



**FINAL REPORT**

**Residential Lighting Fixture  
Market Assessment:  
Ceiling Fans and Outdoor Lighting**

**Submitted  
to  
The Consortium for Energy Efficiency  
by  
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## 1. Executive Summary

The purpose of this research was to conduct an assessment of the national residential lighting fixture market in order to identify promising market segments for the creation of market transformation opportunities. The Consortium for Energy Efficiency (CEE) initiated this research in response to its members' concerns about the lack of available ENERGY STAR lighting fixtures. Specifically, CEE members indicated that they needed more information about the market to better focus their program efforts. While the primary focus of this research was on compact fluorescent light (CFL) fixtures, CEE did not preclude the research from uncovering other opportunities related to the residential fixture market. CEE intends to use the results of this research to develop a national initiative to cost effectively increase the installation of efficient lighting where inefficient lighting sources would otherwise be used.

### Background

Lighting is one of the primary energy end-uses in U.S. homes. It accounts for as much as 10 to 15 percent of total energy consumption in a typical home. Since the introduction of electric lighting, incandescent lighting sources have been the dominant technology used in homes. Fluorescent tubes became a lighting option in U.S. homes between the 1940's and 1960's, but it was not until 1979 that the first fluorescent bulb could be screwed into a standard incandescent socket. However, it wasn't until the 1990's that consumers could find CFL bulbs at retail stores, and they are still not widely available.

Lighting manufacturers and others have said that the best way to encourage the use of energy saving CFLs is to create dedicated CFL fixtures. Dedicated CFL fixtures can accept only pin-based CFL bulbs and cannot be used with standard incandescent screw-based light bulbs. In this way, the savings generated from dedicated CFL fixtures are permanent—replacement bulbs will always be pin-based CFLs; screw-in incandescent bulbs will not be physically compatible. So far, very few dedicated CFL fixtures are available to consumers.

In 1997, the Environmental Protection Agency (EPA) and the Department of Energy (DOE) introduced a labeling initiative for residential fixtures under its ENERGY STAR program. ENERGY STAR is a voluntary partnership between the U.S. Department of Energy, the U.S. Environmental Protection Agency, local utilities and industry partners. The program is designed to help consumers identify and purchase the most energy efficient products on the market. The ENERGY STAR fixture specification sets minimum performance levels of efficiency for portable, indoor hardwired, and outdoor residential fixtures. Currently there are nearly 2,000 ENERGY STAR qualifying lighting fixtures from 41 manufacturers; however, this fixture count is somewhat misleading, as product counts from some manufacturers may include style variations on the same model. In 1999, the ENERGY STAR program estimated 1.1 to 1.4 million ENERGY STAR residential fixtures were sold. This represents less than 1% of the approximately 165 million fixtures sold annually.

Clearly, ENERGY STAR products play a very small role in the residential fixture market. The primary problem is that they are not seen above the “noise” of the competition. There is a clear need to focus on increasing the number of fixtures that are available in the marketplace. However, from a consumer perspective, style or aesthetics as well as price drive fixture sales. There is little brand awareness of most fixture types, which means it is harder to compete on factors such as quality, performance, or energy saving capabilities. Promotion of ENERGY STAR products is an attempt to attach a branding scheme to products that have not previously been sold on this basis. We therefore conclude that to compete among the wide variety of fixture types and styles that exist, the best chances for an energy saving fixture to achieve substantial market share is within lighting fixture product categories where the style choices are minimal. This will make specific energy saving products more visible and their non-aesthetic attributes more easily recognizable.

Below we summarize our market segmentation methodology and the selection of the market segments that we believe hold the most potential for achieving wider market penetration. We also provide an overview of our assessment of two market segments—ceiling fans and outdoor lighting—that meet this criterion, as well as an overview of some of the considerations about fixture purchasing opportunities that can influence market intervention strategies.

### Phase One Findings: Market Segmentation

- We chose to segment the residential lighting fixture market by product-based selections, due to the fact that any other segmentation scheme ultimately is based on having energy-saving products to promote.
- Despite the fact that there are nearly 2,000 ENERGY STAR qualifying products from 41 manufacturers, the fact remains that energy saving fixtures are not able to effectively compete among the wide selections of non-efficient alternatives.
- Style or aesthetics is the most important factor for consumers buying indoor lamps and fixtures. For outdoor lighting, functional issues such as safety, security, and durability are most important.
- The basis of fixture design dictates the amount of style variation that exists within a product category.
  - **Style-based** categories of lamps and fixtures are characterized by a wide selection of models, with various housing designs, colors, and options.
  - **Functional** lighting categories have little variation from one model to the next.
  - **Combination** lighting categories have some aesthetic appeal, but have little variation in style design (i.e., torchieres) or are installed primarily to serve a functional purpose (safety, security).
- Efficient lighting products with a functional basis of design may have a greater likelihood of competing with non-efficient alternatives, because there will be less style variation that must be satisfied.

- Because of having at least a partially function-based design, relatively high sales, and the potential for energy savings, we believe the following six market segments hold the most promise:
  - Recessed lighting
  - Outdoor (not including floods)
  - Torchieres
  - Ceiling fans
  - Portable task/desk lighting
  - LEDs
- The CEE Lighting Committee narrowed the focus to two segments: ceiling fans and all types of outdoor lighting.

### **Ceiling Fans Market Characterization**

- Approximately 15 to 19 million ceiling fans are sold annually. This represents 9% to 12% of all residential fixture sales annually.
- Ceiling fans have very little style variation among models. A Victorian-style design dominates product selections.
- About 95% of the ceiling fans being sold annually include lighting or are capable of including lighting.
- As much as 60% of the energy consumed by ceiling fans may be attributable to lighting.
- Virtually no ceiling fans being sold in residential markets include CFLs.
- CFLs may be appropriate for many ceiling fan applications (dish, dome designs), both for integrated and add-on lighting. They are unlikely to be used in can or cup designs due to CFL bulb size and appearance.
- CFLs must be able to match consumer expectations for light output, which is a particular concern due to high ceiling installations; they must also have dimming capability.
- Consumer need for ceiling fans is based on by a desire to improve room comfort and reduce cooling needs and budgets—functions that consumers directly relate to energy consumption. This may be used as a primary selling feature for including CFLs as a lighting feature—Why make your fan work harder than it has to? The ENERGY STAR label would be an important part in labeling this benefit for consumers.
- Once need for ceiling fans is established, consumers buy ceiling fans based on style (i.e., white blades, or brown? Frosted dome light or cut glass?) and price.
- There is a large number of ceiling fan manufacturers, but the vast majority of them cater to niche markets. Only a few manufacturers have significant market share.
- Market interventions should consider addressing the distribution outlets where most product sales occur: mass marketers. About 80% of ceiling fans are sold through large retailers, with 45% to 60% of sales occurring at home improvement centers. Market interventions should also be directed at manufacturers that supply these markets.
- Home Depot is the largest single retailer of ceiling fans, accounting for about 4.5 million ceiling fan sales annually.
- Ultimately, we conclude that there are a number of technical issues that must be addressed before an ENERGY STAR rating can be achieved. These issues are related to each of the energy using components of the fans, including lighting, motor, blades, and controls.

