue of marketing CFLs in grocery stores is further discussed in Section 2.6.

Lighting fixtures are sold at the following types of retailers:

- Furniture stores,
- Home improvement stores,
- Hardware stores,
- Department stores, and
- Discount stores.

Most retailers purchase their lighting fixtures from manufacturers while some purchase them from wholesalers. The major features they consider for stocking fixtures are style, quality, price, and consistency with other product offerings in the store. For furniture stores, style is key. Franchise companies like True Value hardware stores purchase from a franchise cooperative or corporate fulfillment center, thereby eliminating direct contact with manufacturers.¹⁷

Large chain stores and mass merchandisers may encounter difficulty participating in utility programs due to utility boundaries. In addition, they often use large distribution centers and may not have much control on what is shipped to individual areas or stores.¹⁸

Recently surveyed retailers revealed the following:¹⁹

- Most stock CFLs at least part of the year,
- Most report they are prepared to answer customer questions about CFLs,
- Most report the advantages of CFLs are energy efficiency, longevity, and cost-effectiveness,
- Most report the main disadvantage is high price, and

¹⁷ Pacific Consulting Services and Shel Feldman Management Consultants. Op. Cit.

¹⁸ Calwell, et. al. Op. Cit.

¹⁹ Dethman, Linda. *Northwest Energy Efficiency Alliance LightWise Program: White Paper for Decision Makers*. October 1999.

- Most favor the ENERGY STAR association.

The remainder of this subsection presents more detailed information on the various retail groups. In addition, findings and recommendations for promoting energy efficient lighting from previous research²⁰ are included where applicable.

Home Improvement Centers

Home improvement stores, also called do-it-yourself stores, are popular with homeowners and small builders and contractors. Examples of this type of retailer include Home Depot and Home Base, and Home Depot has been identified as the largest lighting retailer in the country. These large chain stores have established relationships with large lighting manufacturers. However, as one program manager pointed out, they have an adequate stock of CFL bulbs but a minimal number of energy efficient fixtures. Moreover, they usually do not stock ENERGY STAR fixtures consistently, but more often on a short-term or promotional basis. Over 65 % of CFLs and 24% of incandescent bulbs are bought from home improvement stores.

The following strategies for promoting energy efficient lighting products to this type of retailer have been presented in the literature:

- Develop better relationships between manufacturers and these retailers,
- Demonstrate to store managers that ENERGY STAR lighting products can sell quickly,
- Provide point-of-purchase (POP) information, in-store training, and in-store promotions,
- Convince retailers to display incandescent bulbs and CFLs side-by-side, and
- Add energy efficiency and Energy Star information to employee training.

Mass Merchandisers

Mass merchandisers are large discount stores that sell a variety of products. Two examples of this store type are Target and Wal-Mart. These stores have rigorous buying and stocking policies and tend to stick with products that are in high demand and have frequent turnover. In addition, there is a long lead-time involved in adding new products to their inventory. For example, one program manager described their attempts to convince Target to carry a CFL product. Despite multiple attempts to negotiate with the chain's headquarters, the store declined to carry the product due to their limited valuable shelf space. Another program

²⁰ See for example: Ecos Consulting and ICF Consulting, Op Cit. and Calwell, et. al. Op. Cit.

manager mentioned the difficulty in educating salespersons in these stores due to the large variation of products that are carried.

Mass merchandisers typically stock few, if any, hardwired fixtures but may carry CFLs and some plug-in fixtures. Nearly 12% of CFLs and 30% of incandescent bulbs are bought from mass merchandisers.

Lighting Specialty Stores

Lighting fixtures typically carried by lighting specialty stores are unique and higher priced than products found in mass merchandise or home improvement stores. Furthermore, lighting specialty stores tend to use effective merchandising techniques and have the floor space to effectively promote ENERGY STAR products. One program manager interviewed noted that specialty table and floor lamps with thin paper lampshades are perfect applications for CFL bulbs due to the delicate nature of the shade which could be easily burned or damaged by a hot bulb.

Hardware Stores

Most hardware stores are independently owned and operated, giving them minimal buying power with manufacturers. In fact, some manufacturers view hardware stores as “high maintenance and low volume accounts.” As a result, they typically purchase products through distributors and supply houses. Over 20% of CFLs and 9% of incandescent bulbs are bought from hardware stores.

Grocery & Drug Stores

Grocery stores devote less than 1% of their shelf space to light bulbs, which they purchase from distribution companies. Despite this, an amazing 37% of incandescent bulbs are purchased at grocery and drug stores²¹ due to the convenience and availability. In addition, grocery stores tend to be risk-averse when it comes to stocking new products, especially ones that do not fit in their typical product lines.

Grocery stores contacted for this study sold incandescent bulbs, outdoor floodlights, and colored bulbs. In addition, one sold bug lights and replacement bulbs for bathroom fixtures, appliances and track lighting. One of the grocers stated that they sold floodlights for as much as \$7 and that these bulbs were normally on the shelf for at least a couple weeks. Both stores reported providing 12 feet of shelf space for their lighting products and that their corporate offices make all of the decisions pertaining to which products they stock.

²¹ Calwell, et. al. Op. Cit.

A representative from Fred Meyer was also interviewed for this study. Even though Fred Meyer is considered a mass merchandiser, their stores contain large grocery sections. This retailer explained that they do carry both compact fluorescent light bulbs and compact fluorescent torchieres in addition to incandescent indoor and outdoor fixtures. Fred Meyer stocks most of their lighting products in the lighting department, but they also provide approximately four feet of shelf space in the grocery section. Currently, they only carry incandescent and a few other specialty bulbs in the grocery section and no CFLs.

Other

Office supply stores and department stores sell limited lighting products. JC Penney and Sears were mentioned in the literature as selling a sizable percentage of national lighting fixtures. In addition, Office Depot, Staples, and Office Max were mentioned as atypical sources of lighting products for consumers.

The Internet and mail-order catalogs are two other sources of lighting products for consumers. Websites offering the ENERGY STAR torchiere stress safety issues and have educational information and other links on energy efficient lighting for consumers.

Builders

Builders use price as the main criterion in choosing fixtures for new homes. In addition, it is important for them to use fixtures that match the décor of the home.²² Builders typically purchase their lighting fixtures from wholesalers and sometimes from electrical contractors.

Builders interviewed in previous research²³ reported purchasing lighting fixtures from wholesalers and electrical contractors. Builders who use contractors typically lay out the specifications for what they want, and contractors buy within those specifications and their allotted budget. Large manufactured home builders have reported buying light fixtures through national buying contracts, while mid-size builders (50 to 100 homes per year) tend to have specialized staff to deal with purchasing.

Contractors

Contractors are typically involved with new construction or with remodels of existing homes. While some contractors specialize in either of these areas, most of the contractors we interviewed for this study worked in both segments. In addition, all of them worked in both single family and multifamily buildings. Each of the six respondents had experience installing compact fluorescent dedicated fixtures, but only two reported installing residential compact fluorescents. In addition, only two contractors had experience with ENERGY STAR

²² Pacific Consulting Services and Shel Feldman Management Consultants. Op. Cit.

²³ Pacific Consulting Services and Shel Feldman Management Consultants. Op. Cit.

fixtures. Some of the contractors purchased their fixtures from wholesalers or local parts stores, while the others purchased directly from a manufacturer.

Depending on the market segment they are working in, decisions regarding lighting fixtures might be made by the contractor, the homeowner, or the builder or architect. In cases where the contractor chooses the fixture, respondents reported using the following criteria:

- Price,
- Availability,
- Quality,
- Style, and
- Purpose of the light.

Price was mentioned the most often. In addition, for existing homes, one contractor reported replacing whatever was originally there unless the homeowner specifically requested something different. Another respondent reported he would not recommend a product unless he had used it himself and he had not yet tried CFLs or ENERGY STAR products. Contractors reported learning about new lighting products from trade publications, fliers or seminars from wholesalers, or from job specifications by way of architects.

Most of the contractors had different reasons why they thought compact fluorescent lighting appealed to their customers; these include cost savings, energy savings, long life, and light color. One of the contractors suggested that architects are more concerned with appearance, so this might mean that, in some cases, the customer would have to request compact fluorescent fixtures. When asked what would need to happen for contractors to install more compact fluorescent fixtures, most of the contractors said that the demand from architects or from homeowners would have to increase. Another mentioned that regulations would probably have to change because the products are too expensive for most customers.

Consumers

There are approximately 3.6 million households in the four Northwest states of Idaho, Montana, Oregon, and Washington, and approximately half of these are in Washington.²⁴ In addition, a typical household uses 30 to 50 bulbs in 20 to 30 fixtures.²⁵ Recent research identified the following characteristics for consumers who shopped for fixtures:²⁶

- Own their home,
- Are working,

²⁴ 1990 census data.

²⁵ Jennings, Judith, et. al. *Residential Lighting: The Data to Date*. Lighting Research Group, IESNA Conference Proceedings, 1996.

²⁶ Pacific Consulting Services and Shel Feldman Management Consultants. Op. Cit.

- Have a post-high school education,
- Have annual incomes greater than \$40,000, and
- Are aware of compact fluorescent price and performance.

Furthermore, the majority of these consumers purchased a fixture as part of a remodel or to add a new fixture to their home.

Factors that consumers look for in lighting fixtures include primarily price and performance, with style, operating cost and safety also considered important. Few consider energy efficiency. Furthermore, consumers revealed that they obtain most of their information for deciding about a purchase from store displays, product packaging, and sales clerks.²⁷

Utility and Government Program Personnel

Retailers and manufacturers indicated that they believe utilities can make a significant impact in the market for CFLs.²⁸ Working together to provide consistent programs across utility boundaries and even states has helped. As of June 1999, approximately \$23 million was being invested annually by U.S. electric utilities to promote residential lighting efficiency, resulting in incentives for approximately 1 to 1.5 million CFLs targeted at residential consumers.²⁹

Government programs, like the ENERGY STAR residential light fixture program and the ENERGY STAR CFL program³⁰ provide a consistent message for consumers and a common marketing platform for manufacturers and retailers. Many utility programs are providing incentives for the ENERGY STAR programs and helping to introduce them to their area. One program manager interviewed reported that consumer focus groups revealed that consumers view both utility and ENERGY STAR logos on lighting packages as “good authorities” for endorsing the product.

LightWise Representatives

Field representatives for the LightWise program contact retailers in the Northwest to promote the program. A majority of their time is spent visiting retail stores throughout the area. Most of the field representatives focus on hardware and lighting specialty stores, but may also visit larger mass merchandisers such as Target and Fred Meyer, and some have visited local distributors. They try to raise retailers’ awareness of energy efficient lighting by educating salespeople and informing them of the benefits of participating in the program. They also promote manufacturer buy downs of compact fluorescent lighting products offered by the

²⁷ Pacific Consulting Services. *Residential Lighting Market White Paper*. 1999.

²⁸ Pacific Consulting Services and Shel Feldman Management Consultants. Op. Cit.

²⁹ Calwell, et. al. Op. Cit.

³⁰ <http://www.energystar.gov>

program. In addition to increasing retailers' awareness, they assist the participating retail stores in setting up displays and point-of-purchase information. They also do in-store promotions where they educate customers about the benefits of compact fluorescent lighting.

We conducted in-depth interviews with four field representatives, or circuit riders, that work east of the I-5 corridor in the Northwest promoting the LightWise program. These interviews provided valuable information that was used in preparing the interview guides for the remainder of the market actors. All four of the field representatives said they are having a large influence on the market. They reported that a majority of the retailers they visited show interest and become involved in the program (60 to 95% enroll in the program).

Representatives reported a number of factors that contribute to retailers' resistance to carrying energy efficient lighting products. The following were mentioned most often:

- High selling price compared to other lighting products,
- Lack of awareness regarding product features,
- Limited styles and designs of lighting fixtures, and
- Low cost of electricity in the area

In addition, one respondent reported that a retailer he talked to did not want to have to "special buy" from a distributor with whom he did not already do business.

Other Lighting Program Representatives

Other program managers interviewed reported differing opinions on the lighting market. One representative reported the market is very tough and low-income customers cannot afford to buy the products. Another representative stated that the biggest barrier was consumers' dislike of fluorescent products either because they are afraid of them, think they are ugly, or just do not want them in their house. She explained it is an emotional issue, not an awareness issue. Both representatives agreed consumers are aware of the product benefits and features and may still choose not to purchase them. A third program manager interviewed stated that consumers are still ignorant of CFLs and a lot more education needs to occur. Her view was that the market was growing and would continue to grow as CFLs become smaller and look more like the bulbs consumers are used to using.

Representatives also reported different opinions regarding combining bulbs and fixtures into a single program. One respondent explained that they purposely did not include fixtures that required installation in order to avoid liability issues. Another reported that the combination of bulbs and fixtures was a good fit because the educational effort and the hurdles to overcome with retailers are similar. A third argued that they are different markets and require different sales approaches. Two reasons for this are: 1) bulbs are typically purchased without much forethought while fixtures require more of a commitment from the consumer,

and 2) bulbs may be purchased for several reasons while fixtures are typically chosen for aesthetic reasons. All three representatives thought the ENERGY STAR programs were a big benefit to the market.

2.5 Market Issues

The preceding section described the various market actors that contribute to the energy efficient lighting products market. This Section discusses the issues of market barriers, market segmentation, and product promotion strategies.

Market Barriers

A number of factors contribute to the limited growth of the CFL bulb and fixture market. Many studies have been done describing various market barriers and factors contributing to the resistance of consumers and retailers to embrace these products. The following are some of the primary barriers encountered in this study:

- High first costs,
- Unavailability,
- Lack of awareness of technology, benefits, and cost effectiveness,
- Incompatibility with existing fixtures, dimmers, and timers or photocells,
- Performance problems,
- Unattractiveness, and
- Fear of fluorescent technology.

It is important to note that compact fluorescent residential lighting has improved dramatically in the last decade, and, with new technology, manufacturers have been able to reduce some of these barriers. Smaller, more attractive CFLs have appeared on the market. In fact, some of the newest CFLs with lower wattage are virtually identical in shape and size to incandescent bulbs. Some manufacturers are even producing dimmable CFLs and CFLs that have dusk-to-dawn lighting capabilities. In addition, most of the performance problems have been overcome. CFLs are available today that:

- Start immediately,
- Have an attractive, warm light color,
- Produce no audible hum,
- Produce no perceptible flicker,
- Do not interfere with remote controls, and
- Start and operate brightly at cold temperatures.³¹

³¹ Calwell, et. al. Op. Cit.

However, quality and reliability problems still exist. For example, one CFL manufacturer described problems he had finding reliable ballasts that did not hum. In addition, one program manager stated that it is not uncommon for some CFL manufacturers to overstate the brightness of their product by as much as 20%, thus disappointing many consumers who turn to CFLs for brighter light.

High first cost is the most mentioned factor in the literature. However, prices for compact fluorescent lighting products are decreasing and market actors reported different opinions on the subject. Some retailers interviewed for this study stated that price is not as big of a factor as it was in the past. Of the four interviews with large home improvement centers, none mentioned a high first cost of the product as a barrier. In fact, one of the four said specifically that it was no longer a barrier. Among the five smaller retailers, two agreed that high price was a reason the products are not selling. The LightWise field representatives also reported that many smaller retailers that they visited considered the high price of the product a problem in marketing it. However, one retailer stated that customers are responding to lower prices and another reported that, among the six stores that she deals with, CFLs and compact fluorescent fixtures actually sell better in less affluent neighborhoods. On the other hand, all three distributors interviewed reported that cost is the most important factor for low sales of CFLs. Moreover, one distributor stated that as long as compact fluorescent lighting is expensive, demand would increase only if the energy codes are changed. Similarly, a bulb manufacturer stated that prices would decrease only with additional utility subsidies.

Two other important barriers that still exist today are consumer and retailer awareness of CFL technology and product unavailability. Many consumers still have the preconception that fluorescent lights are noisy and produce undesirable light color. Some consumers also believe that there are health risks involved with fluorescent lighting. As one program manager put it, “lots more education is needed; people just don’t understand CFLs.”

The market for dedicated fluorescent fixtures has many of the same barriers that CFLs do, with an additional one - irreversibility. Dedicated CFL fixtures require more of a commitment from consumers because the CFL bulbs cannot be replaced with less expensive incandescent bulbs. However, while a CFL bulb might be 25 times as expensive as an incandescent bulb, the difference between a dedicated compact fluorescent fixture, including the CFL bulb, and an incandescent fixture might be only 50%.³²

Market Segments

Typically, residential consumers have been segmented by their type of living structure: new construction versus existing homes and single-family homes versus multifamily buildings. The research reviewed for this study did not address differences in market segments. In

³² Calwell, et. al. Op. Cit.

addition, the market actors interviewed for this study offered little information regarding these issues. Some observations regarding these segments are presented below.

The decision to include energy efficient lighting fixtures and bulbs in new homes is influenced by a number of factors. Extensive research into the residential new construction market has revealed that builders and contractors are overwhelmingly influenced by first cost. Builders perceive that consumers value other factors such as square footage, floor plan, kitchen appliances, etc. above energy efficiency. As a result, those areas receive more attention than does lighting fixtures. As one program manager explained, aesthetics is the main criteria for lighting in new construction. Furthermore, builders may be constrained in some cases by building and energy codes. For example, one contractor interviewed for this study explained that he was required to install fluorescent lights in the kitchen.

Another factor affecting the choice of lighting fixtures is the type and size of project. Production builders working on developments of tract homes issue a set of specifications applicable to a large set of homes to be built. Contractors working on the project may choose fixtures for the home based on the builder's specifications and allotted budget. On the other hand, builders working with a customer on a custom built home or on a small project will typically leave these decisions with the homeowner, although they may offer recommendations. The large production builder or contractor typically purchases his lighting fixtures direct from a manufacturer or distributor in bulk. For example, one manufacturer interviewed reported they have a sales engineer who works with architects in new construction. The custom homebuilder or contractor, however, is more likely to shop at a large home improvement store for lighting products. Interestingly, these smaller builders and contractors, similarly to consumers, may be influenced by utility rebate and manufacturer buydown programs to purchase more efficient products.

Multifamily buildings are usually managed by an owner or property manager. One program manager interviewed commented that for smaller buildings of 20 units or less, the property manager would typically purchase lighting products from a large home improvement store. A larger project, however, would be more likely to employ a contractor or energy manager who would purchase the products from a distributor or manufacturer. For example, one manufacturer interviewed for this study reported doing a lot of business with CFLs in the multifamily sector.

Another issue with multifamily buildings is that they are often inhabited by renters. Renters may not choose to purchase CFLs because they do not expect to stay in the unit long enough to realize the payback. In addition, renters typically do not install additional hardwired fixtures in their units, but rather choose more portable inexpensive lighting options.

Product Promotion Strategies

A number of promotional and distributional methods were discussed in the literature and researched in our interviews. Following is a brief discussion on the use of POP materials, product giveaways, and rebate and catalog programs.

Point-of-Purchase Materials

Previous evaluation studies on the Alliance lighting programs have recommended strategies that would encourage manufacturers and retailers to work together on promotional activities. Research suggested that manufacturers, retailers, and utilities needed to work together to develop point-of-purchase (POP) information that would increase customer awareness of CFL products. Many reports suggested that POP materials are one of the best ways to educate consumers since 65% of lighting purchase decisions are made in the store.³³ One study also reported that a POP display combined with a 15% discount would increase sales by 545%.³⁴

Approximately half of the retailers interviewed for this study reported that they currently receive some type of point-of-purchase brochures, signs, or other display items from at least one of their manufacturers of compact fluorescent lighting products.³⁵ Three of these retailers received POP materials from Sylvania, which, one of them mentioned, was extremely helpful in informing customers not only about compact fluorescent technology, but also about lighting and electricity in general. Each of the retailers that received POP materials from Sylvania stated that these materials help but are not enough and they would like to see more from other manufacturers. In fact, all but one of the retailers interviewed said that they would like to see more POP materials from manufacturers.

When we asked retailers what types of materials they would like to see from manufacturers, they suggested the following:

- Headers and brochures from manufacturers that stress the benefits of long life, energy savings and decreased maintenance for hard to reach bulbs,
- Packaging that also emphasizes these benefits in an attractive way,
- Education for sales people so they can promote compact fluorescent lighting better, and
- Displays to show customers the color and brightness of the light.

³³ Richard Heath and Associates. *California Residential Lighting and Appliance Program*, Draft. November 1999.

³⁴ Heath, Rebeca Piirto. "POP Art," *Marketing Tools Magazine*. April 1997.

³⁵ It is interesting to note that all of the large home improvement stores reported receiving POP materials, while none of the mass merchandisers did.

Nearly every respondent felt that there would be more demand for compact fluorescent products if consumers were more aware of them and of their benefits. Most felt that more POP information would be the best way to inform customers. A few of the respondents added that more advertising was also needed. These respondents suggested that advertising should be provided by the utilities or by lighting programs. They felt that these groups had more influence over consumers than manufacturers do.

Product Giveaways

Lighting programs have used the strategy of giving customers a free sample of a bulb they wanted to promote. However, one report reviewed for this study stated that this may actually hinder market transformation efforts for CFLs. The findings of this report suggest that “having consumers pay (something) for their first CFL products will encourage more CFL purchases than giving consumers their first CFL product free of charge.”³⁶

Rebate and Catalog Programs

Various lighting programs have sent mail-in rebates or catalogs to consumers in hopes that these would entice them to buy CFLs and compact fluorescent products. One program manager interviewed for this study, who had used both rebates and catalogs at different times to promote CFLs, described their current catalog program as very successful. Previous research on CFL programs compared the effectiveness of using rebates and catalogs. Results showed that 81% of consumers that were offered a mail-in rebate and 72% of those that received a catalog stated that they would likely purchase a CFL in the future. Both the catalog program and the rebate program had positive effects overall, but the catalog program may have had a negative impact on some consumers’ likelihood to purchase CFLs at full price. “The rebate program did not have this negative impact, likely because of lower rebates.”³⁷

2.6 Market Opportunities

This Section presents some opportunities for expanding the market for compact fluorescent lighting products, including the use of customer “hooks” in product marketing, the use of “starter products,” the expansion of CFLs in grocery stores, and the use of CFLs in manufactured housing.

³⁶ Brattesani, Karen A. *Seattle City Light Compact Fluorescent Lighting Products Research Report*. September 1994.

³⁷ Regional Economic Research, Inc. *Northern States Power Residential Lighting Evaluation Final Report*. October 1996.

Customer Hooks

The in-depth interviews with market actors included questions asking about features of CFL bulb or fixture products that are appealing to customers. In addition, respondents suggested ideas for promoting benefits or “hooking” the customer into noticing, and learning about, the benefits of compact fluorescent lighting. Since every retailer and field representative that we interviewed stated that there would be more demand for compact fluorescent products if consumers had a better understanding of the benefits, finding ways to raise consumer awareness and interest is an important issue.

Long Life

Nearly every respondent interviewed mentioned long life as an important benefit of compact fluorescent products. Most of them added that customers seemed especially interested in this feature because longer bulb life would mean less maintenance. LightWise field representatives and retailers mentioned that many consumers complained about changing bulbs, especially those who have hard-to-reach bulbs that need to be replaced. Some even suggested advertising ideas that could be used to promote this feature. For example, a television or radio advertisement could talk about the dreaded chore of climbing a ladder to replace a hard-to-reach light.

Respondents further mentioned that manufacturers should emphasize the avoided costs of replacing incandescent bulbs as a benefit of CFLs. While none of the respondents felt that this was as important as the decreased maintenance aspect, they thought that it should also be stressed. Furthermore, it was suggested that using a picture or graph to illustrate the life of a CFL compared to the life of a standard incandescent bulb would be more helpful than simply stating it on the package. As one retailer put it, “customers want to shop, not read.”

Two respondents mentioned that consumers were interested in the CFLs that offered warranties. Some consumers are wary of products claiming to last for 10,000 hours, for example, but with a warranty customers would be more willing to try it. Future participation in the ENERGY STAR program would provide this desire for a warranty. Under the program, a warranty that is good for either 12 months from the date of purchase or an equivalent service, such as an “800” number or address for consumer complaint resolution, must be provided to meet ENERGY STAR compliance.

Energy Savings

Energy savings is another benefit of compact fluorescent products that was mentioned in the interviews. Respondents that mentioned energy savings explained that they either thought customers were interested because it would mean lower utility bills or because it would be better for the environment. One LightWise field representative mentioned that he has had a

good response to a display that includes two electric meters spinning, one for an incandescent bulb and one for a CFL. Customers instantly notice how much faster the meter for the incandescent bulb is spinning and make the connection to lower utility bills. The representative mentioned that this display draws in many customers who are interested in investigating the product.

Another possible hook is the environmental aspect of energy savings. Some retailers stated that many consumers are concerned with protecting the environment. They further suggested that packaging and advertising should relate the energy saved in using CFLs in one household to how much energy would be saved if everyone used at least a few. One respondent mentioned that not many customers realize the small amount of electricity they save in their home could help the environment and, if they see how quickly it adds up, they might become more interested.

Less Heat Output

Another benefit mentioned in the interviews is that CFLs burn much cooler than incandescent and halogen bulbs. Several retailers and LightWise representatives stated that safety is a big concern among consumers. These respondents noted that this safety concern has especially helped in selling compact fluorescent torchieres. Two respondents added that CFLs and other compact fluorescent fixtures sell well when there are displays that customers can touch. One field representative mentioned that some customers seem amazed when they can actually touch a bulb or the outside of a fixture, and it is warm but not hot. Of the respondents that mentioned safety, or cooler bulbs, most mentioned that stores should have working displays with signs pointing out how cool they are. Others felt strongly about point-of-purchase advertisements and brochures about the safety of compact fluorescent torchieres compared to halogen torchieres.

Another aspect of the cooler burning bulb is that a consumer can get a brighter light using less watts. One of the LightWise representatives interviewed explained that this is appealing to a customer looking for a brighter light for a fixture that is designed to use bulbs only up to a certain wattage. Another field representative stressed that stores should have a display with lights that are on; his opinion was that many customers respond to the displays when they see how good the light quality actually is.

Shape and Design

Several respondents reported consumers are attracted to CFLs that are either small or have a unique shape, especially the spiral shaped CFLs. They mentioned that some customers liked the smaller, or sub-compact, bulbs because they were less worried about them fitting in their existing fixtures. In addition, the spiral shaped bulbs were reported as especially popular with consumers, and the shape alone prompted them to ask questions about the bulbs. One

program manager explained that the smaller designs appeal to customers because they can easily see the bulb will fit into their fixture; whereas with some of the larger designs, such as the circuline or 2D bulb, the customer may perceive these are more difficult to fit or are incompatible with their fixtures.

Recommendations

Recent research shows that 34% of the consumers that bought a LightWise CFL did so on impulse after being “captured” by the POP display. However, it is important to note that 78% of incandescent shoppers and 65% of CFL shoppers did not see the displays.³⁸ A study by the Point-of-Purchase Advertising Institute (POPAI) found that 65% of purchasing decisions for lighting products are made in the store.³⁹ These results show that more attention needs to be placed on POP displays. One recommendation, then, to increase demand for these products is to work with manufacturers and retailers to increase the number and types of POP displays. Retail stores need to have manufacturer-specific POP displays in addition to program-sponsored displays that stress long life, energy savings, and safety.

Table 2-5 summarizes the recommendations for advertising the “hooks” discussed above.

³⁸ Portland Energy Conservation, Inc. and Ecos Consulting. *LightWise Annual Program Progress Report*. August 1998.

³⁹ Richard Heath and Associates. Op. Cit.

Table 2-5: Recommendations for Using “Hooks”

Feature	Implications	Packaging	POP Displays/Brochures
Long Life	Convenience	Stress the bulb life of CFLs compared to the bulb life of incandescent bulbs, by showing one CFL and ten incandescents.	Stress the reduced maintenance (especially of hard to reach bulbs and fixtures).
	Avoided Replacement Costs	Show the cost of one CFL bulb compared to the cost of ten incandescent bulbs graphically.	Show the cost of one CFL bulb compared to the cost of ten incandescent bulbs graphically.
	Warranty of Long Life	Offer a warranty	Provide information showing independent testing of bulb life.
Energy Savings	Lower Utility Bills	Show that CFLs cost approximately 75% less to use than incandescent bulbs graphically.	Have one CFL and one incandescent bulb on display with electric meters next to each.
	Conservation of Earth's Resources	Explain how an individual's energy savings from the use of CFLs and the total energy savings if 50 to 75% of the Northwest used CFLs would help avoid creating additional power plants.	Explain how an individual's energy savings from the use of CFLs and the total energy savings if 50 to 75% of the Northwest used CFLs would help avoid creating additional power plants.
Cooler Light	Fire Safety	Stress halogen torchiere safety concerns.	Display a compact fluorescent torchiere and a halogen torchiere with a temperature gauge above each for customers to see the heat difference.
	Touchable Bulbs	Stress the temperature difference among CFLs, halogen bulbs and incandescent bulbs.	Display bulbs for customers to compare.
Smaller bulbs/ Twister bulb/“A” lamp bulbs	Fits more fixtures; more attractive	Blister packaging so they can see the product	Display bulbs in hard to fit fixtures.

Starter Products

A “starter” product is considered a product that would entail the least amount of risk for consumers while being able to peak consumer interest in energy efficient lighting. One of the market barriers for compact fluorescent products is the perspective that fluorescent lights are noisy and unreliable and have an undesirable quality of light. In addition, the perception that CFLs are not compatible with existing fixtures contributes to consumer resistance to these products. This implies that most consumers are unaware of the major technological improvements made in fluorescent lighting over the last several years. Offering consumers a product they “can not resist” may help to reduce these barriers.

The market actors interviewed for this research were asked if consumers were especially interested in any particular compact fluorescent lighting product. Several possibilities for “starter” products were mentioned, including the following:

- Spiral or sub-compact bulbs,

- Dimmable bulbs,
- Torchieres, and
- Outdoor fixtures.

One respondent also pointed out that any CFL under \$8 sold well at his store. Among the products listed above, spiral/sub-compact bulbs were mentioned the most, followed by torchieres. Discussion of each of these products as a “starter” product is discussed below.

Sub-Compact Fluorescent Bulbs

Some respondents felt that consumers like the smaller, sub-compact bulbs, with many mentioning the spiral shaped bulbs in particular. Some mentioned that the bulbs that are similar in size and shape to standard incandescent bulbs are popular because there is not much concern, by the customer, of whether or not the bulb will fit in their fixtures. Others mentioned that the spiral shaped bulb was in high demand because of its small size, but also because of its unique shape. One LightWise field representative mentioned that the shape alone peaked customers’ interest. In addition, it was suggested that displays and blister packaging, or clear packaging, could increase the demand for these bulbs.

Compact Fluorescent Torchieres

Halogen torchieres have been extremely popular since the early 1990s. It is estimated that there are 40 million halogen torchieres now in use in the United States.⁴⁰ However, because of safety concerns, these portable lighting fixtures are declining rapidly in popularity. The current safety toll from halogen torchieres is as follows:⁴¹

- Fires: 350
- Deaths: 30
- Injuries: 114
- Property Damage: \$2 million

As of July 1997, halogen torchieres were used in up to 80% of dormitory rooms in some universities. However, many universities have now banned halogen torchieres in dormitories and some have purchased fluorescent torchieres in bulk for their dormitory rooms. Stanford University, who bought 500 fluorescent torchieres in 1997, is one example of schools who are worried about the dangers of halogen torchieres.⁴²

⁴⁰ Geller, Howard, and Jennifer Thorne. *U. S. Department of Energy's Office of Building Technologies: Successful Initiatives of the 1990s*. January 1999.

⁴¹ <http://www.lightsite.net/index.html>

⁴² Calwell, Chris. *Energy-Saving Torchieres: Coming to a Store Near You*. July 1997.
http://www.esource.com/publicdomain/pubs_abstracts.frame.html

Table 2-6 presents a comparison of halogen and ENERGY STAR torchieres.⁴³

Table 2-6: Halogen Torchieres vs. ENERGY STAR® Torchieres

Feature	Halogen	ENERGY STAR®
Bulb Temperature (°F)	750 to 860	100 to 150
Bulb Life	5 to 17 months	3 to 8 years
Bulb Cost	\$4 to \$6	\$20 to \$30
Power Consumption (Watts)	265 to 335	55 to 80
Torchiere Light Output (Lumens)	3,200 to 5,500	3,000 to 4,100
Torchiere Efficiency (Lumens Per Watt)	10 to 12	60 to 65
Operating Cost Per Year	\$35 to \$75	\$7 to \$15

Like other CFL fixtures, compact fluorescent torchieres are more expensive than the less energy efficient models, but the price difference is not as shocking as the price difference between CFL bulbs and incandescent bulbs. Halogen torchieres usually sell for around \$20. Compact fluorescent torchieres can be found for as little as \$30.

Many consumers still have halogen torchieres in their homes because of the need for light and because torchieres meet basic interior décor needs. People living in apartments or newer homes must purchase portable fixtures to brighten their living surroundings because they are likely to have more switched electrical outlets and less hard-wired fixtures in bedrooms and living areas. This is due to the fact that builders generally allocate less than 1% of their construction budget to lighting, leaving as little as \$300 to \$700 for lighting in many new homes.⁴⁴ Because of the combination of the continued need for portable lighting fixtures with the popularity of torchieres and the safety concerns with halogen torchieres, compact fluorescent torchieres could gain a large market share in a short amount of time and concurrently get people interested in compact fluorescent lighting. “Compact fluorescent torchieres represent an excellent means of introducing consumers to ENERGY STAR lighting.”⁴⁵

Several research reports suggested that utilities, or lighting efficiency programs, should sponsor more halogen torchiere turn-in events. Events like this offer a chance to increase consumer awareness and usually attract free advertising. The Alliance has promoted several turn-in events in the past and we recommend that these continue. In addition, a small catalogue, or list of products, could be included inside the torchiere packaging. This would

⁴³ <http://www.lightsite.net/index.html>

⁴⁴ Calwell, et. al. Op. Cit.

⁴⁵ Calwell, et. al. Op. Cit.

help to educate consumers about the availability and benefits of other compact fluorescent lighting products.

CFLs in Grocery Stores

Previous research shows that most grocery stores do not carry compact fluorescent bulbs. In fact, less than 1% of the CFLs sold in the United States from May 1998 to April 1999 were sold in grocery stores. However, many consumers chose to purchase incandescent bulbs at grocery stores; 31% of national incandescent bulb sales were in grocery stores.⁴⁶

Several reports have looked into the idea of expanding the availability of CFLs in grocery stores and identified a number of factors that hinder the effectiveness of that strategy. The following are some of the reasons why CFLs are not typically found in grocery stores:

- The average price of a supermarket product is \$3 to \$5 whereas the average price of a CFL is \$8 to \$13.
- Consumers are not accustomed to making long-term purchases when they go to the grocery store.
- Supermarkets tend to be risk-averse.
- Supermarket staff tends to have little technical knowledge of products.
- Grocery stores purchase lighting products from distribution companies. This could increase the price of CFLs to a level higher than they can be, found in home improvement stores.⁴⁷
- Grocery stores are worried about handling customer complaints about the quality of CFLs.
- Grocery stores do not want to fill limited shelf space with CFLs if they also need to invest in promotion materials.⁴⁸

Each report noted that encouraging grocery stores to stock CFLs could have long-term growth potential. However, the authors disagree on whether or not energy efficient lighting programs should concentrate on getting CFLs into grocery stores.

Two program representatives who are starting to promote lighting products in grocery stores this year were interviewed for this study. One of these, with a California program, sees this as a necessary step to increase the visibility of these products to consumers. Their program design states that the absence of CFLs from grocery stores “reinforces the perception that

⁴⁶ Calwell, et. al. Op. Cit.

⁴⁷ Ecos Consulting and ICF Consulting. Op. Cit.

⁴⁸ Hagler Bailly Consulting, Inc. *Residential Market Effects Study: Refrigerators and Compact Fluorescent Lights*. April 1998.

CFLs are an unusual or specialty product, not suitable for everyday use.”⁴⁹ The program design includes point-of-purchase information, advertising in the grocery chain’s weekly circular, and consumer instant-rebates.

Another program representative interviewed in the Northeast offers an instant rebate coupon to grocery shoppers. This program targets retailers in general and recently has had some success with a smaller grocery chain. Unlike the Northwest, a large number of grocery stores in the Northeast already carry CFLs. This respondent reported that a few years ago many grocery stores were reluctant to carry CFLs; however, since they have become popular over the last few years, grocery stores realized that they needed to stock them. The program offers instant coupons of \$9 toward a qualifying CFL and \$20 toward a qualifying fixture.

Previous research suggested that the market barriers for expanding CFLs to grocery store shelves were too large to overcome. However, with the success of getting CFLs into grocery stores in the Northeast, there may be hope for other parts of the country. One Northwest program manager we interviewed did not think it was cost effective to target grocery stores due to their extreme competition for shelf space coupled with their comparatively low-priced product lines. On the other hand, grocery stores interviewed for this study sold a variety of specialty lights including outdoor floodlights, colored bulbs, bug lights, and bulbs for bathroom fixtures, appliances and track lighting. For example, one grocer interviewed stated they sold floodlights for as much as \$7 and that these bulbs were normally on the shelf for at least a couple weeks. In addition, grocer-retailers like Fred Meyer carry CFLs in their lighting departments and incandescents and a few specialty bulbs in their grocery departments.

We recommend that further research be done to determine the success of CFLs in grocery stores in the Northeast and the opportunity for similar programs in the Northwest.

Manufactured Housing

In the Pacific Northwest, approximately one-third of all new housing is manufactured housing. The fixtures that tend to be installed in these homes are in high use applications such as outdoor porch lights and in the kitchen and bathrooms. They are also usually purchased in large quantities directly from the manufacturer.⁵⁰ These two characteristics make manufactured housing a prime target for promoting compact fluorescent products. We recommend that further research be done in this area and the possibility of working with key manufactured home builders be investigated.

⁴⁹ Richard Heath and Associates. Op. Cit.

⁵⁰ Calwell, et. al. Op. Cit.

3

Consumer Research: Residential Lighting Focus Groups

3.1 Overview and Methodology

In order to explore a variety of consumer-related issues and perspectives on energy efficient lighting, four focus groups were held with homeowners in the Pacific Northwest. These focus groups were organized and conducted by Robert Bordner of Energy Market Innovations, Inc. under subcontract to RER. A brief discussion of the approach used in conducting these focus groups is provided below, followed by a synopsis of the topics discussed during these groups.

Recruitment and Logistics

The Alliance sponsors energy efficiency programs in four northwestern states. The groups were conducted in four different locations in order to obtain broad representation throughout the Pacific Northwest.

Table 3-1: Focus Groups

Location	Date	No. of Participants
Seattle, WA	2//10/00	11
Boise, ID	2/15/00	12
Spokane, WA	2/16/00	11
Eugene, OR	2/17/00	13

Participants for these groups were screened during the recruitment process to ensure that they were (1) homeowners (2) responsible for, or participating in, lighting-related decisions in their home, and (3) at least somewhat familiar with lighting products. Fourteen people were recruited for each group in order to ensure a minimum of 10 participants.

Flow of Discussion

Each group was conducted in a similar fashion, using a moderator's guide that was developed with the project manager. A copy of this moderator's guide is provided in

Appendix B. After the introductions, participants were asked to share their initial thoughts associated with lighting. This process was used to understand what sort of attributes consumers most frequently consider when selecting lighting options for their home. Recent and expected lighting purchases were discussed in terms of function, location, and preferences, as well as where consumers shop for these products.

After this fairly broad-based discussion of lighting, the discussion turned to energy efficient lighting. Again, participants were asked to describe attributes or qualities that they specifically associate with energy efficient lighting. This was undertaken in order to ascertain consumers' levels of familiarity and awareness with energy efficient lighting products. This process also revealed a number of preconceptions that are important to consider as NEEA develops future programs.

After a general discussion of energy efficient lighting, a variety of products were discussed and demonstrated for the participants, including (1) CFL torchieres, (2) low and high CRI fluorescent tubes, and (3) screw-in CFLs. Reactions to each of these products were obtained, including feedback on light quality, packaging, price, and marketing approaches.

Using Focus Group Results

When interpreting the results from this research, it is important to understand that they are purely qualitative in nature. Although steps are taken to ensure balanced groups and direct the flow of discussions, unique dynamics inevitably exist within each group. The findings presented herein are synthesized across the four focus groups. As such, the findings are not presented in the context of any particular groups, but are the collective findings on topics discussed and trends that emerged over the four groups.

3.2 Lighting Priorities

In noting what thoughts came to mind when the topic of “lighting in their home” was mentioned, participants emphasized mood and quality, functionality, aesthetics, and control. Surprisingly, lighting costs—either fixture costs or operating costs—were rarely mentioned at this early stage in the discussion.

Mood and Quality of Light are Important

Lighting is an inherently emotional topic for many people. Quality of lighting is important and is seen, in some regards, as affecting their overall quality of life.

- “...colorful, natural and reactive light. I want lights that react.”
- “I hate a dark house. I cannot stand a dark house because I think that lighting affects your moods. Dark is depressing.”

- “You’d use fluorescent lights cause you get a lot more light.”
- “Mine (thoughts) are emotional. Lights make me happy and I think they’re necessary.”
- “But if you don’t really need to see what you’re doing, and you want to kick back and read, you know....or just lounge and watch TV and want some back-lighting, you know, that intensity isn’t really important.”
- “To me it’s like, no fluorescent.”
- “...I really think about lighting and how it affects the mood. It can totally affect the mood of a place by the lighting.”
- “So it’s a trade-off whether you want your kitchen lit with fluorescent light but you aren’t going to use a fluorescent light in your living room or your bedrooms. It’s just not a pleasant light.”

Functionality is Critical

Above all else, functionality was noted as being of primary importance to focus group participants. Functionality was defined in a variety of ways but was most often framed within the context of specific tasks and/or rooms of the home. Kitchen lighting, for example, was differentiated from lighting used for reading.