- ENERGY STAR specifications should consider not only energy consumption of ceiling fans, but also fan effectiveness in producing airflow.
- In order for a ceiling fan to receive an ENERGY STAR label, all of its energy-using components, not just the lighting component, must meet ENERGY STAR standards. An initial step toward achieving this may be to encourage manufacturers of add-on lighting kits to meet ENERGY STAR standards independently. While ceiling fans packaged with lighting will not have an ENERGY STAR label without standards for all other components, adopting ENERGY STAR lighting criteria in fans would provide consumers with a nearer-term introduction to efficient lighting for fans while details about a product standard are established.
- While an estimated 50% of ceiling fans have integrated lighting or are pre-packaged with a lighting kit, approximately 45% of ceiling fans are lighting adaptable. Consumers buy add-on lighting kits separately. Further research may reveal the precise number of consumers who choose to purchase the add-on lighting kit; it is likely a high percentage.

### **Outdoor Lighting Market Characterization**

- There are approximately 17 million outdoor fixtures shipped domestically each year in the U.S., accounting for at least 10% of all fixture sales annually.
- We define three basic categories of outdoor lighting: decorative (i.e., porch lighting), security (i.e., flood lighting), and landscape lighting (i.e., spot lighting that accents the floral beds, walk-way lighting, etc.).
- The largest volume of sales of outdoor lighting can probably be attributed to decorative lighting, followed by security, then landscape lighting.
- Ultimately, we conclude that the best opportunities for dedicated energy-saving CFL outdoor fixtures exist within the decorative category. These fixtures include porch lighting (attached ceiling and wall) and post-mounted lighting.
- The category of decorative outdoor lighting fixtures has a limited style selection that is dominated by lantern-style fixtures, and the housing is likely to be large enough to accommodate CFL bulbs.
- Consumers have low light output demands for decorative lighting. Moreover, other characteristics of CFL lighting, such as slow start-up, flickering, and color rendering are unlikely to be as important to consumers in outdoor applications as they are in indoor fixtures. The long life of CFLs benefits consumers by reducing the number of bulb change-outs that is required.
- Some landscape lighting may also be appropriate for CFLs due to limited style selections within this category (particularly pathway lighting) and low light output demands.
- However, low-voltage lighting is popular within the landscape lighting category, and the size of CFLs may be prohibitively large to fit in many existing fixture designs.
- Security lighting is not a good application for CFLs, due to high light output needs. However, a greater emphasis on the use of controls in conjunction with non-CFL light sources may be appropriate for energy-saving program marketing efforts.
- There are a very large number of outdoor fixture manufacturers that cater to the residential market, or have products that can be used in the residential market. The largest manufacturers of outdoor fixtures have the widest overall selections of fixtures, with product lines for both indoor and outdoor fixtures.

- Most outdoor fixtures are sold in home improvement centers, with Home Depot and Lowe's being the largest retailers within this category. Therefore, the same implementation strategies as ceiling fans apply for outdoor lighting.

### **Fixture Specifications in Home Improvements and New Construction**

- The greatest volume of fixture sales occurs in the home improvement market, which includes renovation, remodeling, replacement, and decorating, as opposed to the new construction market. Consumers are the primary specifiers of fixtures in home improvement activities.
- The vast majority of ceiling fans and outdoor lighting fixtures are sold at large retailers.
- Home improvement stores dominate this category, followed by department or discount department stores and franchise hardware stores.
- Contractors purchase fixtures from wholesalers, home improvement centers, and lighting specialty stores.
- In the higher end of the market for ceiling fans and outdoor fixtures, lighting specialty stores are the source for both contractors and consumers.
- Homebuyers and builders are the primary decision makers for fixture specifications in residential new construction. Electrical contractors, architects, and interior designers may also influence specifications.
- In general, the more expensive and customized the home, the more input the homebuyer has in the lighting specification as the home is being built.
- CFL fixtures are not routinely specified in newly constructed homes. Builders do not usually consider installing them unless the homebuyer makes a specific request.
- Builders often install a basic "package" of lighting fixtures based on meeting minimal lighting requirements at a minimal budget. Many builders install fixtures with the expectation that the homebuyer will later replace these fixtures to meet their aesthetic preferences.
- If energy saving fixtures are installed in homes without consumer "buy-in" through education and/or input into the style, many homeowners will replace them. The potential savings of the fixtures will therefore be lost.
- We recommend that program implementation efforts for ceiling fans and decorative outdoor lighting concentrate on fixture purchases in the renovation/remodeling and decorating/replacement markets rather than the new construction market. The rationale for this is based on the fact that efforts in the home improvement market can be concentrated on a few retailers and manufacturers, whereas the new construction is more fragmented, with multiple decision makers and channels.

## 2. Introduction

This report summarizes the findings of a two-phase research project on the residential lighting fixture market that Opinion Dynamics Corporation (ODC) conducted on behalf of the Consortium for Energy Efficiency (CEE). The goals of the project were:

- To assess the national residential lighting fixture market,
- To identify promising market segments for the creation of market transformation opportunities,
- To narrow those segments to the two most promising and,
- To identify indicators that can be used to create appropriate market interventions.

In the first phase of the research, we provided a general overview of the market for residential lighting fixtures and identified the most effective ways to segment the market. We concluded that segmenting the market by product type would be the most effective means for creating market transformation opportunities. We identified six segments that appear to offer the best opportunities for energy savings: recessed lighting, outdoor lighting (not including floods), torchieres, ceiling fans, portable task or desk lighting, and Light Emitting Diodes (LEDs). We presented these findings at the CEE Program Committee Meeting on June 6, 2000, held in Boston, MA. Based on the findings from Phase One, and under the direction of CEE and the Lighting Committee (the Committee), in Phase Two we narrowed the focus of the remaining research to two market segments: outdoor lighting (all types) and ceiling fans.

This report summarizes Phase 1 findings, provides an overall fixture market assessment, and provides the rationale for the segments we identified as the most promising. The report also provides a market assessment of the two selected market segments—outdoor lighting and ceiling fans—with a focus on the market structure of each product line.

### 3. Methodology

This research is a compilation of information from a variety of primary and secondary research sources, including depth interviews with industry experts, a review of existing lighting market research, data analysis, and attendance at the Lightfair International trade show and conference. The research tasks performed in each phase of the research process are outlined below.

#### 3.1. Phase One

**Member Depth Interviews:** Our approach to Phase 1 included depth interviews with selected CEE Members who are involved in the design or administration of lighting programs. In these interviews we explored the parameters of program design, focusing on constraints (such as the planning process, timing, budgets, and regulatory influences.) This will help frame the realistic bounds for intervention strategies.

**Secondary Research:** Next, we conducted a review of existing information sources to identify market segments that seem to have the most potential for energy savings. The purpose of this review was to get a better understanding of how the market is structured by conducting a preliminary market assessment. This also allowed us to have a better understanding of the limitations of existing information sources about the fixture market and to identify some research needs. This fed into the final segmentation. There has been a considerable amount of research devoted to the residential lighting industry in recent years. Information sources included lighting evaluations, market progress reports, and market research conducted by utilities, utility groups, public benefits collaboratives, the U.S. government, and marketing information from the lighting industry.

**Industry Conference:** We also attended Lightfair International, the annual architectural lighting trade show and conference. This allowed us to view the latest manufacturer product offerings, see some new lighting technologies, and talk to some of the manufacturers about their product lines.

**Market Segmentation:** Based on all inputs—depth interviews, review and analysis of secondary research, a market assessment, and industry interaction—we explored various ways to segment the market that addressed CEE member constraints, potential energy savings, and maximum impact in the market. Six lighting product segments were identified and presented to the Committee for consideration.

### **3.2. Phase Two**

The product-based segmentation that resulted from Phase One dictated our research focus and methodology for Phase Two. Based on the findings from Phase One, and under the direction of CEE and the Committee, we narrowed the focus of the remaining research to two market segments: ceiling fans and outdoor lighting (all types). Our assessment of these products focuses on identifying market information, particularly the distribution channels for the delivery of these products to the end-user. We do not focus on the technical specifications related to the energy savings potential of these products.

Our research approach in Phase Two was largely exploratory. This research was not intended to provide a complete market characterization of either product category due to budget and timeline constraints. It was originally anticipated that our characterization of the ceiling and outdoor fixture markets would rely on existing information sources. However, existing research about residential lighting fixtures focuses primarily on general fixture market data, but not specific products. Much of the effort involved in characterizing these markets requires primary research of principal market actors such as manufacturers and retailers who are directly involved in the production and distribution of these products to consumers.

As a result, only a limited amount of this research is based on existing lighting evaluations, market progress reports, and market research conducted by utilities, utility groups, public benefits collaboratives, and the U.S. government. We expanded upon and supplemented this information with depth interviews conducted among a small selection of market actors, including manufacturers, retailers, and industry experts. We also reviewed product literature from manufacturers, consulted lighting industry and appliance trade publications, reviewed lighting manufacturer and industry Internet sites, and conducted informal visits with retailers. A list of references can be found in the Appendix.

Due to the fact that ceiling fans are a single product type, whereas outdoor lighting is a category of lighting that encompasses a wide variety of types of fixtures, each product category required a unique research strategy. The result of our research about ceiling fans provides a description of the market size and potential. We create a product description that defines lighting as one of the four ceiling fan components (lighting, motors, blades, and controls) impacting energy usage. In part, the research quantifies the portion of ceiling fans that incorporate (or are capable of incorporating) lighting, provides a description of how lighting is included in fans or made available as an add-on feature, and explores whether a third-party market exists for ceiling fan lighting kits. The research also identifies major ceiling fan manufacturers, describes the distribution channels that exist to deliver products from manufacturers to end-users, and quantifies the distribution flows by retail channel.

The characterization of the outdoor fixture market was more complex due to the wide range of product types that exist within the category. Our research also explores market size and potential. In doing so, the research creates a product description that defines how outdoor lighting may be categorized (decorative, landscape, and security lighting). Identifying outdoor lighting by categories allowed us to assess how each category of lighting is used by consumers and to identify the lighting technologies that currently are used within each category so that

potential energy saving opportunities within each category could be revealed. Our research also details the overall distribution flows of outdoor lighting from manufacturers to end-users and identifies major manufacturers.

As part of the research, the Committee was interested in understanding how various implementation strategies might be used for changing the market. We provide an overview of new construction and renovation activity in the U.S. This includes a detailed description of the specification process for installing fixtures in newly constructed homes from the contractor and homeowner perspectives. We also provide an overview of the major retail channels that are instrumental in delivering lighting products to consumers.

Much of the information we present in this report is based on anecdotal sources and is qualitative in nature. We believe that much of its value is in providing the Committee with direction for understanding how the distribution channels impact the market for each of these segments.

## 4. Phase One: Market Characterization and Preliminary Segmentation

### 4.1. Member Depth Interviews

The initial step of this research process involved depth interviews with CEE Members. CEE provided ODC with a prioritized list of Members, from which we contacted 20 and completed 15 interviews. The purpose of the depth interviews was to get input from CEE Members about the parameters of their lighting fixture program design, including the planning process, budget, timing, and regulatory influences. Some of the findings are as follows:

- Member programs are almost exclusively focused on market transformation goals to create interventions within the marketplace that will eventually lead to a sustainable demand for energy efficient lighting products among consumers.
- Programs focus on increasing consumer awareness of energy efficient lighting products, encouraging manufacturers to produce more efficient lighting products in a wider variety of styles and prices, and encouraging retailers to promote and carry efficient lighting products.
- Most programs include both CFLs and energy efficient fixtures.
- Members receive program directives from utilities, internal review boards, and state and local regulators.
- There is a disconnect between most general lighting programs and lighting efforts geared toward new construction. Most lighting programs do not include new construction as a component of the general lighting plan; instead, lighting is a component of the new construction program. Separate programs mean separate goals, budgets, implementation strategies, and staff.
- Most Members report lighting program planning cycles and budgets that run on a calendar year, from January through December. The demand for most lighting products peaks during the period from October through March, the darkest months of the year. Many Members recognize and compensate for the seeming disparity of program interruptions during the peak lighting season by having multiple-year planning cycles or budget carry-over abilities.
- Planning for the program years begins during the late spring or summer of the previous year, with regulatory filings often made in the fall.
- There is some uncertainty among some Members about their roles in conducting energy efficiency programs in the future, due in part to industry changes that are taking place.
- To varying degrees, Members say their programs allow for mid-program or mid-year modifications and respond to market changes as they occur.

- The measurement of program success appears to be in its infancy. At the most basic level, program goals are measured by energy savings, the distribution of lighting products to consumers, and market share. Measures of consumer awareness of energy efficient lighting products, the number of efficient lighting products available from retailers and manufacturers, and product prices are also indicators of program success.
- Members support the ENERGY STAR platform. They consider it to be a valuable technical benchmark for efficiency and a key marketing tool in their lighting programs.
- Members say the most significant factor that influences program design is budget constraints. Limited funding prohibits Members from designing and implementing the types of programs they would like to have.

#### **4.2. Market Assessment**

Lighting accounts for about 10 to 15 percent of total energy consumption in a typical U.S. home.<sup>1</sup> About 87% of residential lighting sources currently use incandescent technologies. The U.S. Department of Energy estimates that up to 31.7 billion kWh, or 35% of all electricity currently used for lighting, could be saved with the use of CFLs. While about half of U.S. households are familiar with CFLs, only 8.9% of households use CFLs.<sup>2</sup>

A considerable amount of research has been devoted to characterizing overall residential lighting markets. Rather than repeating it here, among the many resources that exist, we recommend two sources in particular for assessments of the overall fixture and CFL markets: *Lighting the Way to Energy Savings: How Can We Transform Residential Lighting Markets?* (Natural Resources Defense Council, December 1999) and *Lighting Market Sourcebook for the U.S.* (Lawrence Berkeley National Laboratory, December 1997).

CFL lighting fixtures are an important part of transforming the lighting market. The savings are permanent to the extent that incandescent lighting technologies are not physically compatible with built-in CFL ballasted fixtures (CFL fixtures have pin-based replacement lamps; screw-in incandescent bulbs do not fit.) In addition, replacement CFL pin lamps, priced at \$4 to \$5 each, are more price competitive with incandescent bulbs than the all-in-one CFL bulbs that are currently available for \$10 and up.