- “...everybody has the hobby that they like, so they’re referring to lighting to meet those specific needs...I also do cross-stitch which entails small detail work.”
- “...do they illuminate the area that I want sufficiently, which falls into well-lit areas...Right now I’ve kind of got a problem with my garage area. I don’t have quite the lighting applications that I need out there in that area.”
- “When I think of lighting, I think of reading because I like to read and I like to have a nice bright light when I’m reading.”
- “We’re in the kitchen a lot so, of course, I want my kitchen well lit.”
- “When you need light, you need light. Intense light.”
- “The problem with the kitchen light is it’s recessed in the middle of the room so all of it’s shadowed on the outside.”
- “In shopping for lights I’ve found so many are so impossible to replace the bulbs in. Like your exterior lights. I have two at my house that are in complete disarray.”

Aesthetics are Important

In addition to the purely functional emphasis that many people place on lighting, the importance of aesthetics was noted.

- “You can walk into any home in Boise that’s been built in the last few years and it’s track lighting, recessed lighting, everything looks alike. We should be able to have adequate lighting and come up with something that’s a little more decorative, too.”
- “It would be nice if it fits the decor of the house or the area it’s in.”

People Like to be in Control of their Lighting

Convenience and control were noted as being important attributes of lighting systems. Dimmers were mentioned frequently, as was the general ability to vary the intensity of lighting within rooms to fit the task at hand.

- “I was thinking more of convenience like three-way lighting fixtures and four-way lighting fixtures.”
- “I want to create it somehow. Lights that you can ‘dial a mood’ so to speak.”
- “I bought an exterior light with a motion sensor, put it on my garage. I had a fluorescent light that’s supposed to turn on at night and turn off during the day and it didn’t work. So I went and just bought a motion sensor with incandescent bulbs.”

3.3 How Consumers Shop for Lighting

Most participants noted that they shop for low-cost bulbs at grocery stores or larger discount stores such as Costco, Kmart, Pay ‘N Pack, or Fred Meyer. On the subject of incandescent bulbs, many people commented on how short-lived incandescent bulbs seem to be. This is viewed as a major inconvenience, especially with exterior fixtures and fixtures that are in hard-to-reach places.

- “I usually buy light bulbs when they’re on sale. I very rarely pay regular price.”
- “I’m into convenience so if I can’t find things at Fred Meyer, I just don’t find them.”
- “We buy 80% of our bulbs at Safeway.”
- “Yeah, you buy at Safeway or Fred Meyer.”
- “I’ve got very high ceilings so I don’t even want to think about going there.”
- “They have a tendency to go out soon, you’re right. But if you’re paying less for them you’re still coming out ahead.”
- “I buy those ones at Home Depot where you get them for sixty-seven cents and you put them outside and our lights out in front of the house. We leave them if we go away for the weekend and we come back and they only last like three weeks or a month. That’s it. You can’t leave them on for any length of time.”

Most consumers purchase lighting fixtures at home centers such as Eagle, Home Depot, or Home Base. Lighting specialty stores are seen as a source of quality lighting fixtures, but consumers view these stores as having higher prices and shop at these stores only when they are looking for higher-end items. Some consumers mentioned shopping at specialty shops first to find out what style they want, but then make purchases based upon price at another set of stores.

- “Most of the lighting that we have bought like for our bathroom and for our dining room has been from Eagle, Home Base or Home Depot.”
- “It’s more custom. You go to Eagle and it’s what you find in everybody’s home. You go to Phoenix and you’re going to find individual personalized lighting. You’re not going to go in their house and say ‘Oh you got those at Eagle.’ You’re going to say ‘Where did you get that light?’...”
- “Like champagne and beer. Eagle has a little section. Seattle Lighting, that’s it... that’s what they do.”
- “If it was for a really special fixture, I’d go to Seattle Lighting first. It depends on the application. If it’s for a basement fluorescent lamp, Eagle.”
- “I’d probably go to the specialty shops first and see what they have to offer and then end up getting it at a Fred Meyer’s or someplace like that.”

3.4 Familiarity and Perceptions with Energy Efficient Lighting

Before specifically reviewing energy efficient lighting products, participants discussed their familiarity with and perceptions of energy efficient lighting products. This step was useful in identifying consumers’ preconceived opinions about these products and in forming a basis against which their subsequent opinions could be compared.

Initial Perceptions

To begin the discussion of energy efficient lighting, participants were asked to write down what came to mind when the topic of “energy efficient lighting” was mentioned. Each participant then shared what he or she had written. While fluorescent lighting was most often mentioned by participants, other items were mentioned as well, including reflective surfaces, daylighting, and controls. Specific products, perceptions, and actions that were mentioned include the following:

- “fluorescent”
- “great”
- “low wattage”
- “It meets the requirement, whatever it is, at minimal cost.”

- “dim...it can’t be as bright”
- “pricey”
- “dimmers”
- “conservation and the environment”
- “screw-in fluorescents”
- “daylighting”
- “Watt Miser bulbs...but they never seem as bright”
- “I have a philosophy in my house; you leave the room, you turn the light off.”

Familiarity with Energy Efficient Lighting Products

Within each group, about two or three people were familiar with the concept of screw-in CFLs. Once the topic of CFLs was raised, discussions typically illustrated a lack of understanding about these products, and uncertainty regarding the cost and value associated with these products.

- “I was thinking about those new spiral ones. I haven’t bought one because they’re so expensive.”
- “If you think you’re going to save money, you’ll pay more money to save that money. But do you really save?”
- “That’s the thing. I don’t think they put enough proof out there.”
- “Well, who’s going to take the time to sit and calculate it.”
- “Isn’t the mercury vapor kind of energy efficient?”

Many of the familiar stereotypes associated with fluorescent lighting—flicker, hum, and light quality—were expressed right away.

- “Fluorescent, yeah...they feel sterile and the light color isn’t the same. It’s too uniform.”
- “If I could get something that lit as well that didn’t make the noise, the hum.”
- “The only thing when I think about energy efficiency is fluorescent lighting. I hate fluorescent lighting. I think it’s bad for you.”

3.5 Reactions to Energy Efficient Lighting Products

Following the general discussion of energy efficient lighting, consumers were shown a variety of energy efficient lighting products, including the following:

- CFL Torchiere Technology
- Fluorescent Strip Lighting
- CFL Lamps

The broad objective of these discussions was assessing general consumer reactions to these products, and also determining what particular elements surprised them and gave them the understanding that they previously did not have. Typical reactions to these different technologies and products are provided below.

CFL Torchiera

A GE Profile CFL torchiera lamp was demonstrated and the reactions were discussed. In general, torchiera fixtures were not well regarded by participants. Among those who have halogen torchieras, people commented that they liked both the quality and the quantity of light put out by these lamps. Torchiera lamps are generally known as low cost fixtures, considered by some to be dated in appearance. Most people were aware of the fire hazard potential associated with halogen torchiera lamps and, in Eugene, it was mentioned that the University of Oregon has banned such lamps specifically because of the fire hazard.

- “Those are not safe. You get one of those turned on and it’s too hot to cook eggs on. If it gets knocked over, you can lose your whole house. Especially if it gets knocked over on a curtain. In fact they’re illegal to have – on campus.”

Reactions to the CFL torchiera were mostly positive, although the lamp was not viewed as being entirely comparable in terms of light output and quality. Consumers generally thought the light from the CFL torchiera was fine. However, the interest was very limited in actually purchasing such a lamp. This is perhaps an age issue since a large part of the torchieras market is college students and first-time apartment renters who are looking for an inexpensive source of lighting.

- “I would think about it. We’ve got an incandescent torchiera. It works fine. It’s got a nice night-time light that’s not so bright that you feel like staying awake all night. But I would replace it with something that was more efficient.”

Fluorescent Tubes

A comparison of “cool white” and “kitchen & bath” tubes was demonstrated with side-by-side fixtures to illustrate the differences in light quality associated with these fluorescent

tubes. The following discussion confirmed that people often have a negative impression of the quality of light of standard fluorescent bulbs, and highlights the fact that people are both unaware of, and confused about, variations in light color provided by fluorescent tubes.

Although many are dissatisfied with the color of light provided by their fluorescent tubes, these same consumers are unaware of how to tell if a fluorescent tube has color qualities that they want, or if they are superior. It was noted that display of fluorescent tubes in home centers is set up with commercial/industrial shoppers and contractors in mind, who are perceived to care more about price than quality.

Importantly, price is not particularly important in consumer's fluorescent tube purchases because of the broad-based awareness that these products last longer.

- “We have one in our kitchen that we keep on all the time, a fluorescent light. It goes for years. We're always surprised when it runs out. It's amazing. We never turn it off.”

Consumers also appear to be willing to pay more for better light quality, assuming that they are able to make informed decisions based upon quality.

CFL Lamps

Using four clip-on desk lamps aimed at a wall, three CFLs and one incandescent were demonstrated to elicit reactions to light quality, brightness, and other characteristics among the different products. Significantly, when asked to identify the incandescent lamp, there was a great deal of debate and indecision among the group. Consumers often initially guessed the correct one, but then started to back away from their selection as they looked more closely at the quality of light emitted by the other bulbs.

In some cases, people reported differences in the color and the light path provided by the lamps. Nevertheless, consumers were quite surprised by a number of CFL attributes, including quality of light, brightness, lack of heat, shape of lamps, price of lamps, longevity of lamps, and energy savings. A short discussion of each of these topics is provided below, followed by a list of questions frequently asked about CFLs.

Quality of Light

Some consumers expected energy efficient lights to have poor color-rendering qualities and/or shadows. Participants were surprised by the color quality and clarity of the lamps shown. Importantly, however, these same consumers are uncertain how to select fluorescent lighting with satisfactory color.

- “Fluorescents are getting pretty damned sophisticated.”
- “That one there is really warm.”
- “I think they’re all fluorescent” [referring to the incandescent as well].
- “The range of color. They weren’t just white, they weren’t, what was it? Green?”
- “Yellow, green. Which makes them a little warmer.”
- “Yeah, it’s been a while since I’ve looked at fluorescent.”
- “The range of colors is kind of surprising.”

Brightness

Some consumers are initially of the opinion that energy efficient lights are dim. These people were therefore especially surprised to see how bright the lamps actually were.

- “If I saw 75% and equally as bright, I would definitely look at them.”
- “This one looks pretty bright.”
- “They were all bright...”

Lack of Heat

While safety issues related to heat are most prominent in torchieres, consumers also perceive that safety is an issue for some reading lamps as well, since fixture labels often specify a maximum of 60 Watts. For this reason, the lack of heat generated by a CFL was surprising to some and viewed as positive.

- “It would be more appropriate than the incandescent bulb that you’re putting in there. They’re less heat.”
- “I was impressed with the fact that you can unscrew it while it has been on. It’s not hot.”
- “But to me that low heat is a big deal. And it’s safer.”
- “I have a little reading light that gets way too hot. I have to point it at the wall. I’m always worried about the wall getting too hot. So from this I’ll definitely go look.”

Shape of Lamps

Participants were universally intrigued by the variety of shapes for CFLs and, importantly, the close similarity that some lamps have with their incandescent counterparts. Consumers tend to prefer the CFLs that more closely resemble traditional A-lamps.

- “I like these because they’re different.”

- “I would probably go more with what I’m used to...I’d go with more of the standard, old-fashioned looking one. This would be something I’d just pick up at the store once a month, buy one, and then try to replace them all.”
- “I’m still surprised that they can fit into regular fixtures.”
- “I want a lightbulb to look like a lightbulb...Those look like lightbulbs.”

Price of Lamps

For many consumers, the prices associated with items shown were substantially lower than they expected based upon past experiences with CFLs.

- “That’s real reasonable.”
- “Especially with the price. Being less than I thought. I was intrigued by these initially in the Real Goods catalog and I looked at the price and said ‘well I’m going to have to wait for this to get cheaper.’”
- “I didn’t know there was a screw-in being made that cheap yet. That’s pretty cheap for a little fluorescent.”
- “I think they’ve come down in price, too, since when I first started looking into these.”
- “No, I’d say \$15.95.” [Moderator: That lamp was \$3.95] “Really? Wow.”

Longevity of Lamps

Consumers in each group noted dissatisfaction with how frequently incandescent bulbs require replacement. Even taking into account a fair degree of skepticism regarding manufacturer-provided hours of life, consumers were nevertheless impressed by the potential for longevity with CFLs.

- “I didn’t know they lasted that long.”
- “I look at these models here and the first thing that comes to mind is ‘They’ve got quite a bit of life.’ I hear my wife telling me to change the porch light again. Then it doesn’t matter what it costs or how much it saves. I just don’t have to do it.”

In terms of manufacturer claims, consumers expressed dissatisfaction with manufacturer imprecisions about lamp life expectancy.

- “I absolutely hate that when they use ‘up to’ seven years.”
- “It just says lasts up to five years. That means a lot more to me than ten thousand hours because I really don’t have a concept of what ten thousand hours is. You have to stop and figure out how many hours or years and all that kind of stuff. Five years sounds easier to deal with.”

Energy Savings

Although consumers tend to know that fluorescent lights use less energy, they were genuinely surprised when the magnitude of energy savings was expressed as a percentage relative to comparable incandescent lamps. Consumers are not generally aware that they can save 75% of their lighting costs with CFLs.

- “To me that would be a big sale item if it’s going to bring my energy bill down.”

Discussions also highlighted the fact that most consumers do not view lighting as a significant cost on their utility bills, even though few know how much it costs them for a year.

- “I don’t think, on your utility bill, that lighting is a big issue. It’s your heating cost and all that. That’s where the money goes. But I don’t know how much it costs to run a light bulb. Nobody has ever told me...”
- “I agree with you. I think the dryer and the electric hot water heater -- that’s where most of the energy is going, so I don’t want to trade the incandescent bulbs for fluorescent bulbs because I don’t like fluorescent lighting ... I don’t think it’s a very pleasant light. I’d rather pay what I think is a very small amount for better light.”

Frequently Asked Questions About CFLs

During the discussion of CFLs, it became apparent that consumers continue to have a surprisingly long list of unanswered questions. These questions extend way beyond justifying the prices of these lamps and include the following:

- “Can they be used outside?”
- “Do they make them as floods?”
- “Will it fit in my fixtures?”
- “What happens when they break?”
- “Is the gas poisonous?”
- “How do I dispose of a CFL?”
- “Will CFLs explode the way fluorescent tubes explode when they are dropped?”
- “I heard fluorescent lights cause cancer—do these lamps (CFLs) cause cancer?”
- “How are these lamps different from one another?”
- “Why do some claim to last longer?”
- “Does the color affect the lifetime?”
- “Do they get hot?”
- “Why do they cause interference?”
- “Why are there so many disclaimers on the packages?”

- “How do I really use the warranty?”
- “Can these be used with dimmers?”
- “Why is a range of wattages given rather than ‘this is it’?”

3.6 Marketing Approaches

Under the topic of marketing approaches, a broad range of topics was covered including packaging, performance information and standards, warranties, coupons, energy efficiency branding, retail displays, and general guidance in product selection.

Packaging

Close scrutiny of the packaging frequently led to in-depth comparisons across products, and prompted a number of detailed questions about the products (see discussion above). As might be expected, reactions to the packaging were quite varied, focusing on (1) the ability to see the product, and (2) the information contained on the packages.

Often, one of the first reactions was a preference for packaging that allowed the consumer to “see” the product they were purchasing – a factor that is particularly important given the diverse array of shapes and styles available. Clear plastic packaging that allows the product to be viewed was generally favored. This preference was predictably countered by another’s preference for environmentally friendly packaging – and the use of plastic is not perceived as environmentally friendly.

Consumers need more information to make CFL purchase decisions and, although consumers like the packaging with a lot of information for them, some saw the packaging as being too “busy.” Additionally, consumers suggested that the information might be more effective if displayed graphically.

Performance Information and Standards

Consumers were attracted to, but skeptical of, the various statistics printed on the packages – including lumen equivalence, longevity, and energy savings estimates.

The general public is not familiar with the concept of lumens as a standard for light output. Although many people know that wattage is a measure of “power,” the default measure on a CFL package is an undefined “wattage equivalent” that uses an incandescent lamp as the baseline reference.

The “incandescent equivalence” issue is therefore an important barrier in discouraging consumers from adopting CFLs; it deserves substantial attention. CFL packages generally give ranges of bulbs for which they may substitute (e.g., 75-100 watts). This approach is not

acceptable to consumers who want to know more precisely what they are buying. The following exchange, referencing a CFL torchiere, provides a representative example:

- “What’s the bulb rated at?”
- “It’s fifty-two watts.”
- “Is it fifty-two watts fluorescent, or incandescent, or a hundred watts...?”
- “Is that incandescent lumens?”

Longevity is another area in which consumers lack understanding and are skeptical of manufacturer-provided information. Proverbial “red flags” shoot up in people’s minds when packaging claims that CFLs last “up to” seven years. The “up to” portion of the claim causes consumers to doubt that the product will actually last that long.

Energy savings estimates also are viewed suspiciously. This results from a combination of factors, including (1) that these savings estimates are tied to the actual longevity of the lamp (see above), and (2) that most consumers have no idea how much an individual lamp costs to run and, therefore, lack a baseline against which such estimates may be compared.

In each of these areas, there was an expressed preference for independent certification or verification of such information and standards. Warranties (see below) are seen as addressing the issue of longevity, but not necessarily the other two performance variables (energy savings and light quality).

Warranties

Consumers notice manufacturer warranties that are displayed prominently on the packaging, as well as the absence of such warranties on competing products. Warranties were viewed positively, although this initial enthusiasm generally diminished as soon as someone raised the issue of logistics for collecting on a CFL warranty.

- “I think that puts a little bit of confidence in backing up the price.”
- “Yeah but how would you ever collect the warranty?”

The other downside of warranties is that they really address only one of the areas of performance uncertainty that consumers have with CFLs -- longevity. *The other two issues – energy savings and light quality can only be addressed by an unconditional guarantee of customer satisfaction.*

Coupons

In one group, customers suggested that coupons might be used to lure the consumer into a store, and that displays could then be used to educate the consumers and help them make a

decision. Coupons are clearly preferred over rebates since the stores process the coupons; rebates are perceived as having too high of a transaction cost for the consumer.

- “I know, they need a coupon! If they really want people to try them, they would send out a two dollar off coupon.”
- “We’re a coupon grabbing society.”
- “Don’t use the mail-in rebate.”
- “Mail-in rebates half the time you don’t get them back anyhow.”

A \$2 off coupon was suggested and, upon further probing, was viewed more favorably than a \$1 coupon. A suggested alternative was a coupon that would give a decreasing discount for each successive lamp purchased and then would give a bonus after the fifth lamp, thereby locking the customer in over time.

Energy Efficient Branding

Familiarity with the LightWise label was negligible. When the term ENERGY STAR was raised, there was typically a somewhat greater, although still low, awareness. No one associated ENERGY STAR with lighting, but instead mentioned computer monitors and large appliances as items they associated with the ENERGY STAR logo. Typical comments included the following:

- “It has some rating for energy efficiency.”
- “I think EPA is involved, but I don’t know.”
- “Watch out, the government is involved.”
- “I’ve seen it. I’m not exactly sure what it is.”

If the ENERGY STAR label is used as the primary vehicle for energy efficiency branding, it will be necessary to build into it a definition for consumers as to what this branding means in the context of lighting.

Importance of Retail Displays

The importance of quality retail displays became evident early in the focus groups. During the groups, consumers were intrigued by the ability to see and experience the light quality of the lamps, to take lamps out of their packages, and to ask questions.

- “I just bought some lamps a month ago. I was in Eagle two or three times looking and I never noticed an energy efficient section.”
- “I’m sure they’re there. But there’s nothing that jumped out and said ‘Hey look at me, I’m energy efficient.’”

- “Plus we’ve bought incandescent for all those years. You need to have that visual comparison. If you want somebody to buy the product they need to be able to measure apples to apples.”
- “They don’t package it very well on the shelves. Generally, you’re looking at the end of the [fluorescent] tube on the shelf...so all you see is this 1” by 1” end.”

A retail display that enables consumers to handle the lamps, to observe their respective light qualities, and to educate themselves may be highly effective for increasing CFL penetration in the market. This observation is supported by California CFL program managers who identify comprehensive retail displays as a showstopper for effective promotion of CFLs.

Consumers Desire Guidance in Product Selection

Focus group participants asked many questions that focused on the appropriateness of CFLs in different types of applications. It was suggested that packaging and/or displays should guide consumers toward lights that are appropriate for specific rooms or tasks. Examples include the following:

- Recessed fixtures,
- Exterior lighting,
- Dimming lights,
- Reading lights, and
- General area lights—bare bulb, non-bare bulb.

Such guidance may be considered for broader incorporation into packaging and/or retail displays.

3.7 Summary of Key Findings and Themes

Based upon the results of these focus groups, it appears that consumers are favorably impressed by the CFL products demonstrated. Lower-than-expected prices gained the attention of focus group participants quite quickly. Moreover, although people began with a number of prejudices against fluorescent lighting, many were interested in exploring the possibilities for more CFL use in their homes. Several important themes emerged from the focus groups, all of which should be taken into consideration when developing program design alternatives.