The fixture manufacturing market is highly fragmented with hundreds of manufacturers and thousands of styles. The U.S. Census Bureau identifies over 500 residential fixture manufacturers in the U.S.<sup>3</sup> This is in stark contrast to the light bulb manufacturing market,

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<sup>1</sup> U.S. Environmental Protection Agency. Fact sheet on High-Efficiency Lighting from ENERGY STAR Web site. <http://yosemite.epa.gov/appd/eshomes/eshaware.nsf/webpages/EnergyStarlibrary.htm>.

<sup>2</sup> U.S. Department of Energy, Energy Information Administration. *Residential Lighting: Use and Potential Savings, 1993 Residential Energy Consumption Survey*.

<sup>3</sup> U.S. Census Bureau, *Residential Electric Manufacturing*. Manufacturing Industry Series. 1997.

which is characterized by a small number of very large manufacturing companies. The sheer number of fixture manufacturers and product lines makes broad interventions neither technologically nor economically feasible.

Light fixtures for residential use consist of three broad sub-markets: portable fixtures, indoor hardwired fixtures, and outdoor fixtures. Within each sub-market, further divisions can be made:

**Portable**—i.e., table, floor, desk, task, etc.

**Indoor Hardwired**—i.e., recessed, track, suspended ceiling, ceiling fans, surface mounted, wall mounted, under counter, etc.

**Outdoor**—i.e., porch wall mounted, porch ceiling mounted, post mounted, spot lights, security, pathway, deck lighting, step lighting, etc.

Additional diversity exists within each of the product types, often with multiple style choices available for a single type of fixture at a retail showroom. In fact, aesthetics and price drive consumer decisions about most fixture purchase decisions, which means it is harder for fixtures to compete on factors such as quality, performance, or features.

Due to the diversity of the sub-markets and product lines, there is no simple formula to describe the distribution channels of fixtures from manufacturers to end-user. The distribution channels for each of the fixture sub-markets follows similar paths, but slight variations exist for individual product types. For example, distribution channels for portable fixtures typically involve consumers purchasing lamps directly from retailers such as department stores, home furnishings stores, and home improvement stores. However, the distribution channel for portable desk lighting would likely include office supply retailers too. Portable fixture styles rarely, if ever, are specified by builders in new construction plans.

In contrast, permanent hardwired fixtures and outdoor fixtures are specified in a wider range of situations and often involve multiple decision makers. There are three primary fixture purchase occasions: new construction, renovation/remodeling, and decorating/replacement. In the choice of fixtures for newly constructed homes, the primary decision makers are usually homebuyers and builders. Builders purchase fixtures from suppliers that include retailers and lighting distributors. Smaller custom builders purchase fixtures from lighting specialty stores. Electrical contractors, architects, and interior designers also influence specifications.

Based strictly on volumes of fixture sales, most fixtures are purchased for replacement and renovation activities rather than in new construction. These sales are likely to consist of relatively few fixtures per consumer. The National Resources Defense Council estimates that 1.7 fixtures are sold per household each year.<sup>4</sup> In a newly constructed home, 25 to 35 permanent fixtures are typically installed. The number of fixtures that must be specified at any one time in a home is never greater than when a new home is built.

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<sup>4</sup> Calwell, C., Granda, C., Stephens, C., and Ton, M. *Energy Efficient Residential Luminaires: Technologies and Strategies for Market Transformation*. Natural Resources Defense Council, submitted to the U.S. Environmental Protection Agency, Office of Air and Radiation, Energy Star Programs Under Grant #CX824685. May 13, 1996.

Clearly there exists tremendous potential for energy savings from CFL fixtures, but the truth of the matter is that the technology remains a niche market. Manufacturers are not making enough energy saving fixtures, retailers are not demanding them or stocking them, and consumers are not buying them. With the wide variety of types and styles of residential fixtures that exist, the problem of bringing energy saving fixtures into the forefront all at once is too big. Therefore, it makes more sense to concentrate on a few markets where energy saving fixtures can be placed to compete directly with their non-efficient alternatives. In Phase One, we created a scheme for identifying the most promising residential fixture market segments and selected areas that appear to have significant energy savings opportunities.

### 4.3. Potential Segmentation Schemes

In creating a segmentation scheme for the residential lighting market, the objective is to identify areas of the market that will result in an increase in product availability when properly addressed through various intervention strategies. There are a number of different avenues we considered when thinking about the best way to segment the residential lighting sector. These include:

- **Product types**—Lighting product lines generally are grouped into three categories: indoor permanent hardwired fixtures, indoor portable fixtures, and outdoor fixtures. Within each of these categories, there are sub-types, such as ceiling fixtures and wall sconces, table lamps and floor lamps, and post-mounted and pathway lighting
- **Basis of fixture design**—Some fixtures are designed and marketed on the basis of the wide variety of styles that exist; these styles are ever changing according to fashion trends and consumer preferences. Consumers consider these types of fixtures to be elements of their decorating scheme, as well as light sources. Other types of fixtures have little variation in style, even among competing manufacturers. They serve a greater functional, rather than aesthetic purpose. A third category of fixtures are designed with both style and functionality in mind. Understanding the basis of fixture design helps to identify fixtures that have limited variation among competing products.
- **High use areas of home**—The rooms in the home where people are using lights most often present the greatest opportunities for energy savings. CFL technology achieves its best savings in areas where lights are used continuously for 3 or 4 hours or more each day. Kitchens, living rooms, bedrooms, and bathrooms have the highest installed wattage and account for almost 50% of a typical household's lighting energy usage.<sup>5</sup>

High use areas of the home, roughly in order of highest use, include:

Kitchens  
Living room/Family room  
Outdoor/porch lights  
Bathrooms

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<sup>5</sup> Vorsatz, D., Shown, L., Koomey, J., Moezzi, M., Denver, A., and Atkinson, B. December 1997. *Lighting Market Sourcebook for the U.S.* Berkeley, CA: Lawrence Berkeley National Laboratory. LBNL-39102.

- **High-use fixture types**—Similarly, by identifying precisely which types of fixtures people use most often in the home, the greatest opportunities for energy savings can be found.
- **Purchase opportunities**—This segmentation scheme considers the timing of purchases of new fixtures, such as during new construction, as part of a renovation or remodeling project, and as part of a decorating or replacement activity. Further breakdowns might include specific purchase occasions, such as the lighting market created from kitchen and bath renovation activities.

*New Construction*

*Renovation/Remodeling*—Defined as work that involves major construction or changing the amount of livable floor space.

*Decorating/Replacement*—Defined as involving no major construction work. It includes sprucing up a home with new colors, furnishings, etc; replacing broken or malfunctioning lamps and fixtures; and adding more light for specific tasks.

- **Distribution channels**—By looking upstream into distribution channels, one can identify constraints and opportunities for promoting efficient lighting fixtures. This includes manufacturers, distributors, retailers, and specifiers who influence the market.
- **Consumer preferences**—This segmentation scheme identifies the types of lighting products that consumers are buying, that is, the biggest sellers.
- **Regional differences**—The fixture markets in different parts of the country are likely to be different, based on many of the factors introduced here. For example, there may be differences in the distribution channels, new construction activity, consumer preferences and lifestyles, etc. that impact fixture use.

None of these segmentation schemes alone provides a full picture of the residential lighting market. There are areas of cross-over among each of the segmentation schemes, and elements from each of these categories can be combined to create additional segmentation schemes.

#### **4.4. Segmentation by Product Type**

After careful consideration, we settled on product type as our approach for segmenting the fixture market. Our rationale is based on the fact that any implementation strategy for addressing the fixture market gets back to the fact that **there must be energy saving products to promote**. The CFL fixture market has not developed enough to do this, which is part of the reason why the efficiency community has encountered so many barriers in creating wider usage of the products. CFL fixtures must be available in every style variation of the non-efficient alternatives in order to be able to compete head-to-head with the other fixtures. While there are nearly 2,000 qualifying ENERGY STAR fixtures from 41 manufacturers, the products are not widely produced or available from retailers where consumers most often buy fixtures, and they are difficult to find among competing products from retailers that do carry them. Less than 1% of residential fixtures sold are ENERGY STAR fixtures.

Briefly let us consider the implications if we were to segment the market based on purchase decision. The research might have focused in part on the new construction market and how to influence decision makers such as contractors who are involved in specifying fixtures. Understanding contractor motivations for installing fixtures and gaining insight about how to educate them about the benefits of energy saving CFL lighting would be logical steps in the research process for addressing this market. However, the research would eventually lead to the need for fixtures to fill a wide range of end-uses (i.e., bathroom ceiling lights and vanity lighting, hallway lighting, kitchen ceiling and task lighting, bedroom lighting, living room ceiling lighting, stairwell lighting, entry way lighting, outdoor lighting, etc.). Furthermore, the fixture choices must match consumer expectations about performance and style in each application. We conclude that **there must be energy saving products to promote**, but that the current selection of ENERGY STAR qualifying products is unlikely to fully satisfy these needs.

Similarly, segmenting by high-use areas of the home would likely steer research into a room such as the kitchen. Here, the implementation strategy might focus on the renovation market. Understanding which fixtures are commonly used and where consumers acquire lighting products would likely be parts of the research process. However, the implementation strategy for addressing this market would be fruitless if energy saving products were not available in the range of product types and styles that consumers expect to find. Again we get back to the fact that **there must be energy saving products to promote**.

Part of the success in promoting energy-saving lighting in the commercial sector is based on the fact that within this sector, it was relatively easy to target two lighting products in particular: linear fluorescents and exit signs. Before EPCAct standards were incorporated in November 1995, the 40-watt, 4-foot fluorescent T12 tubes with standard phosphors, dominated lighting sources in the commercial sector. Now more efficient alternatives—34-watt T12s and 32-watt T8s—serve the same lighting function and provide the same aesthetic appeal with significantly less energy consumption. Exit signs—used 24 hours per day, seven days a week—were formerly almost exclusively based on incandescent technologies. Now LED-based technologies are widely used in the efficient Exit sign market, while still serving the same function. Both 4-foot fluorescent

fixtures and exit signs have little variation in style, and so were easily replaceable. We believe that there is a need to look for similar opportunities in the residential market.

Segmenting by product type incorporates elements of the basis of fixture design, high-use areas of the home, high-use fixture types, and consumer preferences. We want to emphasize that in choosing a product-based segment scheme, we **do not ignore the importance of understanding the fixture market from these other perspectives**. In fact, this information will play a large role in creating appropriate implementation strategies.

#### 4.4.1 Consumer Motivation

The consumer is the one who actually uses lighting products. Understanding what consumers want and need is therefore paramount. When selecting and purchasing lamps and fixtures, consumers first consider the lighting application or intended use for the lighting source, and focus their attention on a particular type of lighting (e.g., ceiling, table lamp, wall sconce). As consumers focus on the selection of a particular product that fulfills that function, style or aesthetics is the most important factor in the purchase decision for indoor lamps and fixtures. For outdoor lighting, functional issues such as safety, security, and durability are most important, and aesthetics are secondary.<sup>6</sup> Other factors such as energy savings potential, safety, price, availability, and long life are secondary considerations. These factors have consumer appeal and may factor into consumer choice, but by themselves do not drive fixture purchases.

#### 4.4.2 Basis of Fixture Design

When thinking about our product segmentation scheme, we wanted to consider how products match consumers' buying motivation. Since style or aesthetics is the primary purchasing factor for almost all fixture types, we decided to look at fixtures from this perspective and categorize them according to the basis of their design.

**Style-based** categories of lamps and fixtures are characterized by a wide selection of models, with various housing designs, colors, and options (such as ceiling, table lamps etc.). These types of lighting are often an integral part of room décor. Product selections tend to be driven by fashion and decorating trends.

**Functional** lighting categories have little variation from one model to the next. They are installed primarily to serve the purpose of illuminating the room and include products such as recessed cans, track and linear fluorescent.

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<sup>6</sup> Opinion Dynamics Corporation and Regional Economic Research. *Baseline Study of the Northeastern Residential Lighting Market*. June 3, 1998. And *Baseline Study of the New Jersey Residential Lighting Market*. November 1999. Northeast Energy Efficiency Partnerships.

**Combination** lighting categories have some aesthetic appeal, but have little variation in style design (i.e., torchieres) or are installed primarily to serve a functional purpose (safety, security).

Many of those in the energy efficiency community, including some CEE members, base their lighting program efforts on the goal of promoting the availability of a wider range of efficient lighting products in a wider range of *styles*, or with more *aesthetic* appeal. In other words, as a long term goal, they want efficient lighting products to be available in *all of the product types that consumers are seeking*. Ideally, this strategy places efficient products in head-to-head competition with less efficient alternatives, increasing their visibility and availability. However, due to the vast selection of fixture types and styles within the residential lighting fixture market, this approach is ambitious, and assumes there is manufacturer, retailer, and specifier support for such an initiative, as well as consumer awareness and demand for the products.

An alternative strategy for promoting energy efficient lighting is to focus on promoting products in categories with little aesthetic variation or where the style or aesthetics of the lighting housing are not the primary reasons the fixture is being purchased or installed—in other words, focusing on the *functionality* of the light.

Table 1 summarizes common residential lamp and fixture styles according to the basis of their design.

**Table 1: Basis of Fixture Design**

Style	Function	Combination
Table lamps	Recessed	Torchieres
Task/Desk lamps	Track lighting	Porch lighting (Outdoor attached)
Floor lamps	Linear fluorescent	Outdoor post-mount
Wall sconces	Bathroom fans	Outdoor walkway
Suspended ceiling	Under-counter	Ceiling fans with lights
Attached ceiling	Outdoor floods	

#### 4.5. Product Selection Criteria

In selecting the list of most promising product segments, we considered a number of issues, including:

*Basis of fixture design:* To be seen above the “noise” of alternatives, CFL fixtures must be able to compete head-to-head. Fixture types with little aesthetic variation are the most likely to meet this criterion.

*High hours of operation:* Is this fixture turned on/off frequently? Is it used for several continuous hours per day?

*High-volume sales potential:* The energy saving potential, and hence the market transformation potential, are highest with fixtures that consumers buy most frequently.

*Appropriate use of CFL technology:* Is it cost-effective to use a CFL in this application? Will CFL lamps fit in the housing? Will CFL performance be affected by this product? Will controls degrade the performance of CFLs?