Past Experiences and Perceptions Dominate Thinking About CFLs

Focus group participants’ preconceived notions about CFLs are based on a combination of past experience and outdated information. Such perceptions include high prices, dim light,

flickering ballasts, and large size. New CFL marketing efforts need to challenge people to re-think what they believe to be the facts about CFLs.

Consumers are Very Attracted by Prices of \$5.95 and Under

When the retail prices of two lamps were mentioned as \$3.95 and \$5.95, people were very surprised and took notice. This price point, combined with the improved quality of light and the awareness of the lamp life, is likely to get the attention of many consumers.

Consumers are Interested in Learning More About CFLs

Perhaps the strongest message to come out of these focus groups is that, given the chance, consumers are interested in learning more about CFLs. Consumers who are shown the quality of light now available from CFLs and are educated about the longevity of the bulbs will give CFLs serious consideration. Consumers are uniformly surprised by the longevity of these bulbs (a factor that is perhaps more important than the actual energy savings), the quality of light provided, and the current market prices for these lamps.

Interactive Retail Displays are Critical

Once they experience CFLs first hand and have their questions answered, participants generally left the focus groups very impressed. Retail displays allowing consumers to touch, examine, and compare CFLs with incandescent lamps will play a powerful role in transforming the CFL market. A creative combination of retail displays and promotional events should be considered when selecting ways to facilitate consumers' desires to learn more about these lamps.

Consumers are Confused and Skeptical of Performance Claims

Manufacturers' claims of light quality, longevity, and energy savings are met with a strong dose of skepticism from potential consumers. Experience tells them that fluorescent light quality is not desirable; any attempted comparison to watt-equivalent ranges does not satisfy them. Claims of lamp life "up to" a number of years, as well as energy savings estimates, are discounted heavily. Desire for standardization and independent verification of such claims was expressed.

Focus on Energy Efficient Kitchen Remodel Designs

Many focus group participants referred to past or planned projects to remodel their kitchens with a major focus on installing new lighting. Recessed can fixtures were often mentioned in this regard. Retail displays demonstrating the effective use of CFLs in lighting remodels may attract a valuable target market.

Unconditional Satisfaction Guarantees

One option to consider is aiding manufacturers in offering an unconditional satisfaction guarantee. Such a guarantee might be valid only for a limited period – 60 to 90 days, but would serve to address consumer uncertainties about performance that may be satisfied only through direct experience. Returned lamps could be tracked to ascertain consumer satisfaction with various models, thereby providing manufacturers with accelerated feedback on which models are more/less desirable, feedback that otherwise may only be obtained through years of experience. All returned lamps could be donated to charities.

4

Consumer Conjoint Analysis

4.1 Overview

Consumer conjoint analysis was used in this study to help understand the consumer purchase decision process by determining which CFL lighting attributes consumers value most and least. Consumer conjoint analysis also provides an estimate of how modifying such attributes changes what consumers buy.

The term conjoint analysis describes a broad range of techniques for estimating the value people place on different attributes that define products and services. The goal of any conjoint survey is to assign specific values to the options buyers consider when making a purchase decision. Using this knowledge, CFL program planners can focus on the most important product features when devising a strategy for expanding market share.

Traditional surveys ask respondents to estimate how much value they place on each product attribute. This can be a difficult task, and the result does not take into account the tradeoffs consumers may make when presented with different combinations of attributes. Conjoint analysis, on the other hand, breaks the decision process into a series of choices or ratings, depending on the method used. These choices or ratings allow one to compute the relative importance of each attribute included in the analysis. Instead of the ‘stated preference’ approach of traditional surveys, conjoint analysis uses ‘derived importance’ values for each product attribute.

An additional advantage of the conjoint analysis method is the ability to develop market simulation models to estimate the impact on the purchase decision when certain attributes are modified. However, results from the model should be used as indicators of predicted preference and not of predicted market share. Conjoint models do not predict market share for a number of reasons including:

- The assumption within the conjoint model of perfect information,
- The assumption within the conjoint model of equal availability of competing products,
- Respondents may not accurately reflect potential buyers, and

- Conjoint results reflect potential market acceptance of products given proper promotion, product distribution, and time.

Several steps were taken in performing the conjoint analysis. Budgetary and time frame issues influenced how each step was taken. To complete the conjoint survey within the specified study parameters, it was decided to conduct the survey through an interactive web site with respondents accessing the survey through the Internet. After determining how the survey was to be conducted, the following steps were taken:

1. Identify the attributes to include in the survey,
2. Determine which conjoint methodology to use,
3. Determine the means of soliciting survey participants,
4. Create and testing the survey instruments,
5. Collect the data,
6. Analyze the results,
7. Calculate the utilities for each attribute and feature, and
8. Develop the market simulation model.

4.2 Attributes

Although the purchase of the CFL bulb is the main focus of the analysis, purchase decisions for both CFL bulbs and energy efficient fixtures were evaluated. It was determined that separate surveys would be needed for the bulbs and for the fixtures as the bulb purchase decision relates to multiple lighting features while the fixture purchase decision includes fixture appearance as a primary concern.

The need to limit the number of questions restricted the number of attributes that could be included in the survey. Previous research suggests that the number of questions should be limited to between 10 and 20 (Orme 1999, Sawtooth 1999, Johnson and Orme 1996). One reason for the limit is respondent fatigue; after many questions, the amount of additional information gained is not likely worth the loss of attention or potential early termination of the survey by the respondent. The attributes considered for inclusion in the survey are the following:

- Bulb type
 - incandescent
 - compact fluorescent
 - halogen
- Fixture type
 - torchiere

- ceiling
- outdoor
- task
- Bulb shape
 - bulb
 - small CFL
 - circular
- Brand name
 - known brand
 - non-brand name
- Purchase cost
- Operating cost
- Bulb life

Light quality was also considered an important attribute; however, due to the web-based nature of the survey, it had to be omitted. In the process of analyzing the data, it became apparent that colinearity was an issue. Bulb type and brand name were both highly colinear with purchase cost, and therefore were not included in the final list of attributes used to develop the market simulation model. Colinearity remains an issue among some of the remaining attributes; however, enough variability exists to provide useful insights.

4.3 Conjoint Methodology

In conjoint analysis, product concepts can be shown to respondents one at a time, or they can be presented in pairs. Pairwise presentation can be harder for the respondent, since each question requires understanding two products instead of just one. However, the comparative nature of pairwise presentations allows the respondent to make finer distinctions and to contribute more information than with single-concept presentations. For this reason, pairwise presentation was selected.

Within each pairwise presentation, the product choices contain features from each of the different attributes. This conjoint approach that includes features from all of the attributes is termed a “full profile.” Conjoint data are collected from survey respondents by asking their relative preference (a scale from 1 to 9) for the presented products. If the respondent strongly prefers the product presented on the left side of the screen, they indicate that with a low rating. If they prefer the product on the right side of the screen, they answer with a high rating. In analyzing the data, the relative value to each respondent of the various attributes is estimated. These estimated values are called utilities and are developed from the coefficients

resulting from an ordinary least squares (OLS) analysis of the data. These utility values are used to make predictions of consumer preference for different sets of competing attributes.

The pairwise nature of the survey presentation requires the conversion of quantitative variables (purchase cost, operating cost, and bulb life) to categorical variables. The OLS analysis uses a “dummy variable” approach with a vector of independent variables for each observation. The vector has the elements -1, 0, or 1 depending on whether the respective attributes appear in that question. A dummy variable is assigned a value of -1 when the attribute appears on the left, a value of 1 when it appears on the right, and a value of 0 if the attribute is not included in the presentation. For example, the variable purchase cost was categorized into the attributes of low purchase cost, medium purchase cost, and high purchase cost; bulb life was treated similarly. In addition, the variable operating cost was categorized into low operating cost and high operating cost.

Each pairwise presentation has some different and some identical attributes on the left and right side of the screen. In the dataset, each presentation has two observations, one representing the features from the left perspective and one from the right perspective. For example, the left side of the survey presentation has a long-life bulb that has a high cost and the right side has a long-life bulb with a medium cost. The preference rating by the respondent is 3. The left side observation has 3 as its dependent variable, and the right side variables include -1 for the long-life bulb, -1 for the high cost, and 1 for the medium cost features. The right side observation has a 3 as its dependent variable, and the right side variables include 1 for the long-life bulb, -1 for the high cost, and 1 for the medium cost features. The only variable that changed value was long life.

These categories of attributes were then termed features. The final set of attributes and features for the bulb conjoint survey are as follows:

- Bulb shape
 - bulb
 - small CFL
 - circular
- Bulb cost,
 - low
 - medium
 - high
- Operating cost
 - low
 - high
- Bulb life

- short
- medium
- long

The final set of attributes and features for the fixture conjoint survey are as follows:

- Purchase price
 - low
 - medium
 - high
- Operating cost, and
 - low
 - high
- Bulb life
 - short
 - medium
 - long

Bulb shape was not considered to be an attribute with fixtures since the bulb would come with the fixture and, in most cases, would not be highly visible.

The order in which the questions appeared in the survey was a concern. If the original order is maintained, it is possible for respondents to learn as they answer the questions and, therefore, to respond differently to questions appearing later in the survey. To alleviate this concern, the order of the questions was varied with each new respondent.

When performing the OLS regression, one feature from each attribute was not used in the computation in order to avoid a linear dependency among the variables and indeterminance in the computation. Omitting one feature of each attribute from the computation is equivalent to setting the initial utility of those omitted features to zero. The value of the regression intercept term divided by the number of attributes is added to all the coefficients; it is also added to the zero value of the omitted features. The resulting utility values for all the features, then, are the value of the coefficient plus the value of the intercept term divided by the number of attributes (Sawtooth Software).

4.4 Soliciting Survey Participants

The desired number of completed surveys for the conjoint survey was 150 to 200. Timing was a critical element in determining how survey participants would be solicited as only a

short period of time was available for performing the survey. Three strategies were identified and employed. The first strategy was a postcard mailing to 2,000 households with computers in the Pacific Northwest using a mail list purchased from a vendor. The second strategy was an e-mail sent to 4,000 e-mail addresses in the four states. The e-mail list was purchased from an opt-in e-mail list provider to ensure that those receiving the e-mail solicitation were not averse to responding to such solicitations. The third strategy was to add a link on several Northwest web-sites inviting visitors to participate in the survey. Links were added to the Alliance, Seattle City Light, Tacoma City Light, and the Northwest Lighting Lab web-sites.

To encourage participation, a drawing for cash and other prizes was offered. Respondents were eligible to win if they lived in the Northwest and successfully completed the survey by February 20. Their chance of winning was doubled if they answered both the bulb and the fixture surveys. The following prizes were offered:

- \$500 cash,
- Solar Dynamo AM/FM radio,
- Canon BJC-2000 color bubblejet printer,
- Logitech quickcam VX USB,
- HP Scanjet 3300 CSE flatbed scanner,
- Microsoft cordless wheel mouse, and
- Innovations “Smart Charger” battery manager.

A drawback of web-based surveys is the potential for biased results. In order to respond to the survey, the participant must have access to a computer and the Internet and be knowledgeable about how to access and respond to the survey. A significant portion of the population now has access to these tools and knows how to use them, but this is not universal. The population of web-based respondents is likely to be representative of those more likely to purchase CFLs and CFL fixtures in the future since this population is more technologically comfortable, but the results will be biased toward that group. The results from this analysis utilizing the web-based approach will be very useful, but must be considered in light of the characteristics of the responding population.

4.5 Creating And Testing The Survey Instruments

Two options were available for the design of the survey instrument. One option was to use fictitious products with features that do not necessarily exist. This approach has the advantage of removing any preconceived perceptions about certain brands or products plus the flexibility of creating attribute features that are independent of other attribute features. Providing fictitious features (such as CFLs lasting 1,000 hours or incandescent bulbs lasting

10,000 hours) may provide data with no colinearity; however, it also may distort results as the respondent must choose from illogical options. Therefore, purchase options were created that reflect reality, although some brand names were fictitious. Features and prices were gathered from a number of sources such as Internet shopping sites, the Home Depot, and local hardware stores. A copy of the survey instruments is provided in Appendix C.

To begin the survey, the respondent could first take the bulb survey or the fixture survey. Over the first week, more people took the bulb rather than the fixture survey. It was decided that the fact that the bulb survey was listed first explained why more people took it. Therefore, the order was changed and, as anticipated, response rates for the two surveys moved closer. However, the fixture survey respondents never fully equaled the number of bulb survey respondents due to the rapidly declining response rate over the life of the survey.

The survey started with three background questions on purchase decisions. These questions were asked to provide insight into what types of lighting products were being purchased by respondents, where the lighting products were bought, and which of these lighting product sources was the primary source for the purchase. Following these questions, the respondents were presented with the purchase decision options. For the bulb survey, 13 purchase comparisons were provided; for the fixture survey, 15 purchase comparisons were provided. About 85% of the respondents answered both surveys. Results from the opening questions are provided in Table 4-1. A listing of the questions along with the respondent preferences are provided in Table 4-2 for bulbs and Table 4-3 for fixtures.

Time limited the amount of pre-testing for the survey instruments. As the survey instruments were being developed, RER staff (as well as Alliance staff) was invited to test them. Many valuable suggestions and modifications developed as the result of this limited pre-testing.

4.6 Collecting the Data

The survey became accessible to potential survey participants on February 2. The e-mail solicitation was sent that evening. By mid-morning on February 3, over 200 responses had been received, exceeding the goal of 150 to 200 total responses. By the end of the week, the postcards were mailed and the website links were in place. By February 11, over 500 bulb and nearly 500 fixture surveys had been completed with 84% of the respondents identifying the e-mail solicitation as the source of the survey. By the end of the eligibility period on February 20, the number of daily new responses had dropped significantly. The dataset was cleaned after the eligibility period by removing any responses from RER and Alliance staff, removing all responses without an e-mail address, and removing those with duplicate e-mail addresses. The final response count is shown below.

- Bulb survey – 564 total responses (182 or 32% east of the Cascades, 373 or 66% west of the Cascades, and 9 or 2% from various other locations).
 - Washington 309 (55%)
 - Oregon 159 (28%)
 - Idaho 51 (9%)
 - Montana 36 (6%)
 - Other 9 (2%)
- Fixture survey – 523 total responses (167 or 32% east of the Cascades, 351 or 67% west of the Cascades, and 5 or 1% from various other locations)
 - Washington 285 (54%)
 - Oregon 151 (29%)
 - Idaho 48 (9%)
 - Montana 34 (7%)
 - Other 5 (1%)

The cited source for the survey is as follows:

- E-mail solicitation – 80 %
- Website link – 10 %
- Postcard solicitation – 4 %
- Referred by a friend – 2 %
- Other/no response – 4 %

The e-mail solicitation response was remarkably high, about 12%, while the response rate from the postcard solicitation was about 1%. Without the e-mail solicitation, the goal of 150 to 200 responses would not have been met. If one can accept the potential bias from this population, the utilization of a buy-in e-mail list provides a population with a good response rate and an exceptionally quick response time.

4.7 Results

Table 4-1 provides the results from the first three questions of the survey. As one would expect, incandescent bulbs were the most frequently purchased bulb lighting product purchased over the past six months. After the three incandescent bulb types, the next most frequently purchased bulb product was traditional fluorescent tubes with about one-third of the respondents purchasing them. CFLs were the least often cited bulb purchase with less than 15% of the respondents stating that they have bought a CFL over the past six months. Also, as would be expected, the incidences of lighting fixture purchases were much lower than bulb purchases. Nearly half of the respondents have not made a lighting fixture purchase

in the last six months. Of those who have, incandescent wall and ceiling mounted fixtures were the most commonly purchased types. This fixture type was followed by indoor incandescent free-standing fixtures, then halogen torchieres. CFL fixtures were the least cited lighting fixture purchase.

Lighting products were purchased at a variety of different locations over the past few years. Grocery stores were the most commonly cited purchase place at 57%, followed closely by hardware stores then mass merchandise stores, such as Target and Wal-Mart. Lighting specialty stores were not identified by any of the respondents as a place where they have bought lighting products over the past two years. Super discount club stores, such as Costco and Sam's Club, were identified as a purchase location by only 16% of the respondents.

Of the places identified as where respondents usually buy their lighting products, the most common location was the mass merchandise stores at 32%. Grocery stores, hardware stores, and home improvement stores each were similarly identified at close to 20% each. Lighting specialty stores and electrical/plumbing stores were infrequently identified as the usual place where lighting products are purchased, being mentioned by only about 1% of the respondents each.

Table 4-1: Lighting Product Purchase Results

<p>Q1. Which of the following types of lighting products have you purchased over the past six months? (select all that are applicable)</p> <p>Light Bulbs</p> <ul style="list-style-type: none"> <u>55.0%</u> Incandescent bulbs (less than 60W) <u>76.1%</u> Incandescent bulbs (60W or greater) <u>37.0%</u> 3-way incandescent bulbs <u>17.0%</u> Incandescent floodlights or recessed reflector lights <u>28.8%</u> Halogen bulbs <u>33.4%</u> Fluorescent tubes <u>14.7%</u> Compact fluorescent bulbs <u>20.6%</u> Other bulbs <u>3.9%</u> Have not purchased any bulbs
<p>Lighting Fixtures</p> <ul style="list-style-type: none"> <u>9.7%</u> Compact fluorescent bulb fixtures <u>5.2%</u> Compact fluorescent torchieres (uplighting floor lamp) <u>11.6%</u> Halogen torchieres (uplighting floor lamp) <u>18.5%</u> Indoor incandescent fixtures - wall or ceiling mounted <u>15.9%</u> Indoor incandescent fixtures - free standing <u>9.8%</u> Indoor compact fluorescent fixtures - wall or ceiling mounted <u>2.3%</u> Indoor compact fluorescent fixtures - free standing <u>11.9%</u> Outdoor incandescent fixtures <u>3.8%</u> Outdoor compact fluorescent fixtures <u>13.6%</u> Other fixtures <u>45.7%</u> Have not purchased any fixtures
<p>Q2. Where have you purchased lighting products in the last two years? (select all that are applicable)</p> <ul style="list-style-type: none"> <u>57.1%</u> Grocery Store <u>56.3%</u> Hardware Store (such as Eagle, Ace Hardware, or True Value) <u>36.5%</u> Home Improvement Stores (such as Home Depot or Home Base) <u>24.1%</u> Electrical/Plumbing Store <u>44.8%</u> Mass Merchandise Store (such as Target or Wal-Mart) <u>16.2%</u> Superstore Discount Club (such as Sam's Club or CostCo) <u>0.0%</u> Lighting Specialty Stores <u>24.4%</u> Other Store
<p>Q3. Of the places that you checked above, where do you usually buy your lighting products? (select only one)</p> <ul style="list-style-type: none"> <u>19.1%</u> Grocery Store <u>17.3%</u> Hardware Store (such as Eagle, Ace Hardware, or True Value) <u>20.1%</u> Home Improvement Stores (such as Home Depot or Home Base) <u>0.7%</u> Electrical/Plumbing Store <u>31.9%</u> Mass Merchandise Store (such as Target or Wal-Mart) <u>7.5%</u> Superstore Discount Club (such as Sam's Club or CostCo) <u>1.1%</u> Lighting Specialty Stores <u>1.6%</u> Other Store <u>0.5%</u> Don't Know

Bulb Survey Results

Table 4-2 identifies the 13 pairwise purchase decision presentations included in the conjoint survey. The features by attribute are identified along with the average response value and the share of responses by each of the nine preference categories. (A preference response with a low number indicates a preference for the left-side purchase option and a high number for the right-side purchase option.)

In general, the preference values given to CFLs were favorable, though an incandescent or halogen bulb was the preferred option in most cases. The favorable response to the CFLs is in contrast to the low CFL product purchases identified by Question 1 in Table 4-1. Looking at the distribution of preference ratings from 1 to 9 shows strong opinions at each end of the scale with the lowest values in the middle of the scale. When the options were CFL versus incandescent or CFL versus halogen, the distribution was especially skewed toward each extreme. When bulb life was the primary difference between two options, as in Question 7, the longer life option was predominately selected. The larger, rounder circulite and GE 2-D CFL bulbs were generally not preferred, as shown by the results (Questions 9 and 13), with the GE 2-D CFL bulb the least preferred of the two (Question 10). When the options included a lower cost CFL bulb, as in Questions 11 and 12, the low cost CFL was the preferred choice. This included the expected preference when the options included two CFL choices, but there was also a CFL preference when compared to an incandescent.

The attribute of name brand was originally intended to be part of the conjoint results, but was dropped because of its close association with price. Reviewing the results in Table 4-2, it appears that name brand has little impact on the preference selections. In fact, the results from Questions 10, 11, and 12 indicate that name brand had a negative impact on preference. However, differences in the features in other attributes, especially price, are believed to be the primary reason the non-name brand options were preferred.

Another attribute that appears to be of significance, though not fully characterized in the survey to support inclusion in the conjoint analysis, is represented by Question 16. Here, the choice is between a CFL and an incandescent, much like in Question 5. In Question 5, the incandescent was the preferred option. In Question 16, the situation is different in that the application of the bulb replacement is in a very high ceiling installation. Such an installation is more difficult, putting a higher premium on a longer life bulb. This is reflected in the preference results where the longer life CFL was the preferred option.