*Emerging technologies:* It may be possible that in some residential lighting applications, there are other technologies that hold significant promise for energy savings, even if they are not necessarily based on CFL technology.

*Consumer perspective:* Varies by technology. Considerations include: How will consumer preferences for light color and light quality impact their acceptance of the product?, Is dimmable capability necessary?, Will the fixture be used with controls?, etc.

#### **4.6. Primary Market Segments**

We identified six market segments that we believe hold promising potential for energy savings and presented them during the June 6, 2000 CEE Program Committee Meeting. At the meeting, the Lighting Committee examined each segment and after careful consideration, narrowed the focus to two areas: ceiling fans and outdoor lighting (all types). Selection of these segments does not mean that the Committee believes the best or only savings potential exists there; rather the choice is a function of limited resources and levels of program and research efforts already being expended in the other areas. Briefly, the Committee's assessment of each segment is as follows:

**Recessed lighting**—While more information is desired by the Committee in the areas of potential energy savings and how recessed cans are being specified, recessed lighting is already the subject of consideration by many in the efficiency community. The Committee felt that efforts to promote recessed lighting are currently in process and not in need of further market assessment at this time. The Pacific Northwest National Laboratory (PNNL) is currently creating a specification to be used in a technology procurement program and many Committee members intend to support the introduction of these products through their local programming.

**Torchieres**—Several manufacturers have CFL torchieres available and most of the ENERGY STAR-qualifying portable fixtures are torchieres. Many utilities currently include torchieres as a distinct part of their lighting programs. Many have conducted successful halogen torchiere turn-in programs and promotions. The Committee is satisfied with existing strategies for promoting the technology.

**Portable task/desk lighting**—This represents a small portion (about 2%) of residential lighting energy consumption and the light quality from CFLs may not match consumer preferences for reading or task lighting (i.e., color, flickering, fears about interference with electronic equipment in close proximity, delay in reaching full light output.) The Committee also concluded that the product is too different from the hard-wired fixture markets, where other program efforts are currently being focused.

**LEDs**—This is an emerging technology that holds great potential. The technology is widely used in exit signs, and recent developments have made LEDs available in a broader range of colors. This means the technology may have broader applications in the future, including uses such as outdoor (footpath) lighting, under-counter lighting, night lights, decorative/holiday lighting, etc. There are no white LED-based fixtures that are currently available for the residential market. LEDs offer the advantages of very long life, low maintenance needs, durability, and cool operating temperatures. More technical research must be conducted and more products must be developed before the technology will impact the residential market. The Committee believes that LEDs is a technology worthy of monitoring, but its efforts are best focused on products, rather than R&D at this time.

**Ceiling Fans**—Ceiling fan sales are as high as 15 to 19 million units per year, and can be used in many areas of the home, including bedrooms, living rooms, rooms with high ceilings, porches, etc. They have somewhat limited style variations, and many models incorporate lighting. During the CEE Committee Meeting in June 2000, the Natural Resources Defense Council also presented their findings on preliminary research into the energy efficiency potential for ceiling fans, revealing that ceiling fan energy consumption may be reduced by up to 60%. The Lighting Committee was interested in pursuing research into the lighting component of ceiling fans to determine how lighting is used in ceiling fans and explore energy saving opportunities.

**Outdoor Lighting**—ENERGY STAR outdoor lighting products are currently available, but there still appears to be significant potential for additional energy savings within this segment. Outdoor lighting is used by two-thirds of U.S. homes (likely to be much higher in single family homes) and the long operating hours of outdoor lighting make it one of the highest energy using lighting sources in homes. There is a limited range of styles that are likely to satisfy consumer aesthetics. While our original recommendation was to focus research efforts on all outdoor lighting except flood lighting with controls, the Committee requested that we expand the focus of research to all types of outdoor lighting.

## 5. Phase Two: Segmentation Characterization and Intervention Strategies

As identified by the CEE Lighting Committee, in Phase Two of the research, we focused our attention on creating a market assessment of two categories of residential lighting products: ceiling fans and all categories of outdoor lighting. Under the direction of CEE, we did not focus on intervention strategies for these two segments, but instead devoted most of our resources to the task of assessing each market. The nature of this phase of the research was largely exploratory. Our goal was to create a preliminary market characterization, including product descriptions and outlines of the major distribution channels from manufacturers to end-users. Understanding the markets from these perspectives will help to identify appropriate intervention strategies and any other research needs.

In the course of this research, we approached some manufacturers to better understand how product lines are developed and how distribution channels function. While some manufacturers were forthcoming and interested in our research, others we approached were extremely reluctant to discuss the ceiling fan market, being concerned about divulging proprietary information (despite credentials from CEE).

Manufacturers routinely attend trade shows to showcase product lines, make industry contacts, get design ideas, inspect competitor lines, and get customer feedback. We believe these trade shows provide a valuable opportunity to better understand product lines, new technologies, and distribution channels. These trade shows may also be good forums for the efficiency community to make contacts with manufacturer representatives in a more informal setting. We believe CEE and/or its members should make a point of attending these trade shows in the future, with a broad research agenda in mind. These trade shows include:

- Lighting show in Dallas (held twice a year)
- Lightfair (an architectural and trade show)
- Hardware show in Chicago (held in the summer)
- American Lighting Association Conference
- High Point (a home furnishings show)
- National Association of Wholesalers (does occasional lighting shows)

The remainder of the report describes ceiling fans and outdoor lighting separately and then summarizes distribution functions and consumer product acquisition functions common to both.

## 6. Ceiling Fans

### 6.1. Product Description

A ceiling fan is a suspended ceiling fixture that incorporates a fan with “paddles” or blades, and often includes lighting capabilities. Ceiling fans are primarily used to reduce cooling needs and most fans can operate in “reverse” to provide heating benefits too. They are used in many areas of the home, including living rooms, dining rooms, kitchens, bedrooms, rooms with high ceilings, and porches<sup>7</sup>.

During the 1970’s, ceiling fans regained popularity and sales remain strong, with 19 million sold in the U.S. last year.<sup>8</sup> Sales in the South and Southern East Coast are the strongest, presumably due to the higher temperature and humidity levels that are typical of the regions. Many consumers consider ceiling fans to be a decorating accessory, and their aesthetic value is an important part of their use. While this holds true, there is a somewhat limited selection of style variations among ceiling fans, with the vast majority of ceiling fans being based on Victorian-style design.

Price ranges for ceiling fans vary widely, with models at the low end available for under \$20 and those at the high end priced as high as \$1,000. Fan price is generally associated with fan quality, with higher-end models offering better construction and performance, as well as wider ranges of design. While many ceiling fans are sold in the form of an integrated package that includes the fan blade, motor, and lighting kit, some products are marketed as modular, giving the consumer a choice of motor output, blade size and style, and lighting kit. Descriptions and price ranges of varying ceiling fan grades summarized in Table 2 include:

**High performance grade**—These fans are top-of-the-line and the solid housing construction is designed to be durable and functional. These fans generate the best airflow due to better motor and blade design and blade pitch. Prices typically range from \$189 to \$1,000 and fans are designed with varied aesthetic appeal.