Table 4-2: Bulb Conjoint Survey Results (values in the boxes represent percent of respondents by preference level. Far left = a preference of 1, far right = a preference of 9)

Q4. Which would you most likely purchase? Average=2.9									
<p style="text-align: center;">Lights of America Quad Compact Fluorescent</p> <p style="text-align: center;">Equal to a 60 W incandescent bulb light output Energy use is 13 W (\$1.30/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$12.97</p>					<p style="text-align: center;">Philips Earthlight 60 Compact Fluorescent</p> <p style="text-align: center;">Equal to a 60 W incandescent bulb light output Energy use is 16 W (\$1.60/yr)* Lasts ~3 years (6,000 hours) Purchase price is \$14.97</p>				
48.0	13.5	9.8	3.5	6.4	5.0	3.2	3.5	7.1	
Q5. Which would you most likely purchase? Average=4.9									
<p style="text-align: center;">GE Soft White Incandescent</p> <p style="text-align: center;">Equal to a 60 W incandescent bulb light output Energy use is 60 W (\$6.00/yr)* Lasts ~6 months (1,000 hours) Purchase price is \$0.24</p>					<p style="text-align: center;">Philips Earthlight 60 Compact Fluorescent</p> <p style="text-align: center;">Equal to a 60 W incandescent bulb light output Energy use is 16 W (\$1.60/yr)* Lasts ~3 years (6,000 hours) Purchase price is \$14.97</p>				
24.3	7.8	9.8	5.9	5.3	8.0	9.0	7.8	22.2	
Q6. Which would you most likely purchase? Average=5.0									
<p style="text-align: center;">GE Soft White Incandescent</p> <p style="text-align: center;">Equal to a 60 W incandescent bulb light output Energy use is 60 W (\$6.00/yr)* Lasts ~6 months (1,000 hours) Purchase price is \$0.24</p>					<p style="text-align: center;">Lights of America Twister Compact Fluorescent</p> <p style="text-align: center;">Equal to a 60 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$12.50</p>				
23.9	9.2	7.8	4.1	5.7	7.4	10.6	8.2	23.0	
Q7. Which would you most likely purchase? Average=7.2									
<p style="text-align: center;">GE Soft White Incandescent</p> <p style="text-align: center;">Energy use is 60 W (\$6.00/yr)* Lasts ~6 months (1,000 hours) Purchase price is \$0.24</p>					<p style="text-align: center;">GE Soft White Incandescent Long Life</p> <p style="text-align: center;">Energy use is 60 W (\$6.00/yr)* Lasts ~9 months (1,500 hours) Purchase price is \$0.34</p>				
8.3	2.3	3.4	1.2	6.7	5.9	8.5	14.0	49.6	
Q8. Which would you most likely purchase? Average=5.5									
<p style="text-align: center;">Philips Halogen Bulb</p> <p style="text-align: center;">Equal to a 150 W incandescent bulb light output Energy use is 150 W (\$15.00/yr)* Lasts ~18 months (3,000 hours) Purchase price is \$3.98</p>					<p style="text-align: center;">Lights of America Megalight Compact Fluorescent</p> <p style="text-align: center;">Equal to a 150 W incandescent bulb light output Energy use is 34 W (\$3.40/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$17.99</p>				
17.2	8.0	8.5	6.4	6.0	6.7	11.5	10.8	24.8	

Table 4-2 (cont'd): Bulb Conjoint Survey Results (values in the boxes represent percent of respondents by preference level. Far left = a preference of 1, far right = a preference of 9)

Q9. Which would you most likely purchase? Average=4.3									
Philips Halogen Bulb Equal to a 150 W incandescent bulb light output Energy use is 150 W (\$15.00/yr)* Lasts ~18 months (3,000 hours) Purchase price is \$3.98					General Electric 2-D Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 39 W (\$3.90/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$22.50				
25.4	11.2	13.5	6.9	9.6	3.9	7.6	6.0	16.0	
Q10. Which would you most likely purchase? Average=2.5									
Lights of America Circlelite Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 34 W (\$3.40/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$17.99					General Electric 2-D Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 39 W (\$3.90/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$22.50				
43.4	19.0	13.7	7.8	10.5	0.9	0.5	1.4	3.2	
Q11. Which would you most likely purchase? Average=8.0									
Philips Earthlight Universal Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$14.97					Feit Electric EcoBulb Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$7.50				
3.2	1.1	0.5	0.9	4.8	3.2	9.0	14.7	62.6	
Q12. Which would you most likely purchase? Average=5.4									
GE Soft White Incandescent Equal to a 60 W incandescent bulb light output Energy use is 60 W (\$6.00/yr)* Lasts ~6 months (1,000 hours) Purchase price is \$0.24					Feit Electric EcoBulb Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$7.50				
20.6	8.0	6.7	5.5	3.9	7.8	10.1	9.2	28.2	

Table 4-2 (cont'd): Bulb Conjoint Survey Results (values in the boxes represent percent of respondents by preference level. Far left = a preference of 1, far right = a preference of 9)

Q13. Which would you most likely purchase? Average=6.2									
Lights of America Circlelite Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 34 W (\$3.40/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$17.99					Lights of America Megalight Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 34 W (\$3.40/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$17.99				
8.9	4.4	4.3	2.7	21.6	6.7	9.4	9.9	32.1	
Q14. Which would you most likely purchase? Average=4.5									
Westinghouse R30 50 Watt Incandescent Reflector Equal to a 50 W incandescent bulb light output Energy use is 50 W (\$5.00/yr)* Lasts ~1 year (2,000 hours) Purchase price is \$4.75					Philips R30 Compact Fluorescent Reflector Equal to a 50 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~4 years (8,000 hours) Purchase price is \$29.25				
23.9	12.2	10.5	8.7	7.8	5.1	8.2	6.6	17.0	
Q15. Which would you most likely purchase? Average=4.9									
Philips R30 45 Watt Halogen Reflector Equal to a 50 W incandescent bulb light output Energy use is 50 W (\$5.00/yr)* Lasts ~18 months (2,500 hours) Purchase price is \$7.15					Philips R30 Compact Fluorescent Reflector Equal to a 50 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~4 years (8,000 hours) Purchase price is \$29.25				
20.9	7.3	12.9	7.4	8.7	6.7	8.7	7.4	19.9	
Q16. Which would you most likely purchase? Average=5.6									
GE Soft White Incandescent For a very high ceiling installation Equal to a 100 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Lasts ~5 months (750 hours) Purchase price is \$0.24					Philips Earthlight Universal Compact Fluorescent for a very high ceiling installation Equal to a 100 W incandescent bulb light output Energy use is 25 W (\$2.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$14.97				
17.7	7.6	6.9	3.9	4.3	8.7	13.5	9.4	28.0	

* Operating cost based on 5-6 hours/day at 5 cents per kWh

Fixture Survey Results

Table 4-3 identifies the 15 pairwise purchase decision presentations included in the fixture conjoint survey. As with the bulb survey, the features by attribute are identified along with the average response value and the share of responses by each of the nine preference categories. (A preference response with a low number indicates a preference for the left-side purchase option and a high number for the right-side purchase option.)

Results from the fixture survey follow a different pattern than those from the bulb survey. In the bulb survey, the distribution of preference ratings from 1 to 9 often showed strong opinions at each end of the scale with the lowest values in the middle of the scale. This pattern was much less frequent in the fixture survey with over half of the results having a preference skewed either to the far right or to the far left.

Fixture options including a halogen bulb were much less preferred than they were in the bulb survey. This was especially true with the torchiere (Question 4) where there was a heavy preference for the CFL option despite its higher cost. The safety issue with halogen torchieres may be the primary factor in this heavy preference for CFL torchieres.

Fixture price does not appear to have the same impact on preference as bulb price did. Even when fixture price was much higher for the CFL option, such as in questions 11 and 12, the preference was still for the CFL option. How long the bulb lasts and the perceived extra work it takes to change a bulb in a fixture seem to be reasons for this lack of regard for price in fixture preferences.

Table 4-3: Fixture Conjoint Survey Results (values in the boxes represent percent of respondents by preference level. Far left = a preference of 1, far right = a preference of 9)

Q4. Which would you most likely purchase? Average=2.9									
GE Profile Compact Fluorescent Torchiere Equal to a 300 W halogen bulb light output Energy use is 63 W (\$6.30/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80					Illuminada Halogen Torchiere Equal to a 300 W halogen bulb light output Energy use is 300 W (\$30.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$15.90				
44.4	18.9	10.9	5.4	2.5	3.4	4.4	2.9	7.3	
Q5. Which would you most likely purchase? Average=8.0									
Lifestyle Halogen Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$34.90					Lights of America Compact Fluorescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80				
2.7	1.3	1.9	1.0	2.3	3.1	11.3	13.8	62.7	
Q6. Which would you most likely purchase? Average=4.1									
Lights of America Compact Fluorescent Outdoor Coachlight Equal to a 100 W incandescent light output Energy use is 27 W (\$2.70/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$47.50					Hampton Bay Incandescent Coachlight Equal to a 100 W incandescent light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~5 months (750 hours) Purchase price including bulb is \$17.90				
31.0	11.1	9.6	7.8	6.9	8.0	7.1	5.5	13.0	
Q7. Which would you most likely purchase? Average=4.7									
Lights of America Compact Fluorescent Indoor Ceiling Plastic Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$17.99					Hampton Bay Incandescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 120 W (\$12.00/yr)* Bulb lasts ~6 months (1,000 hours) Purchase price including bulb is \$24.97				
27.2	9.9	6.7	5.4	8.6	7.8	8.0	6.7	19.7	
Q8. Which would you most likely purchase? Average=5.9									
Lights of America Compact Fluorescent Indoor Ceiling Plastic Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$17.99					Lights of America Compact Fluorescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80				
16.6	6.3	5.9	3.6	6.5	6.5	10.9	13.8	29.8	

Table 4-3 (cont'd.): Fixture Conjoint Survey Results (*values in the boxes represent percent of respondents by preference level. Far left = a preference of 1, far right = a preference of 9*)

Q9. Which would you most likely purchase? Average=7.6									
Hampton Bay Incandescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 120 W (\$12.00/yr)* Bulb lasts ~6 months (1,000 hours) Purchase price including bulb is \$24.97					Lights of America Compact Fluorescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80				
5.7	2.5	1.7	1.3	4.4	3.1	7.8	18.4	55.1	
Q10. Which would you most likely purchase? Average=6.3									
Hampton Bay Incandescent Indoor Ceiling Glass Dome Energy use is 120 W (\$12.00/yr)* Bulb lasts ~6 months (1,000 hours) Purchase price including bulb is \$24.97					Lifestyle Halogen Indoor Ceiling Glass Dome Energy use is 100 W (\$10.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$34.90				
9.9	6.5	5.0	4.8	6.3	8.6	14.1	12.6	32.1	
Q11. Which would you most likely purchase? Average=4.5									
Alpan Hawk Compact Fluorescent Tasklight Equal to a 60 W incandescent bulb light output Energy use is 13 W (\$0.65/yr)* Bulb lasts ~10 years (10,000 hours) Purchase price including bulb is \$39.95					Illuminada Incandescent Tasklight Equal to a 60 W incandescent bulb light output Energy use is 60 W (\$3.00/yr)* Bulb lasts ~1 year (1,000 hours) Purchase price including bulb is \$7.90				
27.7	8.6	11.1	6.9	6.7	6.3	8.8	7.8	16.1	
Q12. Which would you most likely purchase? Average=4.5									
Alpan Hawk Compact Fluorescent Tasklight Equal to a 60 W incandescent bulb light output Energy use is 13 W (\$0.65/yr)* Bulb lasts ~10 years (10,000 hours) Purchase price including bulb is \$39.95					Milano Halogen Tasklight Equal to a 60 W incandescent bulb light output Energy use is 20 W (\$1.00/yr)* Bulb lasts ~3 years (3,000 hours) Purchase price including bulb is \$19.90				
27.7	10.5	8.0	6.5	5.5	8.0	10.9	7.1	15.7	
Q13. Which would you most likely purchase? Average=5.9									
Illuminada Incandescent Tasklight Energy use is 60 W (\$3.00/yr)* Bulb lasts ~1 year (1,000 hours) Purchase price including bulb is \$7.90					Milano Halogen Tasklight Energy use is 20 W (\$1.00/yr)* Bulb lasts ~3 years (3,000 hours) Purchase price including bulb is \$19.90				
12.4	8.2	6.9	5.2	7.1	7.3	10.9	12.6	29.4	

Table 4-3 (cont'd.): Fixture Conjoint Survey Results (*values in the boxes represent percent of respondents by preference level. Far left = a preference of 1, far right = a preference of 9*)

Q14. Which would you most likely purchase? Average=3.1									
Lights of America Compact Fluorescent Outdoor Coachlight Equal to a 100 W halogen bulb light output Energy use is 27 W (\$2.70/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$47.50					Sea Gull Halogen Coachlight Equal to a 100 W halogen bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$37.90				
39.0	16.8	12.6	5.2	6.7	4.6	5.9	2.5	6.7	
Q15. Which would you most likely purchase? Average=3.1									
GE Profile Compact Fluorescent Torchiere Equal to a 300 W halogen bulb light output Energy use is 63 W (\$6.30/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80					Sullivan Incandescent Torchiere Equal to a 300 W halogen bulb light output Energy use is 300 W (\$30.00/yr)* Bulb lasts ~5 months (750 hours) Purchase price including bulb is \$12.90				
40.0	14.1	13.4	7.6	6.9	2.9	5.0	1.9	8.2	
Q16. Which would you most likely purchase? Average=2.5									
Sullivan Compact Fluorescent Indoor Ceiling Plastic Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$17.99					Greenwood Incandescent Indoor Ceiling Plastic Dome Equal to a 120 W incandescent bulb light output Energy use is 120 W (\$12.00/yr)* Bulb lasts ~6 months (1,000 hours) Purchase price including bulb is \$12.97				
51.8	14.9	12.0	5.5	3.6	2.3	3.1	1.9	4.8	
Q17. Which would you most likely purchase? Average=4.9									
Hampton Bay Incandescent Coachlight Equal to a 100 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~5 months (750 hours) Purchase price including bulb is \$17.90					Sea Gull Halogen Coachlight Equal to a 100 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$37.90				
21.4	8.0	10.1	7.3	8.4	7.1	9.8	7.6	20.3	
Q18. Which would you most likely purchase? Average=6.9									
Sullivan Incandescent Torchiere Energy use is 300 W (\$30.00/yr)* Bulb lasts ~5 months (750 hours) Purchase price including bulb is \$12.90					Illuminada Halogen Torchiere Energy use is 300 W (\$30.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$15.90				
9.6	3.8	2.7	1.9	6.9	5.4	10.5	14.3	44.9	

* Operating cost based on 5-6 hours/day at 5 cents per kWh except for task lighting which is based on 2-3 hours/day

4.8 Conjoint Utilities

Conjoint analysis is useful for learning how potential buyers of a product, in this case CFL bulbs and fixtures, value its various features. Conjoint data are collected from survey respondents by asking about their preferences for hypothetical product concepts described in terms of specific product attributes and attribute features. In analyzing the data, one infers the value to each respondent of having each possible attribute feature. These estimated values are called utilities. As described in the conjoint methodology portion of this study, the utilities are based on the coefficient and intercept values from an OLS regression analysis.

The utility values indicate which features are the most important to the consumer in making their lighting product purchase decision. These utilities can then be used to make predictions about how respondents would choose among different feature combinations of the products. The goal is to conclude what product changes would have the most beneficial (or least detrimental) effect on maximizing the likelihood that buyers would choose a particular product.

Bulb Conjoint Utilities

For the bulb survey, four attributes with a total of 11 features were modeled. Table 4-4 lists the calculated utilities from the respondents for the region as a whole and for east and west of the Cascades. The attribute features for bulb life, in terms of both medium and long life, have the largest utility, both at the regional and sub-regional levels. Within the bulb life attribute, the utility for the short life time bulb is significantly less than for the medium and long life bulbs. Considering the high utility value for medium and long life bulbs, greater emphasis should be placed on marketing this aspect. The value for the convenience of not needing to change bulbs on a regular basis appears to be high.

However, the absolute value of a particular utility does not necessarily indicate that a particular attribute is more important than another. The differences in absolute values within an attribute are of more interest. For bulb life, the medium and long life utilities are about five points higher than short life indicating importance. However, the high bulb cost utility is over eight points lower in value compared to the low cost bulb utility. This indicates a significant and continued concern on the part of consumers for the cost of bulbs.

Of all the attributes, the operating cost utilities have the least difference in absolute values. However, some sub-regional differences exist for this attribute. East of the Cascades the difference between the two feature utilities is much larger while west of the Cascades it is much smaller indicating a greater concern for cost on the east side of the mountains. This regional concern for cost is further borne out with the utilities for bulb cost with the difference between high and low cost bulb utilities greater on the east side of the mountains.

The preference for bulb shape is greatest for the small CFL shape as represented by earthlights, megalights, twisters, etc. The CFL circular shape, as represented by circulites and D-lights, has the lowest utility within this attribute with a differential of over five points from the small CFL shape. The “A” lamp bulb shape CFL was only given an average utility value.

For the region as a whole, small CFL bulbs with medium or long life at a low bulb cost would have the greatest utility value. However, no current product meets each of these features. Within the specific conjoint choices provided in the survey, the Feit Electric EcoBulb came closest to this ideal package of attributes.

Much interest has recently been focused on marketing a CFL that is similar in appearance to the common incandescent bulb. However, the results from this conjoint survey indicate that the need to acquire this shape is not a primary concern with consumers. It appears that they expect CFLs to look somewhat different and, in fact, like the shape, except for the circular one. It may be of interest to fine tune this high regard for the small CFL shape through additional conjoint work that includes an expanded list of CFL shapes to see which is most appealing to customers. In regards to shape, it is clear that consumers do not like the bulkier, circular shape CFL bulbs.

Table 4-4: Bulb Conjoint Utilities

Attribute	Characteristic	Regional Utility	East of Cascades Utility	West of Cascades Utility
Bulb Life	Life Short	8.5	8.5	8.5
	Life Medium	13.4	13.8	13.1
	Life Long	13.6	13.8	13.4
Operating Cost	Operating Cost-Low	8.5	8.5	8.5
	Operating Cost-High	6.3	4.8	7.1
Bulb Shape	“A” Lamp Bulb	8.5	8.5	8.5
	Small CFL	11.9	11.9	12.1
	Circular	6.3	6.4	6.4
Bulb Cost	Bulb Cost-Low	11.4	12.3	10.9
	Bulb Cost-Medium	8.5	8.5	8.5
	Bulb Cost-High	3.1	3.1	3.2

Fixture Conjoint Utilities

Three attributes representing eight features were modeled using the results from the fixture survey. Table 4-5 lists the calculated utilities for these attributes and features for the region

as a whole and for east and west of the Cascades. In general, there are minimal regional differences.

Differences between the three purchase price attribute feature utility values are small, indicating that fixture purchase price is not a primary concern to consumers when selecting between incandescent, halogen, and CFL fixtures. Although many of the fixture questions provided fixture alternatives with significant cost differences, these cost differences were not as large as the cost differences for the bulbs alone. The survey tried to present similar looking fixture alternatives within each presentation. Price differentials were primarily the result of the type of bulb. However, because the price of the fixture was much more than the cost of the bulb alone, the relative difference in cost for the entire fixture package was not extreme. Utility gained from other attributes overcame most of the difference one could expect between higher and lower cost products that look similar. However, the fact that the utility value for the medium purchase price is largest presents some concern. It is unclear why this should be.

There was more distinction between the two feature alternatives for operating cost than there was for the three purchase price features. As one would expect, lower operating cost had a higher utility than higher operating cost. Pursuing marketing strategies that emphasize the lower operating cost for CFL fixtures should have favorable results.

There was one dominant attribute feature that the survey participants most responded to in the fixture survey. This was the long life of the CFL bulb with an absolute utility value difference of over nine points above short and medium life bulbs. As found in the bulb survey, though not to as high a degree as the fixture survey, the value for the convenience of not needing to change bulbs on a regular basis appears to be very high. It is likely that consumers find the prospect of replacing bulbs in fixtures, such as ceiling and outdoor fixtures, much more inconvenient than the replacement of a bulb in a table lamp or similar application. Future marketing efforts should clearly focus on this attribute and the benefits provided by CFL fixtures.

Table 4-5: Fixture Conjoint Utilities

Attribute	Characteristic	Regional Utility	East of Cascades Utility	West of Cascades Utility
Bulb Life	Life Short	11.6	11.4	11.6
	Life Medium	11.6	11.4	11.6
	Life Long	20.7	20.9	20.6
Operating Cost	Operating Cost-Low	11.6	11.4	11.6
	Operating Cost-High	9.3	9.1	9.4
Purchase Price	Purchase Price-Low	11.6	11.4	11.6
	Purchase Price-Medium	12.4	12.2	12.5
	Purchase Price-High	11.8	12.0	11.8

4.9 The Market Simulation Model

The utility values calculated from the results of the conjoint surveys can be used to simulate market preferences for products with different sets of attribute features. Such simulation is limited to the attributes and features modeled. However, within the context of these attributes and features, such a model can provide insight as to which combination of features would be best received in the marketplace.