**Mid-grade**—These fans use lower quality motors and other components, but the fans are still durable and can provide functional airflow. Prices typically range from \$100 to \$299.

**Low-grade**—These fans are designed to be low cost and the motor and components are low quality. Blade materials may warp, the blades may wobble, motors may be noisy, and the fans do not provide adequate airflow. Fan performance is compromised for the price savings. This category of ceiling fans is sometimes popular with extremely price-conscious consumers and contractors who want to minimize materials costs in construction. Prices typically range from \$39 to \$99.

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<sup>7</sup> Ceiling fans suitable for outdoor use should be U.L.-listed for wet and damp locations.

<sup>8</sup> *Appliance Magazine*, Statistical Review. Dana Chase Publications.

Consumers who buy or receive the lowest grade fans are typically disappointed with the product, and encounter problems, such as wobbling, noisy motors, and poor airflow. One industry expert described lower-priced ceiling fans as “first-generation” fans, making reference to first-time buyers who initially are drawn to the least expensive models, but soon upgrade their fans to higher-end products. The average lifetime of a ceiling fan is 13 years.<sup>9</sup>

**Table 2: Ceiling Fan Grades and Sources**

Grade	Price range	Where they are sold.
High	\$189 to \$1,000	Lighting specialty, distributors, catalogs, DIY
Mid	\$100 to \$299	DIY, hardware, department stores
Low	\$39 to \$99	DIY/hardware, discount department stores

## 6.2. Energy-Savings Potential

The National Resources Defense Council (NRDC) estimates that the average energy consumption per ceiling fan is 346 kWh/year. With an average of 1.5 ceiling fans per household, that is the equivalent energy consumption of a new efficient refrigerator!<sup>10</sup> NRDC estimates that energy consumption of ceiling fans can be reduced by more than 60% through improvements in blade design and more efficient motors and lighting. From an energy using perspective, ceiling fans are a complex product, with four basic components that contribute to energy consumption: lighting, motors, blade design, and controls. With the exception of lighting, which is discussed in Section 6.3, the basic fan components are discussed here.

**Fan Motors**—The vast majority of fan motors are direct drive, and the remainder are induction. Very low efficiencies are associated with both technologies (as low as 5% to 20%), but the fact that they consume very little power (5 to 115 watts depending on fan speed, as well as blade design and configuration),<sup>11</sup> contributes to the fact that manufacturers have focused little attention on improving their efficiencies. There is also evidence that few efficiency gains can be achieved with either the direct drive or induction motors, as both are based on mature technologies. Most ceiling fans are manufactured in Asia and component parts, including motors, are sub-contracted by the manufacturer. A couple of manufacturers (Emerson, Regency) utilize their own motor designs and a small number have domestic production.

<sup>9</sup> *Appliance Magazine*, 22<sup>nd</sup> Portrait of U.S. Appliance Industry. Dana Chase Publications. September 1999.

<sup>10</sup> Horowitz, N. (Natural Resources Defense Council) and Calwell, C. (Ecos Consulting) *Residential Ceiling Fans: A Look at Their Energy Use and Opportunities for Energy Savings*. Draft. June, 2000.

<sup>11</sup> Parker, D.; Callahan, M.; Sonne J. (Florida Solar Energy Center) and Su, G. (AeroVironment). *Development of a High Efficiency Ceiling Fan: The Gossamer Wind*. FSEC-CR-1059-99. <http://alpha.fsec.ucf.edu/~bdac/pubs/CR1059/CR1059.html>.

**Fan blades**—Ceiling fans typically incorporate 3 to 5 fan blades with a circular diameter ranging between 27 and 60 inches. The diameter of the fan blade generally is related to room size and therefore cooling needs. A number of factors, including the size, shape, and number of blades, plus blade pitch contribute to airflow effectiveness and energy efficiency. One study conducted by the Florida Solar Energy Center (FSEC) found airflow efficiency of a prototype ceiling fan could be improved by as much as 111% with improved blade design.<sup>12</sup>

**Controls**—Controls allow users to manipulate fan speed and light intensity. Wall controls, pull chains hanging from the fixture, and hand-held remote controls are various ways that blade speed and lights can be controlled. Lighting is usually controlled separately from the fan. Most ceiling fans can be run at three speeds and in reverse to alternate cooling and heating benefits.

Timers and temperature sensors that turn fans on once the room reaches a specified temperature are available to automate usage. To the extent that these controls can reduce the use of fans in unoccupied rooms, they are likely to provide energy savings. However, if used to cycle fans on and off in unoccupied rooms, their effectiveness is questionable. Ceiling fans provide cooling benefits based on the concept of creating a “wind chill” that alters room occupants’ perception of heat, but not necessarily the actual temperature. Therefore, leaving ceiling fans operating in an unoccupied room does not provide any air temperature improvement for future occupants.

### 6.3. Lighting Configurations

Ceiling fans are available in three basic lighting configurations: 1) with fan/light combinations or integrated lighting, 2) without lighting, and 3) without lighting, but capable of accommodating an add-on lighting kit. Approximately half of ceiling fans sold in the U.S. have lighting, and another 45% of ceiling fans are lighting adaptable.<sup>13</sup> There is no data available to indicate the percentage of lighting adaptable fans that have lighting, but we assume it is a high percentage.

**Fan/Light Combinations and Integrated Lighting:** This category of ceiling fans either incorporates lighting as a permanent, integrated part of the fan fixture or includes lighting in the box with the other ceiling fan components. Fan/light combinations are probably more popular than integrated designs, but this varies by manufacturer. In more modern or contemporary fans, lighting is an integral part of the design, and so more likely to be permanently integrated. Emerson, a manufacturer with a varied selection of fan designs, estimates that about 15% to 20% of their ceiling fan products have permanent, integrated lighting.

**Without lighting:** About 5% of ceiling fans are designed never to have lighting capabilities, and are solely used for their ventilation function. Whereas fans that are designed to accommodate add-on lighting kits have switch cover designs that allow for lighting retrofits, these models do not. At the higher end of the market, ceiling fans designed to be used without lighting have die-

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<sup>12</sup> Parker, D.; Callahan, M.; Sonne J. (Florida Solar Energy Center) and Su, G. (AeroVironment). *Development of a High Efficiency Ceiling Fan: The Gossamer Wind*. FSEC-CR-1059-99. <http://alpha.fsec.ucf.edu/~bdac/pubs/CR1059/CR1059.html>.

<sup>13</sup> Personal communication with Mark Jeffrey, Emerson Electric. St. Louis, MO. July 2000.

cast fan housing and switch covers, making it virtually impossible to drill a hole to accommodate an add-on lighting kit.

Ceiling fans are usually centrally located in a room to achieve maximum airflow benefits, and often displace a lighting fixture that has been or would be in that place. However, a centrally located ceiling fan is not necessarily optimally situated for occupant lighting use, as tasks that require lighting are usually situated throughout the room. A greater emphasis on lighting design in lighting specifications (particularly in higher-end markets) is creating a trend to think of ceiling fans as an appliance, not a lighting fixture. Omitting lights with the ceiling fan allows for a lighting design that might include the installation of perimeter ceiling fixtures or task-specific lamps throughout a room to better coincide with how light will be used.<sup>14</sup> The fact remains, however, that most ceiling fans sold still incorporate lighting.