Simple preference between two alternatives can be determined by simply adding up the utility values of the features included. The option with the largest utility is the preferred alternative. However, simple preference does not recognize the fact that respondents do not *always* purchase the product that has the highest utility for them. One reason why buyers act suboptimally is because they do not take the time to consider the utility arising from each attribute feature. Instead, they rely on assessments based on less precise notions of utility and they may choose products with lower values.

The Market Simulation Model developed from the results of these conjoint surveys assigns non-zero preference shares to the competing products in accordance with their total utilities. More than two product options can be modeled at one time. An exponential transformation translates the utilities to preference shares. For a two-product preference share calculation, the following formula is used:

$$Share\#1 = \frac{e^{bU\#1}}{(e^{bU\#1} + e^{bU\#2})}$$

$$Share\#2 = \frac{e^{bU\#2}}{(e^{bU\#1} + e^{bU\#2})}$$

where

- Share#1* is the preference share for the first product
- Share#2* is the preference share for the second product
- U* is the products total utility
- b* is a constant value

To provide an example and to test the model's predictive powers, a backcast was developed with the utilities to calculate estimates of preference share and scale value for the questions presented in the conjoint survey. A backcast utilizes the regression results to predict the actual observed survey results. It is a means of determining reasonableness of model results. Table 4-6 provides results from the bulb survey backcast. One of the questions, Question 10, had no distinguishing attribute features between the two choices. This question was initially created to test the name brand attribute, which was later dropped. Of the remaining 12 questions, the model correctly identified the survey preference all 12 times. In some cases, the magnitude of preference was different, reflecting the model's ability to address preference, but not necessarily predict market share for the reasons outlined earlier in this section.

Table 4-7 provides the backcast results from the fixture survey. The results from this backcast were not as strong as for the bulb backcast. The model correctly predicted preference 12 times, mispredicted twice with one question having no preference identified. Preference ratings were more extreme with the fixture results than with the bulb results and the model, for the most part, followed those extremes. For both Questions 10 and 17, the misprediction in preference was because of the utilities for purchase price. In both Questions 10 and 17, the lower cost option was preferred by the survey respondents. However, the utility calculated for the medium price purchase cost attribute was larger than either low price or high price. This may indicate a problem in how the purchase price attribute was presented.

Table 4-6: Predicted Preference Share and Scale Values for the Lighting Products Presented in the Bulb Conjoint Survey

Question	Actual Average Response	Predicted Average Response	Predicted Preference Correct?	Predicted Share Option 'A'	Predicted Share Option 'B'
Q4	2.9	4.3	Yes	59%	41%
Q5	4.9	4.8	Yes	53%	47%
Q6	5.0	5.5	Yes	44%	56%
Q7	7.2	6.0	Yes	38%	62%
Q8	5.5	5.1	Yes	49%	51%
Q9	4.3	4.0	Yes	62%	38%
Q10	No Differentiating Attribute				
Q11	8.0	6.0	Yes	37%	63%
Q12	5.4	6.5	Yes	31%	69%
Q13	6.2	6.1	Yes	36%	64%
Q14	4.5	4.8	Yes	53%	47%
Q15	4.9	4.4	Yes	57%	43%
Q16	5.6	5.5	Yes	44%	56%

Table 4-7: Predicted Preference Share and Scale Value for the Lighting Products Presented in the Fixture Conjoint Survey

Question	Actual Average Response	Predicted Average Response	Predicted Preference Correct?	Predicted Share Option 'A'	Predicted Share Option 'B'
Q 4	2.9	2.8	Yes	77%	23%
Q5	8.0	7.0	Yes	25%	75%
Q6	4.1	3.3	Yes	71%	29%
Q7	4.7	3.1	Yes	74%	26%
Q8	5.9	5.2	Yes	48%	52%
Q9	7.6	7.0	Yes	25%	75%
Q10	6.3	4.4	No	58%	42%
Q11	4.5	3.3	Yes	71%	29%
Q12	4.5	3.5	Yes	69%	31%
Q13	5.9	5.2	Yes	48%	52%
Q14	3.1	3.5	Yes	69%	31%
Q15	3.1	2.8	Yes	77%	23%
Q16	2.5	3.0	Yes	75%	25%
Q17	4.9	5.2	No	48%	52%
Q18	6.9	5.0	No Preference	50%	50%

5

Summary and Recommendations

Each of the market and consumer research efforts came up with similar findings in terms of the most significant positive features and significant barriers still facing the CFL market. One of the most important if not the most important positive features of CFL bulbs and fixtures is the long life of the bulb. In the conjoint survey, long bulb life had the largest utility of any of the product features in both the bulb and fixture surveys. In the market research, nearly all of the interviewees indicated that long bulb life was one of the most popular and important characteristics of CFLs. It was viewed positively more from the perspective of less maintenance in changing bulbs than from the money saved with avoided cost from not buying as many incandescent bulbs. Long life was viewed as particularly positive when placing the CFL in a hard to reach spot. Within the focus groups, the short life of incandescent bulbs, especially in hard to reach fixtures, was viewed as a major inconvenience. However, focus group participants were often skeptical about the long-live claims of CFLs. Warranties helped alleviate some of the skepticism and some kind of trusted independent testing to back-up the long-life claim, such as by Underwriter's Lab, would reduce the skepticism.

The level of energy savings from CFLs was viewed as a positive but not necessarily significant feature. In the conjoint survey, the operating cost attribute had relatively lower utility values compared to the other attributes. In the market research, the level of energy savings was not overwhelmingly mentioned as a key component in the purchase decision. However, in the market research, one of the most effective marketing displays was an electric meter display that spun at different rates for the CFL and incandescent bulbs. This visual representation of energy savings had a very positive impact on those who saw it. In the focus groups, participants were not generally aware of the magnitude of the energy savings from CFLs and, once aware, were impressed. The fact that focus group participants had a low awareness of the energy savings potential and because the electric meter marketing display was received so positively may indicate a lack of knowledge on the significance of energy savings, rather than a disregard for savings.

The safety issue of low heat from CFLs, especially in a torchiere application, was a highly regarded attribute. In the conjoint survey, the CFL torchiere was the dominant preference over both halogen and incandescent torchieres. Both the market research and the focus

groups also re-iterated the importance of this feature. Although most of the low heat safety issue focus is directed toward torchieres, other applications, such as using higher light output CFL bulbs in fixtures with heat limitations, were also identified as a positive aspect of low heat of CFLs.

Bulb shape and size is emerging as a positive attribute, compared to its previous negative attribute position. The small size of many modern CFLs and the ability to obtain either very unique shapes or a very standard “A” bulb shape are viewed positively. In the conjoint bulb survey, the small CFL shape had a very high utility, whereas the bulkier, older style circular shape had a very low utility value. The market research results indicated that consumers are attracted to the unique shapes. The focus groups indicated a preference for the “A” bulb shape, but with participants intrigued with the variety of other shapes.

The quality of light from CFLs was a key positive attribute that came from the focus groups. This attribute could not be modeled within the web-based conjoint survey (although it could be with a one-on-one conjoint survey with actual bulbs and fixtures to use as examples). It was also not mentioned extensively in the market research literature and interviews.

On the barrier side, two of the long-term barriers still significantly hinder CFL acceptance. The most important is lack of awareness of the current technology, benefits, and cost effectiveness. The second is the high cost of CFL bulbs. This second barrier appears to be eroding with the continued falling of the price of CFLs. High cost bulbs had a very low utility in the bulb conjoint survey and as bulbs become less expensive, CFLs move away from this high cost attribute. The low cost alternatives in the conjoint bulb survey were highly received. In the conjoint fixture survey, purchase price was not a highly significant attribute. The market research supports the idea that in fixtures, the extra cost of the CFL is not as important as with bulbs and that as bulb prices are dropping, so is the volume of CFL purchases. In the focus groups, participants were very impressed with the low cost of several of the newly available CFL bulbs. The focus group participants indicated that a CFL price in the \$5.95 range makes purchasing a CFL attractive.

The most significant barrier is consumer awareness. This barrier was not modeled through the conjoint survey. However, the interviews with market actors identified low consumer awareness as likely the greatest reason for slow CFL sales. The focus group participants further bore out the issue of consumer awareness and the fact that once consumers gain awareness, then there is significant CFL acceptance. Most of the focus group participants expressed limited knowledge about CFLs at the beginning of the sessions. They expressed surprise and interest as they learned more about CFLs as the session continued. By the end of the session, most had favorable opinions of CFLs.

Overall, product availability has improved significantly over the past few years. Grocery stores continue to be the one primary lighting product source where CFLs are only minimally available.

5.1 Recommendations

CFLs and ENERGY STAR fixtures appear to be close to becoming significant alternatives to incandescent and halogen bulbs and fixtures in the residential sector. Many of the earlier barriers such as performance problems, incompatibility, unavailability, unattractiveness, and even high first cost are being minimized. Many CFL features such as long life, lighting quality (color), low heat production, energy savings, and even bulb appearance are now being viewed as positive qualities that consumers desire. Assuming that price continues to decline to a level of about \$5 to \$7 for new CFL bulbs, the primary remaining barrier is consumer awareness. Once consumers are fully aware of the benefits of CFLs, their market share should grow substantially. An additional important remaining barrier is the general unavailability of CFLs in grocery stores, which is the number one place where consumers buy replacement bulbs.

The recommendations that follow are primarily designed to improve consumer awareness and trust in CFL lighting. These recommendations have been reviewed and reflect the comments and input of the Alliance Board subcommittee on lighting and the Lighting Advisory Committee:

- 1) *Conduct a regional consumer-based campaign that incorporates media (i.e., broadcast and print advertising), public relations, special promotions/events and cooperative advertising with “in-store” efforts to promote and make visible the benefits of energy efficient lighting.* Major elements of this campaign may include:
 - a) Advertising. An example of a “hook” message could be to emphasize how CFLs are “new and improved.” The popular appearance of the twister CFL can be featured as the symbol of energy efficient lighting (with a call to action to look for the ENERGY STAR label to find these products).
 - b) In-store/retail displays of CFLs and fixtures would bring the products to life and enable the consumer to see, operate, and learn about the benefits of energy efficient lighting.
 - c) To enhance the consumer awareness of products in retail further, the program would encourage manufacturers to make their products more easily visible to the consumer (via packaging) and provide more graphical information on packaging.
 - d) A low-risk opportunity can be provided for the consumer to “try out” a CFL, offering a limited time subsidy and unconditional guarantee. A particular product line (i.e., subcompact CFLs) could be the focus of this offer. This

could be funded and administered directly through the program or in combination with the manufacturers and retailers.

- e) Other recommended elements include educational outreach (also see recommendation #3 for utility promotional support), efforts to strengthen and support ENERGY STAR lighting specifications to include meaningful product testing and manufacturers' warranties and access to customer service support.
- 2) *Consider a separate market strategy for ENERGY STAR fixtures.* Recognizing the differences in market acceptance of energy efficient fixtures and CFLs (primarily related to lack of product availability), the program should consider approaches other than mass retail to increase the availability of ENERGY STAR fixture products. The Consortium for Energy Efficiency (CEE) is conducting market research on approaches that will increase the availability of residential energy efficient fixture products. Based on this research (completion planned for early June) and the recommended approaches, CEE intends to launch a new national initiative. Market strategies to promote ENERGY STAR fixtures should consider the outcome of this research and subsequent development of program approaches should be consistent with the CEE initiative.
- 3) *Provide opportunities for utilities to promote energy efficient lighting to residential customers in conjunction with recommendation #1.* Utilities can play a major role in promoting consumer awareness of the consumer-friendly qualities of CFL lighting: long life, lighting quality (color), low heat production, energy savings, and bulb appearance. Program activities that could be offered by utilities include a strong, well-defined outreach program to schools (the portability and lowering-cost features of the CFL make the show-and-tell demonstration easy and affordable), special discounts or rebates on "preferred" products or applications that yield greater energy savings, and expanded consumer education through normal outreach and communications channels, including bill stuffers, newsletters, websites, community events.

Appendix A

Market Research Interview Guides

Contractor Interview Guide

Introduction

Hi, my name is _____ and I'm conducting research on the lighting market for the Northwest Energy Efficiency Alliance. I'd like to ask you some questions regarding the types of lighting fixtures you install in homes. Is this a good time?

Note: if respondent wants more information regarding the Alliance, read the following:
The Northwest Energy Efficiency Alliance consists of industry and consumer groups, state regulators, and the electric utilities in Washington, Oregon, Idaho and Montana. NEEA seeks to bring about significant and lasting changes in markets for energy-efficient technologies and practices, to improve the northwest's efficient use of energy and reduce costs to consumers and the electric system.

1. Do you install lighting fixtures in both new construction and existing homes?
2. Do you install lighting fixtures in both single-family and multi-family homes?
3. Have you heard of ENERGY STAR lighting fixtures?

(ask questions below based on response; if contractor works in both new and existing homes, probe for different responses for each market)

4. In how many homes did you install lighting fixtures last year?

New homes: ____ single-family ____ multi-family

Existing homes: ____ single-family ____ multi-family

5. Who makes the decisions regarding what types of lighting fixtures get installed in the homes you work on? Does this include brand names or just general specifications?

6. *(if contractor has some decision-making responsibility)* What criteria do you use to determine which lighting fixtures you will install?

7. Do you have any experience installing ENERGY STAR lighting fixtures? If so, please describe.

8. What proportion of fixtures you installed last year were ENERGY STAR ?

9. What is the primary reason you do (do not) install ENERGY STAR fixtures?

10. Do you have any experience installing compact fluorescent dedicated fixtures? If so, please describe.
11. What proportion of fixtures you installed last year were compact fluorescent dedicated fixtures?
12. What is the primary reason you do (do not) install compact fluorescent fixtures?
13. What do you think are the key features of ENERGY STAR or compact fluorescent fixtures that appeal to consumers?
14. From where do you typically buy the lighting fixtures you install?
15. How do you or your company typically learn about new lighting products and their performance? (*manufacturer, trade show, etc*)
16. (*if respondent is decision-maker in Q5*) What would need to happen before you would install more compact fluorescent and ENERGY STAR fixtures?

Distributor Interview Guide

Introduction

Hi, my name is _____ and I'm conducting research on the lighting market for the Northwest Energy Efficiency Alliance. You contributed to previous research they did last year, and I have a few follow-up questions. Is this a good time?

Note: if respondent wants more information regarding the Alliance, read the following:
The Northwest Energy Efficiency Alliance consists of industry and consumer groups, state regulators, and the electric utilities in Washington, Oregon, Idaho and Montana. NEEA seeks to bring about significant and lasting changes in markets for energy-efficient technologies and practices, to improve the northwest's efficient use of energy and reduce costs to consumers and the electric system.

1. What is your opinion of the market for residential energy efficient lighting products? *(probe for ideas on growth, opportunity, etc. Do they think this is a niche market? Will it change in the long-term?)*
2. In your opinion, what are the major barriers to expanding the residential energy efficient lighting market? *(probe for consumer awareness, technology, price, performance problems, etc.)*
3. What features of the ENERGY STAR products you distribute do you think appeal most to consumers?
4. How are those features promoted?
5. Do you sell a product that you think is particularly appealing to consumers? Please describe.
6. Are there any new residential energy efficient lighting products coming out in the near future that you know of? If so, describe.
7. How do you introduce these products to the market? *(or, if answer Q6 no, then:)* In general, how do you introduce new products to the market?
8. Do you target certain types of retail stores for your products? Please describe. *(probe for market sectors)*

9. Do you promote your products differently for residential new construction than you do for retail? If so, describe.

10. Is there anything particular about the Northwest region that is different from the rest of the country for the residential lighting market?

(probe for more demand for certain products, etc.)

Grocery & Drug Store Interview Guide

Introduction

Hi, my name is _____ and I'm conducting research on the lighting market for the Northwest Energy Efficiency Alliance. Are you the best person to speak with regarding how you stock, promote, and sell light bulbs? *If so*, is this a good time to ask you some questions?

Note: if respondent wants more information regarding the Alliance, read the following:

The Northwest Energy Efficiency Alliance consists of industry and consumer groups, state regulators, and the electric utilities in Washington, Oregon, Idaho and Montana. NEEA seeks to bring about significant and lasting changes in markets for energy-efficient technologies and practices, to improve the northwest's efficient use of energy and reduce costs to consumers and the electric system.

Lighting Products (in general)

1. Do you sell light bulbs?
2. What types of lightbulbs do you sell?
_____ Incandescent bulbs
_____ Outdoor flood bulbs
_____ Colored bulbs
_____ Replacement bulbs for bathroom fixtures
_____ Replacement bulbs for track lighting
_____ Other _____
3. Where do you buy lightbulbs? (*Direct from manufacturer, a distributor, etc.*)
4. How much shelf space do you provide for light bulbs?
5. (*If answer to Q.2 includes any specialty bulbs.*) What is the average price of the specialty bulbs?
6. How long do these specialty bulbs stay on the shelf? (*in stock?*)
7. Do customers ever ask for bulbs that you do not carry? If so, do you remember what they were looking for?
8. Do you sell lighting fixtures? (*table lamps, desk lamps, torchieres, outdoor fixtures, etc.*)

9. *(If yes to Q.8)* How much shelf space do you provide for lighting fixtures?
10. *(If yes to Q.8)* Where do you buy lighting fixtures? *(Direct from manufacturer, a distributor, etc.)*
11. Who makes decisions about what new products to carry?
12. What criteria do you use to decide about new products to carry?
13. Is there anything limiting you to carrying new lighting products? For example: do you have agreements with your current product distributors that would limit what brands you could carry?

Compact Fluorescent Lighting Products

14. Have you heard of compact fluorescent lights?
15. If yes, what do you know about them?
16. Do you sell compact fluorescent bulbs?
17. If yes, what brand of compact fluorescent bulbs do you sell?
18. *(If yes to Q.16)* How much shelf space do you provide for compact fluorescent bulbs?
19. Do you sell compact fluorescent fixtures? *(table lamps, desk lamps, torchieres, outdoor fixtures, etc)*
20. If yes, what brand of compact fluorescent fixtures do you sell?
21. *(If yes to Q.19)* How much shelf space do you provide for compact fluorescent fixtures?
22. *(If they do not currently sell CFLs)* Has your store ever thought about selling compact fluorescent lighting products?
23. If yes, why did your store decide to / not to carry CFLs?
24. If a manufacturer were willing to provide training and point-of-purchase information, would you consider stocking compact fluorescent light bulbs? *(if they currently sell fixtures)* would they consider stocking compact fluorescent fixtures?

Manufacturer Interview Guide

Introduction

Hi, my name is _____ and I'm conducting research on the lighting market for the Northwest Energy Efficiency Alliance. You contributed to previous research they did last year, and I have a few follow-up questions. Is this a good time?

Note: if respondent wants more information regarding the Alliance, read the following:
The Northwest Energy Efficiency Alliance consists of industry and consumer groups, state regulators, and the electric utilities in Washington, Oregon, Idaho and Montana. NEEA seeks to bring about significant and lasting changes in markets for energy-efficient technologies and practices, to improve the northwest's efficient use of energy and reduce costs to consumers and the electric system.

Bulb Manufacturers

1. What is your opinion of the market for residential compact fluorescent lightbulbs?
(probe for ideas on growth, opportunity, etc. Do they think this is a niche market? Will it change in the long-term?)
2. What proportion of the bulbs you manufacture are compact fluorescents?
3. Why?
(probe for supply/demand issues, profitability, etc.)
4. In your opinion, what are the major barriers to expanding the residential CFL market?
(probe for consumer awareness, technology, price, performance problems, etc.)
5. Do you expect CFL prices to decrease significantly? If so, when do you think that will happen and what will cause it to happen?
6. What features of your CFLs do you think appeal most to consumers?
7. How do you promote these features?
8. Do you have a product that you think is particularly appealing to consumers? Please describe.
9. Do you offer any guaranty with your product? If so, please describe. If so, do you advertise it on the package?

10. Do you have any new residential CFL products coming out in the near future? If so, describe.

11. How do you introduce these products to the market? *(or, if answer Q10 no, then:)* In general, how do you introduce your new products to the market?

12. How do you distribute your products?

(probe for manufacturer's rep, distribution company, showrooms, shipping direct to retailers, etc. also probe for difference between new construction and retail)

13. Do you target certain types of retail stores for your products? Please describe.

(probe for market sectors)

14. Do you promote your products differently for residential new construction than you do for retail? If so, describe.

15. Is there anything particular about the Northwest region that is different from the rest of the country for the residential lighting market?

(probe for more demand for certain products, etc.)

16. Have you heard of the DOE's ENERGY STAR CFL program? If so, what is your opinion of that program?

17. Do you have any plans to use the ENERGY STAR label for your products?

18. How do you feel about utility-sponsored programs that provide incentives to consumers, manufacturers or retailers to promote the demand for CFLs?

19. Would you be willing and able to communicate with utility representatives to help design programs that change the long-term buying habits of consumers and that may or may not include financial incentives?

Fixture Manufacturers

1. What is your opinion of the market for residential energy efficient lighting fixtures? *(probe for ideas on growth, opportunity, etc. Do they think this is a niche market? Will it change in the long-term?)*

2. In your opinion, what are the major barriers to expanding the market for residential energy efficient lighting fixtures?

(probe for consumer awareness, technology, price, performance problems, etc.)

3. What features of your energy efficient products do you think appeal most to consumers?
4. How do you promote these features?
5. Do you have a product that you think is particularly appealing to consumers? Please describe.
6. Do you offer any guaranty with your product? If so, please describe. If so, do you advertise it on the package?
7. Do you have any new residential energy efficient products coming out in the near future? If so, describe.
8. How do you introduce these products to the market? *(or, if answer Q6 no, then:)* In general, how do you introduce your new products to the market?
9. How do you distribute your products?
(probe for manufacturer's rep, distribution company, showrooms, shipping direct to retailers, etc. also probe for difference between new construction and retail)
10. Do you target certain types of retail stores for your products? Please describe
(probe for market sectors)
11. Do you promote your products differently for residential new construction than you do for retail? If so, describe.
12. Is there anything particular about the Northwest region that is different from the rest of the country for the residential lighting market?
(probe for more demand for certain products, etc.)
13. How do you feel about utility-sponsored programs that provide incentives to consumers, manufacturers or retailers to promote the demand for ENERGY STAR lighting fixtures?
14. Would you be willing and able to communicate with utility representatives to help design programs that change the long-term buying habits of consumers and that may or may not include financial incentives?

Program Manager Interview Guide

Introduction

Hi, my name is _____ and I'm conducting research on the residential lighting market for the Northwest Energy Efficiency Alliance. I'd like to ask you some questions regarding your lighting program, (name of program). Is this a good time?

Note: if respondent wants more information regarding the Alliance, read the following: The Northwest Energy Efficiency Alliance consists of industry and consumer groups, state regulators, and the electric utilities in Washington, Oregon, Idaho and Montana. NEEA seeks to bring about significant and lasting changes in markets for energy-efficient technologies and practices, to improve the northwest's efficient use of energy and reduce costs to consumers and the electric system.

1. Please describe how your program works.
(probe for who it targets, products involved, incentive mechanisms, educational components, association with ENERGY STAR, etc.)
2. What are the objectives of the program?
(probe for market transformation objectives)
3. How long has your program been in effect?
4. Do you feel it is a success? Why or why not?
5. What is your opinion of the market for residential energy efficient lighting?
(probe for ideas on growth, opportunity, etc. Do they think this is a niche market? Will it change in the long-term?)
6. Do you have any insights into the differences between the market for lighting products in new construction and existing homes? What about between single-family and multi-family homes?
7. In your opinion, what are the major barriers to expanding the market for residential energy efficient lighting?
8. Are there any products that you feel are particularly appealing to consumers? Please describe.

9. Are there any market segments you have identified that show opportunity for expanding the use of energy efficient lighting products in the near future?
10. Does your program target the sale of CFLs in grocery stores? If yes, how successful has this been? If no, why not?
11. What is your opinion of the ENERGY STAR CFL Program and the ENERGY STAR Light Fixture program?
12. *(if program involves both bulbs and fixtures)* What has been your experience in promoting both bulbs and fixtures in your program? (problems? benefits?)

Retailer Interview Guide

Introduction

Hi, my name is _____ and I'm conducting research on the lighting market for the Northwest Energy Efficiency Alliance. You contributed to previous research they did last year, and I have a few follow-up questions. Is this a good time?

Note: if respondent wants more information regarding the Alliance, read the following:
The Northwest Energy Efficiency Alliance consists of industry and consumer groups, state regulators, and the electric utilities in Washington, Oregon, Idaho and Montana. NEEA seeks to bring about significant and lasting changes in markets for energy-efficient technologies and practices, to improve the northwest's efficient use of energy and reduce costs to consumers and the electric system.

General

- 1) Does your company carry light bulbs and/or residential light fixtures?
If no, thank and terminate.

- 2) Which of the following types of residential lighting products does your company sell?
_____ Light bulbs _____ Compact fluorescent light bulbs
_____ Torchieres _____ Compact fluorescent torchieres
_____ Indoor fixtures _____ Compact fluorescent indoor fixtures
_____ Outdoor fixtures _____ Compact fluorescent outdoor fixtures

How New Products Enter the Market

- 3) Have you begun stocking any new energy efficient lighting products in the last 6 months?
- 4) If so, what are they?
- 5) How are they selling – do customers seem to be interested in these new products?
- 6) What are the steps involved in deciding whether or not to stock a new product?

“Starter” Product

- 7) Are there any compact fluorescent lighting products that consumers seem especially interested in? (*first let them answer, then go on to a*)

- a) Do consumers seem especially interested in:
 - Compact fluorescent spiral, or “twister”, bulbs?
 - Dimmable compact fluorescent bulbs?
 - Compact fluorescent outdoor fixtures?
 - Compact fluorescent Torchieres?
- b) What is it about each of these products that “hooks” customers – why do you think they are popular?

Consumer “Hooks”

- 8) In general, how do you promote your lighting products?
- 9) How do you promote compact fluorescent lighting products? (*point-of-purchase information, end-caps, etc.*)
- 10) Do the manufacturers of the compact fluorescent lighting products you carry help in promoting their products? (*point-of-purchase information, displays, special signage, in-store education, or manufacturer representative in-store to answer consumer questions about their products*)
- 11) How do you feel about this?
- 12) What promotional items / product features / incentives would you like to see offered in order to increase the demand for these products?
- 13) (*If in #8 they said that they do not promote or do not promote much*) What would need to change in order for you to be willing to promote these products more? (*probe for price, product reliability, consumer demand, etc.*)
- 14) In your opinion, are customers responding to your promotions of compact fluorescent lighting products?
- 15) In your opinion, why are consumers interested / not interested?
- 16) In your opinion, would consumers demand these products more if they understood them better?

Appendix B

Focus Group Moderators' Guides

Moderator's Guide
Residential Lighting Focus Groups
NEEA

1. Introductions -- 10 mins.

[Neutral -- Do NOT tip-off on energy efficiency]

- Purpose of meeting is to gain insights into lighting products and choices, including factors that influence you decisions, where you shop for lighting, and reactions to some specific lighting products...
- Introductions around the table
 - ice-breaker (favorite food / hobby)
 - most recent lighting purchase?

2. Recent Lighting Purchases and General Attributes -- 20 mins.

[Still Neutral -- Do NOT tip-off on energy efficiency]

- What comes to mind when I mention lighting in your home?
 - (participants write down/share)
- Recent lighting purchases contemplated
- General factors /priorities considered?
 - color
 - output
 - aesthetics
 - convenience
 - energy efficiency
 - probe for issues related to lamps vs. fixtures
 - rank in order of importance
 - probe interior vs. exterior
- What is likely to be your next lighting purchase for your home?
- Where do you shop for lighting products? Why/When?
- Are some sources associated with particular types of lighting?

3. Familiarity with Energy Efficient Lighting Products -- 20 mins.

[Follow-up on energy efficiency]

- What is the first thing you associate with the term 'energy efficient' lighting?
 - (participants write down/share)

- What are some 'energy efficient' lighting products?
 - compile a list
 - show of hands to assess familiarity with products on the list
 - who has purchased?
 - share/note perceptions associated with each product?
 - note issues related to preferred uses / locations of EE lighting
 - where do you find EE lighting products?
 - familiarity with "Lightwise" products?
 - familiarity with "Energy Star" lighting products?

4. Introduce energy efficient lighting products -- 20 mins.

[show 'N tell time...]

- Fluorescent Strip Lighting
 - any negative impressions (start flicker, color rendition?)
 - demonstrate differences in color, discuss ballast issues

- Introduce CFL products:
 - Guess which lamp is not incandescent?
 - Spiral (or twister) bulb CFL
 - CFL Torchieres
 - Outdoor CFLs (high wattage that are on all the time.
 - CFL-specific fixtures -- desk lamps?
 - Other locations / tasks
 - Other?

- Probe:
 - Familiarity with products shown
 - Initial feedback / reactions?
 - Is this something you could use in your home?
 - If so, where?
 - Identify competing products -- comparison?

- Assess reactions to potential "feature" hooks:
 - Save money -- lower electricity bills
 - Require fewer change-outs (high ceilings)
 - Safety issue WRT Torchiers

5. Marketing Approaches / Messages -- 20 mins.

- Importance of potential marketing messages:
 - Energy savings
 - Environmental benefits
 - Safety
 - Reliability
 - Price -- value for money
 - utility backing / recommendation

- Packaging

- Logistics
 - in-store display with a meter comparing electricity used by an incandescent vs. CFL
 - performance guarantees
 - Use of internet? -- as source of information or for purchases?
 - Interest in coupons / rebates?
 - Interest in technical and or selection information

- interest in information about lamps
 - technical?
 - how to select?
 - where to purchase?

- Pricing?

6. Wrap-up / Summary -- 15 mins.

- PRICE AS A BARRIER
- Importance relative to other attributes
- Importance as a threshold criteria?
- Likelihood to buy now that they have more information
- What is the hook?
- Most interesting products
- Where you are likely to shop for these products
- Products most likely to consider
- Best ways to promote

Background Info.

Fluorescent

- Cool White (uuugh)
- Kitchen and Bath

CFLs

Lamps are all supposed to all be 60W equivalent

Prices:

Ikea globe -- 5.95

Ikea other -- 3.95

LOA Twister -- 10.99

Phillips globe -- 9.97

Phillips other -- 7.47

Appendix C

Conjoint Survey Instruments

Q1. Which of the following types of lighting products have you purchased over the past six months? (select all that are applicable)

Light Bulbs

- 55.0% Incandescent bulbs (less than 60W)
- 76.1% Incandescent bulbs (60W or greater)
- 37.0% 3-way incandescent bulbs
- 17.0% Incandescent floodlights or recessed reflector lights
- 28.8% Halogen bulbs
- 33.4% Fluorescent tubes
- 14.7% Compact fluorescent bulbs
- 20.6% Other bulbs
- 3.9% Have not purchased any bulbs

Lighting Fixtures

- 9.7% Compact fluorescent bulb fixtures
- 5.2% Compact fluorescent torchieres (uplighting floor lamp)
- 11.6% Halogen torchieres (uplighting floor lamp)
- 18.5% Indoor incandescent fixtures - wall or ceiling mounted
- 15.9% Indoor incandescent fixtures - free standing
- 9.8% Indoor compact fluorescent fixtures - wall or ceiling mounted
- 2.3% Indoor compact fluorescent fixtures - free standing
- 11.9% Outdoor incandescent fixtures
- 3.8% Outdoor compact fluorescent fixtures
- 13.6% Other fixtures
- 45.7% Have not purchased any fixtures

Q2. Where have you purchased lighting products in the last two years? (select all that are applicable)

- 57.1% Grocery Store
- 56.3% Hardware Store (such as Eagle, Ace Hardware, or True Value)
- 36.5% Home Improvement Stores (such as Home Depot or Home Base)
- 24.1% Electrical/Plumbing Store
- 44.8% Mass Merchandise Store (such as Target or Wal-Mart)
- 16.2% Superstore Discount Club (such as Sam's Club or CostCo)
- 0.0% Lighting Specialty Stores
- 24.4% Other Store

Q3. Of the places that you checked above, where do you usually buy your lighting products? (select only one)

- 19.1% Grocery Store
- 17.3% Hardware Store (such as Eagle, Ace Hardware, or True Value)
- 20.1% Home Improvement Stores (such as Home Depot or Home Base)
- 0.7% Electrical/Plumbing Store
- 31.9% Mass Merchandise Store (such as Target or Wal-Mart)
- 7.5% Superstore Discount Club (such as Sam's Club or CostCo)

- 1.1% Lighting Specialty Stores
- 1.6% Other Store
- 0.5% Don't Know

How did you hear about this survey?

- 80.2% Email solicitation from the Northwest Energy Efficiency Alliance
- 3.9% Postcard solicitation from the Northwest Energy Efficiency Alliance
- 10.2% Website link
- 2.3% Referred by a friend
- 3.4% Other/No Response

BULBS (values in the boxes represent percent of respondents by preference level. Far left = a preference of 1, far right = a preference of 9)

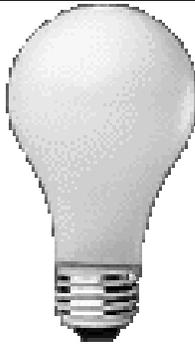
Q4. Which would you most likely purchase? Average=2.9

								
<p>Lights of America Quad Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 13 W (\$1.30/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$12.97</p>				<p>Philips Earthlight 60 Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 16 W (\$1.60/yr)* Lasts ~3 years (6,000 hours) Purchase price is \$14.97</p>				
48.0	13.5	9.8	3.5	6.4	5.0	3.2	3.5	7.1

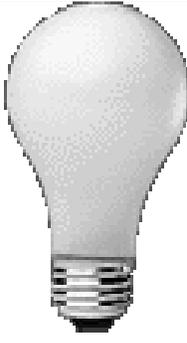
Q5. Which would you most likely purchase? Average=4.9

								
<p>GE Soft White Incandescent Equal to a 60 W incandescent bulb light output Energy use is 60 W (\$6.00/yr)* Lasts ~6 months (1,000 hours) Purchase price is \$0.24</p>		<p>Philips Earthlight 60 Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 16 W (\$1.60/yr)* Lasts ~3 years (6,000 hours) Purchase price is \$14.97</p>						
24.3	7.8	9.8	5.9	5.3	8.0	9.0	7.8	22.2

Q6. Which would you most likely purchase? Average=4.9

								
<p>GE Soft White Incandescent Equal to a 60 W incandescent bulb light output Energy use is 60 W (\$6.00/yr)* Lasts ~6 months (1,000 hours) Purchase price is \$0.24</p>		<p>Lights of America Twister Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$12.50</p>						
23.9	9.2	7.8	4.1	5.7	7.4	10.6	8.2	23.0

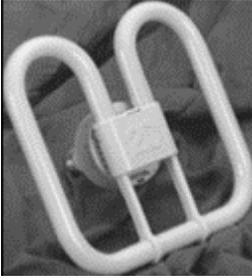
Q7. Which would you most likely purchase? Average=7.1

								
<p>GE Soft White Incandescent Energy use is 60 W (\$6.00/yr)* Lasts ~6 months (1,000 hours) Purchase price is \$0.24</p>				<p>GE Soft White Incandescent Long Life Energy use is 60 W (\$6.00/yr)* Lasts ~9 months (1,500 hours) Purchase price is \$0.34</p>				
8.3	2.3	3.4	1.2	6.7	5.9	8.5	14.0	49.6

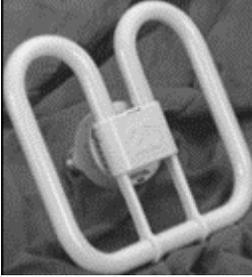
Q8. Which would you most likely purchase? Average=5.3

								
<p>Philips Halogen Bulb Equal to a 150 W incandescent bulb light output Energy use is 150 W (\$15.00/yr)* Lasts ~18 months (3,000 hours) Purchase price is \$3.98</p>				<p>Lights of America Megalight Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 34 W (\$3.40/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$17.99</p>				
17.2	8.0	8.5	6.4	6.0	6.7	11.5	10.8	24.8

Q9. Which would you most likely purchase? Average=4.2

								
<p>Philips Halogen Bulb Equal to a 150 W incandescent bulb light output Energy use is 150 W (\$15.00/yr)* Lasts ~18 months (3,000 hours) Purchase price is \$3.98</p>				<p>General Electric 2-D Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 39 W (\$3.90/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$22.50</p>				
25.4	11.2	13.5	6.9	9.6	3.9	7.6	6.0	16.0

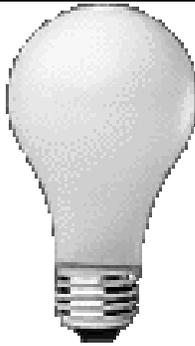
Q10. Which would you most likely purchase? Average=2.5

								
<p>Lights of America Circlelite Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 34 W (\$3.40/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$17.99</p>				<p>General Electric 2-D Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 39 W (\$3.90/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$22.50</p>				
43.4	19.0	13.7	7.8	10.5	0.9	0.5	1.4	3.2

Q11. Which would you most likely purchase? Average=7.9

									
<p>Philips Earthlight Universal Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$14.97</p>					<p>Fiet Electric EcoBulb Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$7.50</p>				
3.2	1.1	0.5	0.9	4.8	3.2	9.0	14.7	62.6	

Q12. Which would you most likely purchase? Average=5.3

									
<p>GE Soft White Incandescent Equal to a 60 W incandescent bulb light output Energy use is 60 W (\$6.00/yr)* Lasts ~6 months (1,000 hours) Purchase price is \$0.24</p>					<p>Fiet Electric EcoBulb Compact Fluorescent Equal to a 60 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$7.50</p>				
20.6	8.0	6.7	5.5	3.9	7.8	10.1	9.2	28.2	

Q13. Which would you most likely purchase? Average=6.1

								
<p>Lights of America Circlite Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 34 W (\$3.40/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$17.99</p>					<p>Lights of America Megalight Compact Fluorescent Equal to a 150 W incandescent bulb light output Energy use is 34 W (\$3.40/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$17.99</p>			
8.9	4.4	4.3	2.7	21.6	6.7	9.4	9.9	32.1

Q14. Which would you most likely purchase? Average=4.4

								
<p>Westinghouse R30 50 Watt Incandescent Reflector Equal to a 50 W incandescent bulb light output Energy use is 50 W (\$5.00/yr)* Lasts ~1 year (2,000 hours) Purchase price is \$4.75</p>					<p>Philips R30 Compact Fluorescent Reflector Equal to a 50 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~4 years (8,000 hours) Purchase price is \$29.25</p>			
23.9	12.2	10.5	8.7	7.8	5.1	8.2	6.6	17.0

Q15. Which would you most likely purchase? Average=4.8

								
<p>Philips R30 45 Watt Halogen Reflector Equal to a 50 W incandescent bulb light output Energy use is 50 W (\$5.00/yr)* Lasts ~18 months (2,500 hours) Purchase price is \$7.15</p>				<p>Philips R30 Compact Fluorescent Reflector Equal to a 50 W incandescent bulb light output Energy use is 15 W (\$1.50/yr)* Lasts ~4 years (8,000 hours) Purchase price is \$29.25</p>				
20.9	7.3	12.9	7.4	8.7	6.7	8.7	7.4	19.9

Q16. Which would you most likely purchase? Average=5.4

								
<p>GE Soft White Incandescent for a very high ceiling installation Equal to a 100 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Lasts ~5 months (750 hours) Purchase price is \$0.24</p>				<p>Philips Earthlight Universal Compact Fluorescent for a very high ceiling installation Equal to a 100 W incandescent bulb light output Energy use is 25 W (\$2.50/yr)* Lasts ~5 years (10,000 hours) Purchase price is \$14.97</p>				
17.7	7.6	6.9	3.9	4.3	8.7	13.5	9.4	28.0

FIXTURES (values in the boxes represent percent of respondents by preference level. Far left = a preference of 1, far right = a preference of 9)

Q4. Which would you most likely purchase? Average=2.9

									
<p>GE Profile Compact Fluorescent Torchiere Equal to a 300 W halogen bulb light output Energy use is 63 W (\$6.30/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80</p>					<p>Illuminada Halogen Torchiere Equal to a 300 W halogen bulb light output Energy use is 300 W (\$30.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$15.90</p>				
44.4	18.9	10.9	5.4	2.5	3.4	4.4	2.9	7.3	

Q5. Which would you most likely purchase? Average=8.1

									
<p>Lifestyle Halogen Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$34.90</p>					<p>Lights of America Compact Fluorescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80</p>				
2.7	1.3	1.9	1.0	2.3	3.1	11.3	13.8	62.7	

Q6. Which would you most likely purchase? Average=4.2

									
<p>Lights of America Compact Fluorescent Outdoor Coachlight Equal to a 100 W incandescent bulb light output Energy use is 27 W (\$2.70/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$47.50</p>					<p>Hampton Bay Incandescent Coachlight Equal to a 100 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~5 months (750 hours) Purchase price including bulb is \$17.90</p>				
31.0	11.1	9.6	7.8	6.9	8.0	7.1	5.5	13.0	

Q7. Which would you most likely purchase? Average=4.7

									
<p>Lights of America Compact Fluorescent Indoor Ceiling Plastic Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$17.99</p>					<p>Hampton Bay Incandescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 120 W (\$12.00/yr)* Bulb lasts ~6 months (1,000 hours) Purchase price including bulb is \$24.97</p>				
27.2	9.9	6.7	5.4	8.6	7.8	8.0	6.7	19.7	

Q8. Which would you most likely purchase? Average=5.8

									
<p>Lights of America Compact Fluorescent Indoor Ceiling Plastic Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$17.99</p>					<p>Lights of America Compact Fluorescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80</p>				
16.6	6.3	5.9	3.6	6.5	6.5	10.9	13.8	29.8	

Q9. Which would you most likely purchase? Average=7.5

									
<p>Hampton Bay Incandescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 120 W (\$12.00/yr)* Bulb lasts ~6 months (1,000 hours) Purchase price including bulb is \$24.97</p>					<p>Lights of America Compact Fluorescent Indoor Ceiling Glass Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80</p>				
5.7	2.5	1.7	1.3	4.4	3.1	7.8	18.4	55.1	

Q10. Which would you most likely purchase? Average=6.3

									
<p>Hampton Bay Incandescent Indoor Ceiling Glass Dome Energy use is 120 W (\$12.00/yr)* Bulb lasts ~6 months (1,000 hours) Purchase price including bulb is \$24.97</p>					<p>Lifestyle Halogen Indoor Ceiling Glass Dome Energy use is 100 W (\$10.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$34.90</p>				
9.9	6.5	5.0	4.8	6.3	8.6	14.1	12.6	32.1	

Q11. Which would you most likely purchase? Average=4.5

									
<p>Alpan Hawk Compact Fluorescent Tasklight Equal to a 60 W incandescent bulb light output Energy use is 13 W (\$0.65/yr)* Bulb lasts ~10 years (10,000 hours) Purchase price including bulb is \$39.95</p>					<p>Illuminada Incandescent Tasklight Equal to a 60 W incandescent bulb light output Energy use is 60 W (\$3.00/yr)* Bulb lasts ~1 year (1,000 hours) Purchase price including bulb is \$7.90</p>				
27.7	8.6	11.1	6.9	6.7	6.3	8.8	7.8	16.1	

Q12. Which would you most likely purchase? Average=4.5

									
<p>Alpan Hawk Compact Fluorescent Tasklight Equal to a 60 W incandescent bulb light output Energy use is 13 W (\$0.65/yr)* Bulb lasts ~10 years (10,000 hours) Purchase price including bulb is \$39.95</p>					<p>Milano Halogen Tasklight Equal to a 60 W incandescent bulb light output Energy use is 20 W (\$1.00/yr)* Bulb lasts ~3 years (3,000 hours) Purchase price including bulb is \$19.90</p>				
27.7	10.5	8.0	6.5	5.5	8.0	10.9	7.1	15.7	

Q13. Which would you most likely purchase? Average=5.8

									
<p>Illuminada Incandescent Tasklight Energy use is 60 W (\$3.00/yr)* Bulb lasts ~1 year (1,000 hours) Purchase price including bulb is \$7.90</p>					<p>Milano Halogen Tasklight Energy use is 20 W (\$1.00/yr)* Bulb lasts ~3 years (3,000 hours) Purchase price including bulb is \$19.90</p>				
12.4	8.2	6.9	5.2	7.1	7.3	10.9	12.6	29.4	

Q14. Which would you most likely purchase? Average=3.2

									
<p>Lights of America Compact Fluorescent Outdoor Coachlight Equal to a 100 W halogen bulb light output Energy use is 27 W (\$2.70/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$47.50</p>					<p>Sea Gull Halogen Coachlight Equal to a 100 W halogen bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$37.90</p>				
39.0	16.8	12.6	5.2	6.7	4.6	5.9	2.5	6.7	

Q15. Which would you most likely purchase? Average=3.3

								
<p>GE Profile Compact Fluorescent Torchiere Equal to a 300 W halogen bulb light output Energy use is 63 W (\$6.30/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$29.80</p>		<p>Sullivan Incandescent Torchiere Equal to a 300 W halogen bulb light output Energy use is 300 W (\$30.00/yr)* Bulb lasts ~5 months (750 hours) Purchase price including bulb is \$12.90</p>						
40.0	14.1	13.4	7.6	6.9	2.9	5.0	1.9	8.2

Q16. Which would you most likely purchase? Average=2.7

									
<p>Sullivan Compact Fluorescent Indoor Ceiling Plastic Dome Equal to a 120 W incandescent bulb light output Energy use is 30 W (\$3.00/yr)* Bulb lasts ~5 years (10,000 hours) Purchase price including bulb is \$17.99</p>					<p>Greenwood Incandescent Indoor Ceiling Plastic Dome Equal to a 120 W incandescent bulb light output Energy use is 120 W (\$12.00/yr)* Bulb lasts ~6 months (1,000 hours) Purchase price including bulb is \$12.97</p>				
51.8	14.9	12.0	5.5	3.6	2.3	3.1	1.9	4.8	

Q17. Which would you most likely purchase? Average=5.0

									
<p>Hampton Bay Incandescent Coachlight Equal to a 100 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~5 months (750 hours) Purchase price including bulb is \$17.90</p>					<p>Sea Gull Halogen Coachlight Equal to a 100 W incandescent bulb light output Energy use is 100 W (\$10.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$37.90</p>				
21.4	8.0	10.1	7.3	8.4	7.1	9.8	7.6	20.3	

Q18. Which would you most likely purchase? Average=6.9

								
<p>Sullivan Incandescent Torchiere Energy use is 300 W (\$30.00/yr)* Bulb lasts ~5 months (750 hours) Purchase price including bulb is \$12.90</p>				<p>Illuminada Halogen Torchiere Energy use is 300 W (\$30.00/yr)* Bulb lasts ~18 months (3,000 hours) Purchase price including bulb is \$15.90</p>				
9.6	3.8	2.7	1.9	6.9	5.4	10.5	14.3	44.9

Appendix D

Market Simulation Results

BACKCAST RESULTS FOR BULB CONJOINT SURVEY:

CONSTANT (b) 0.1

Q4	OPTION A	UTILITY	Q4	OPTION B	UTILITY
1. Bulb Life	Life-Long	13.6	1. Bulb Life	Life-Long	13.6
2. Operating Cost	Low	8.5	2. Operating Cost	Low	8.5
3. Bulb Shape	Small CFL	11.9	3. Bulb Shape	Bulb	8.5
4. Bulb Cost	High	3.1	4. Bulb Cost	High	3.1
	SUM	37.1		SUM	33.7

	Survey Result	Model Result
Preference	Option 'A'	Option 'A'
Share Option 'A'		0.59
Share Option 'B'		0.41
Average Scale Value	2.9	4.3

Q5	OPTION A	UTILITY	Q5	OPTION B	UTILITY
1. Bulb Life	Life-Short	8.5	1. Bulb Life	Life-Long	13.6
2. Operating Cost	High	6.3	2. Operating Cost	Low	8.5
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Bulb	8.5
4. Bulb Cost	Low	11.4	4. Bulb Cost	High	3.1
	SUM	34.7		SUM	33.7

	Survey Result	Model Result
Preference	Option 'A'	Option 'A'
Share Option 'A'		0.53
Share Option 'B'		0.47
Average Scale Value	4.9	4.8

Q6	OPTION A	UTILITY	Q6	OPTION B	UTILITY
1. Bulb Life	Life-Short	8.5	1. Bulb Life	Life-Long	13.6
2. Operating Cost	High	6.3	2. Operating Cost	Low	8.5
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Small CFL	11.9
4. Bulb Cost	Low	11.4	4. Bulb Cost	High	3.1
	SUM	34.7		SUM	37.1

	Survey Result	Model Result
Preference	Option 'B'	Option 'B'
Share Option 'A'		0.44
Share Option 'B'		0.56
Average Scale Value	5.0	5.5

Q7	OPTION A	UTILITY	Q7	OPTION B	UTILITY
1. Bulb Life	Life-Short	8.5	1. Bulb Life	Life-Medium	13.4
2. Operating Cost	High	6.3	2. Operating Cost	High	6.3
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Bulb	8.5
4. Bulb Cost	Low	11.4	4. Bulb Cost	Low	11.4
	SUM	34.7		SUM	39.6
	Survey Result	Model Result			
Preference	Option 'B'	Option 'B'			
Share Option 'A'		0.38			
Share Option 'B'		0.62			
Average Scale Value	7.2	6.0			
Q8	OPTION A	UTILITY	Q8	OPTION B	UTILITY
1. Bulb Life	Life-Medium	13.4	1. Bulb Life	Life-Long	13.6
2. Operating Cost	High	6.3	2. Operating Cost	Low	8.5
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Small CFL	11.9
4. Bulb Cost	Medium	8.5	4. Bulb Cost	High	3.1
	SUM	36.6		SUM	37.1
	Survey Result	Model Result			
Preference	Option 'B'	Option 'B'			
Share Option 'A'		0.49			
Share Option 'B'		0.51			
Average Scale Value	5.5	5.1			
Q9	OPTION A	UTILITY	Q9	OPTION B	UTILITY
1. Bulb Life	Life-Medium	13.4	1. Bulb Life	Life-Long	13.6
2. Operating Cost	High	6.3	2. Operating Cost	Low	8.5
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Circular	6.3
4. Bulb Cost	Medium	8.5	4. Bulb Cost	High	3.1
	SUM	36.6		SUM	31.5
	Survey Result	Model Result			
Preference	Option 'A'	Option 'A'			
Share Option 'A'		0.62			
Share Option 'B'		0.38			
Average Scale Value	4.3	4.0			

Q10	OPTION A	UTILITY	Q10	OPTION B	UTILITY
(Brand name not a utility)					
1. Bulb Life	Life-Long	13.6	1. Bulb Life	Life-Long	13.6
2. Operating Cost	Low	8.5	2. Operating Cost	Low	8.5
3. Bulb Shape	Circular	6.3	3. Bulb Shape	Circular	6.3
4. Bulb Cost	High	3.1	4. Bulb Cost	High	3.1
	SUM	31.5		SUM	31.5
	Survey Result	Model Result			
Preference	Option 'A'	no preference			
Share Option 'A'		0.50			
Share Option 'B'		0.50			
Average Scale Value	2.5	5.0			
Q11	OPTION A	UTILITY	Q11	OPTION B	UTILITY
1. Bulb Life	Life-Long	13.6	1. Bulb Life	Life-Long	13.6
2. Operating Cost	Low	8.5	2. Operating Cost	Low	8.5
3. Bulb Shape	Small CFL	11.9	3. Bulb Shape	Small CFL	11.9
4. Bulb Cost	High	3.1	4. Bulb Cost	Medium	8.5
	SUM	37.1		SUM	42.5
	Survey Result	Model Result			
Preference	Option 'B'	Option 'B'			
Share Option 'A'		0.37			
Share Option 'B'		0.63			
Average Scale Value	8.0	6.0			
Q12	OPTION A	UTILITY	Q12	OPTION B	UTILITY
1. Bulb Life	Life-Short	8.5	1. Bulb Life	Life-Long	13.6
2. Operating Cost	High	6.3	2. Operating Cost	Low	8.5
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Small CFL	11.9
4. Bulb Cost	Low	11.4	4. Bulb Cost	Medium	8.5
	SUM	34.7		SUM	42.5
	Survey Result	Model Result			
Preference	Option 'B'	Option 'B'			
Share Option 'A'		0.31			
Share Option 'B'		0.69			
Average Scale Value	5.4	6.5			

Q13	OPTION A	UTILITY	Q13	OPTION B	UTILITY
1. Bulb Life	Life-Long	13.6	1. Bulb Life	Life-Long	13.6
2. Operating Cost	Low	8.5	2. Operating Cost	Low	8.5
3. Bulb Shape	Circular	6.3	3. Bulb Shape	Small CFL	11.9
4. Bulb Cost	High	3.1	4. Bulb Cost	High	3.1
	SUM	31.5		SUM	37.1

	Survey Result	Model Result
Preference	Option 'B'	Option 'B'
Share Option 'A'		0.36
Share Option 'B'		0.64
Average Scale Value	6.2	6.1

Q14	OPTION A	UTILITY	Q14	OPTION B	UTILITY
1. Bulb Life	Life-Short	8.5	1. Bulb Life	Life-Long	13.6
2. Operating Cost	High	6.3	2. Operating Cost	Low	8.5
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Bulb	8.5
4. Bulb Cost	Low	11.4	4. Bulb Cost	High	3.1
	SUM	34.7		SUM	33.7

	Survey Result	Model Result
Preference	Option 'A'	Option 'A'
Share Option 'A'		0.53
Share Option 'B'		0.47
Average Scale Value	4.5	4.8

Q15	OPTION A	UTILITY	Q15	OPTION B	UTILITY
1. Bulb Life	Life-Medium	13.4	1. Bulb Life	Life-Long	13.6
2. Operating Cost	High	6.3	2. Operating Cost	Low	8.5
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Bulb	8.5
4. Bulb Cost	Medium	8.5	4. Bulb Cost	High	3.1
	SUM	36.6		SUM	33.7

	Survey Result	Model Result
Preference	Option 'A'	Option 'A'
Share Option 'A'		0.57
Share Option 'B'		0.43
Average Scale Value	4.9	4.4

Q16	OPTION A	UTILITY	Q16	OPTION B	UTILITY
1. Bulb Life	Life-Short	8.5	1. Bulb Life	Life-Long	13.6
2. Operating Cost	High	6.3	2. Operating Cost	Low	8.5
3. Bulb Shape	Bulb	8.5	3. Bulb Shape	Small CFL	11.9
4. Bulb Cost	Low	11.4	4. Bulb Cost	High	3.1
	SUM	34.7		SUM	37.1
	Survey Result	Model Result			
Preference	Option 'B'	Option 'B'			
Share Option 'A'		0.44			
Share Option 'B'		0.56			
Average Scale Value	5.6	5.5			

BACKCAST RESULTS FOR FIXTURE CONJOINT SURVEY:

Constant 0.1

Q4	OPTION A	UTILITY	Q4	OPTION B	UTILITY
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Medium	11.6
2. Operating Cost	Low	11.6	2. Operating Cost	High	9.4
3. Purchase Price	Medium	12.5	3. Purchase Price	Low	11.6
	SUM	44.7		SUM	32.7
	Survey Result	Model Result			
Preference	Option 'A'	Option 'A'			
Share Option 'A'		0.77			
Share Option 'B'		0.23			
Average Scale Value	2.9	2.8			

Q5	OPTION A	UTILITY	Q5	OPTION B	UTILITY
1. Bulb Life	Life-Medium	11.6	1. Bulb Life	Life-Long	20.6
2. Operating Cost	High	9.4	2. Operating Cost	Low	11.6
3. Purchase Price	Medium	12.5	3. Purchase Price	Medium	12.5
	SUM	33.6		SUM	44.7
	Survey Result	Model Result			
Preference	Option 'B'	Option 'B'			
Share Option 'A'		0.25			
Share Option 'B'		0.75			
Average Scale Value	8.0	7.0			

Q6	OPTION A	UTILITY	Q6	OPTION B	UTILITY	
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Short		11.6
2. Operating Cost	Low	11.6	2. Operating Cost	High	9.4	
3. Purchase Price	High	9.4	3. Purchase Price	Low	11.6	
	SUM	41.6		SUM	32.7	
	Survey Result	Model Result				
Preference	Option 'A'	Option 'A'				
Share Option 'A'		0.71				
Share Option 'B'		0.29				
Average Scale Value	4.1	3.3				
Q7	OPTION A	UTILITY	Q7	OPTION B	UTILITY	
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Short		11.6
2. Operating Cost	Low	11.6	2. Operating Cost	High	9.4	
3. Purchase Price	Low	11.6	3. Purchase Price	Medium	12.5	
	SUM	43.8		SUM	33.6	
	Survey Result	Model Result				
Preference	Option 'A'	Option 'A'				
Share Option 'A'		0.74				
Share Option 'B'		0.26				
Average Scale Value	4.7	3.1				
Q8	OPTION A	UTILITY	Q8	OPTION B	UTILITY	
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Long		20.6
2. Operating Cost	Low	11.6	2. Operating Cost	Low	11.6	
3. Purchase Price	Low	11.6	3. Purchase Price	Medium	12.5	
	SUM	43.8		SUM	44.7	
	Survey Result	Model Result				
Preference	Option 'B'	Option 'B'				
Share Option 'A'		0.48				
Share Option 'B'		0.52				
Average Scale Value	5.9	5.2				
Q9	OPTION A	UTILITY	Q9	OPTION B	UTILITY	
1. Bulb Life	Life-Short	11.6	1. Bulb Life	Life-Long		20.6
2. Operating Cost	High	9.4	2. Operating Cost	Low	11.6	
3. Purchase Price	Medium	12.5	3. Purchase Price	Medium	12.5	
	SUM	33.6		SUM	44.7	
	Survey Result	Model Result				
Preference	Option 'B'	Option 'B'				
Share Option 'A'		0.25				
Share Option 'B'		0.75				
Average Scale Value	7.6	7.0				

Q10	OPTION A	UTILITY	Q10	OPTION B	UTILITY	
1. Bulb Life	Life-Short	11.6	1. Bulb Life	Life-Medium		11.6
2. Operating Cost	High	9.4	2. Operating Cost	High	9.4	
3. Purchase Price	Medium	12.5	3. Purchase Price	High	9.4	
	SUM	33.6		SUM	30.4	
	Survey Result	Model Result				
Preference	Option 'B'	Option 'A'				
Share Option 'A'		0.58				
Share Option 'B'		0.42				
Average Scale Value	6.3	4.4				

Q11	OPTION A	UTILITY	Q11	OPTION B	UTILITY	
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Short		11.6
2. Operating Cost	Low	11.6	2. Operating Cost	High	9.4	
3. Purchase Price	High	9.4	3. Purchase Price	Low	11.6	
	SUM	41.6		SUM	32.7	
	Survey Result	Model Result				
Preference	Option 'A'	Option 'A'				
Share Option 'A'		0.71				
Share Option 'B'		0.29				
Average Scale Value	4.5	3.3				

Q12	OPTION A	UTILITY	Q12	OPTION B	UTILITY	
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Medium		11.6
2. Operating Cost	Low	11.6	2. Operating Cost	High	9.4	
3. Purchase Price	High	9.4	3. Purchase Price	Medium	12.5	
	SUM	41.6		SUM	33.6	
	Survey Result	Model Result				
Preference	Option 'A'	Option 'A'				
Share Option 'A'		0.69				
Share Option 'B'		0.31				
Average Scale Value	4.5	3.5				

Q13	OPTION A	UTILITY	Q13	OPTION B	UTILITY	
1. Bulb Life	Life-Short	11.6	1. Bulb Life	Life-Medium		11.6
2. Operating Cost	High	9.4	2. Operating Cost	High	9.4	
3. Purchase Price	Low	11.6	3. Purchase Price	Medium	12.5	
	SUM	32.7		SUM	33.6	
	Survey Result	Model Result				
Preference	Option 'B'	Option 'B'				
Share Option 'A'		0.48				
Share Option 'B'		0.52				
Average Scale Value	5.9	5.2				

Q14	OPTION A	UTILITY	Q14	OPTION B	UTILITY	
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Medium	11.6	
2. Operating Cost	Low	11.6	2. Operating Cost	High	9.4	
3. Purchase Price	High	9.4	3. Purchase Price	Medium	12.5	
	SUM	41.6		SUM	33.6	
	Survey Result	Model Result				
Preference	Option 'A'	Option 'A'				
Share Option 'A'		0.69				
Share Option 'B'		0.31				
Average Scale Value	3.1	3.5				
Q15	OPTION A	UTILITY	Q15	OPTION B	UTILITY	
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Short	11.6	
2. Operating Cost	Low	11.6	2. Operating Cost	High	9.4	
3. Purchase Price	Medium	12.5	3. Purchase Price	Low	11.6	
	SUM	44.7		SUM	32.7	
	Survey Result	Model Result				
Preference	Option 'A'	Option 'A'				
Share Option 'A'		0.77				
Share Option 'B'		0.23				
Average Scale Value	3.1	2.8				
Q16	OPTION A	UTILITY	Q16	OPTION B	UTILITY	
1. Bulb Life	Life-Long	20.6	1. Bulb Life	Life-Short	11.6	
2. Operating Cost	Low	11.6	2. Operating Cost	High	9.4	
3. Purchase Price	Low	11.6	3. Purchase Price	Low	11.6	
	SUM	43.8		SUM	32.7	
	Survey Result	Model Result				
Preference	Option 'A'	Option 'A'				
Share Option 'A'		0.75				
Share Option 'B'		0.25				
Average Scale Value	2.5	3.0				
Q17	OPTION A	UTILITY	Q17	OPTION B	UTILITY	
1. Bulb Life	Life-Short	11.6	1. Bulb Life	Life-Medium	11.6	
2. Operating Cost	High	9.4	2. Operating Cost	High	9.4	
3. Purchase Price	Low	11.6	3. Purchase Price	Medium	12.5	
	SUM	32.7		SUM	33.6	
	Survey Result	Model Result				
Preference	Option 'A'	Option 'B'				
Share Option 'A'		0.48				
Share Option 'B'		0.52				
Average Scale Value	4.9	5.2				

Q18	OPTION A	UTILITY	Q18	OPTION B	UTILITY	
1. Bulb Life	Life-Short	11.6	1. Bulb Life	Life-Medium	11.6	
2. Operating Cost	High	9.4	2. Operating Cost	High	9.4	
3. Purchase Price	Low	11.6	3. Purchase Price	Low	11.6	
	SUM	32.7		SUM	32.7	
	Survey Result	Model Result				
Preference	Option 'B'	Option 'B'				
Share Option 'A'		0.50				
Share Option 'B'		0.50				
Average Scale Value	6.9	5.0				

Appendix E

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