**Add-on lighting kit:** Most ceiling fan manufacturers have product lines that allow consumers to choose the elements of their ceiling fan, including blade color, blade material, and lighting kit at the time of purchase (all parts usually self-branded). Whether or not lighting kits are compatible from one manufacturer to another is the subject of some controversy, and is driven by marketing concerns more than technical limitations. Switch plate covers provide the necessary link between fan wiring and a lighting kit and typically include a hole or perforation to allow for a lighting kit to be easily attached. Across most manufacturers, switch plate designs are fairly universal, which means that consumers can customize their ceiling fan with a wide selection of lighting options according to personal tastes. Most ceiling fan manufacturers have self-branded lines of lighting accessories that range from fittings to glass covers to combination fittings and covers. Add-on lighting kits manufactured by third-party brands also exist. Lighting kits are available in prices that range from \$8 to \$200, with a wide variety of fittings and glass covers. A visit to a Home Depot store, which stocks only Hampton Bay and Hunter ceiling fans, reveals an extensive selection of add-on lighting components from Angelo. A sales person readily demonstrated how we might incorporate one of these lighting kits with any fan in our home.

While a universal switch plate design is common in the middle and low end of the ceiling fan market, at the higher end, some manufacturers limit third-party or cross-brand sales of lighting kits for their fans by creating limitations in fan design. At the higher end of the market, some manufacturers create fan designs that have unique lighting kit add-ons, which are unlikely to be matched by appealing alternatives among third-party or cross-brand product lines. Casablanca, for example, uses customized finishes on their fans that make them distinctive from competing brands. Therefore, a brushed brass finish on a Casablanca fan is unlikely to match a brushed brass lighting kit from any other supplier. Customers who have made the investment in such a high-quality fan are usually unwilling to accept an aesthetic compromise of mismatched finishes.

Another way manufacturers ensure that only their brand of lighting kits are used with their ceiling fans is by offering product guarantees that are voided if non-brand lighting add-on kits are used.

Ceiling fan lighting typically uses multiple incandescent bulbs (2 to 4 bulbs, 40 to 100 watts each, often candelabra design) or halogen bulbs. UL safety guidelines set a maximum lamp

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<sup>14</sup> Personal communication with Martin Shepard, Minka Aire, July 2000.

power of 60 watts for multi-lamp configurations and 150 watts for single lamp designs, but manufacturers may use higher quality wiring and sockets to receive higher UL ratings.<sup>15</sup> The NRDC estimates that as much as 60% of the energy usage from ceiling fans is from lighting. The remaining 40% of energy is consumed by the motor, which draws from 5 to 115 watts of power,<sup>16</sup> depending on fan speed, blade design and configuration, and motor efficiency. Table 3 provides a summary of lighting fan options for ceiling fans from NRDC that assumes four hours of lighting use per day and annualized bulb costs.

**Table 3: A Comparison of Ceiling Fan Lighting Options**

<b>Bulb Type &amp; Quantity</b>	<b>Total Power Use (watts)</b>	<b>Total Light Output (lumens)</b>	<b>Efficiency<sup>17</sup> (lumens/watt)</b>	<b>Bulb Life (hours)</b>	<b>kWh/Year</b>	<b>Annual Cost (bulbs + electricity)</b>
60 watt incandescent (4)	240	3460	14.4	1,000	350	\$30.95
60 watt ceiling fan incandescent (4)	240	2600	10.8	1,500	350	\$31.93
150 watt halogen (1)	150	2800	18.7	2,000	219	\$21.52
20 watt CFL (4)	80	4080	51.0	10,000	117	\$16.35
60 watt 2D or 2C (1)	60	4000	66.7	12,000	88	\$8.71

Source: Horowitz, N. (Natural Resources Defense Council) and Calwell, C. (Ecos Consulting) *Residential Ceiling Fans: A Look at Their Energy Use and Opportunities for Energy Savings*. Draft. June, 2000.

Currently there are virtually no CFL-based ceiling fans available in the residential market. As previously mentioned, the Florida Solar Energy Center energy-saving ceiling fan prototype with lighting did incorporate a 20-watt circline lamp, but this product is not currently available in the marketplace. The Modern Fan Company, based in Ashland, Oregon has recently developed two CFL-based ceiling fans that are being marketed to commercial contract markets, with deliveries expected to begin in the Summer of 2000. The fans are being marketed based on the energy-saving potential and convenience of fewer bulb change-outs with CFL technology.<sup>18</sup> Emerson has considered a CFL design for its ceiling fans, but has not put any products into production.<sup>19</sup>

In several respects, CFLs have a number of attributes that make them an attractive option for ceiling fan lighting. For example, there is a large market for ceiling fans in the U.S., with 15 million to 19 million units sold annually. Like fans, they also are used for several continuous hours each day and provide consumers with sometimes the only source of ambient lighting for a

<sup>15</sup> Horowitz and Calwell, June, 2000.

<sup>16</sup> Parker, D.; Callahan, M.; Sonne J. (Florida Solar Energy Center) and Su, G. (AeroVironment). *Development of a High Efficiency Ceiling Fan: The Gossamer Wind*. FSEC-CR-1059-99. <http://alpha.fsec.ucf.edu/~bdac/pubs/CR1059/CR1059.html>.

<sup>17</sup> Note that linear halogen lamp efficiencies can be 30 to 50% lower than the "catalog" values shown here if the lamps are imported from Asia and made by the same processes used to produce typical 300 watt halogen lamps for torchieres.

<sup>18</sup> Personal communication with Ron Rezek and Dave Ellis of the Modern Fan Company, June 2000.

<sup>19</sup> Personal communication with Mark Jeffrey, Emerson Electric. St. Louis, MO. July 2000.

room. The fact that CFLs have a long life would contribute to the energy and bill savings potential of ceiling fans. In addition, the long CFL life means fewer bulb change-outs would be required. From a consumer perspective, these benefits might be very attractive—ceiling fans are often installed on high ceilings, and utilize multiple bulbs. This means up to ten fewer trips up a potentially unstable step-stool or ladder to switch an old bulb for homeowners. Furthermore, introducing large numbers of consumers to an energy-saving CFL, particularly when the benefits of energy savings and convenience are tied to its use in a product, may create spillover demand for other fixtures.

Manufacturers agree that part of the reason no CFL-using ceiling fans exist for the residential market is that *there is virtually no demand* for them. Technically, manufacturers we talked to say a CFL product is possible, but the fact that few have even considered specifying CFLs also means that barriers have never been explored. Likely considerations include the need to limit a strobe effect with moving blades (a factor common to all light sources, not just CFLs), the need to have dimmable capabilities on some products, and the need for adequate light output, particularly because ceiling fans are often installed on high ceilings. The use of electronic controls may also cause degradation of the CFL bulb. The size of CFLs may be too large to fit into some popular lighting kit styles, particularly cans or cups available on many traditional styles. Designs that use a globe or dish style cover may be more accommodating for CFL bulb configurations.

#### **6.4. ENERGY STAR Specifications for Ceiling Fans**

The ventilation component in ceiling fans creates crossover with another, non-lighting product category—the fan motor—that is not currently covered by ENERGY STAR standards. This means that even if a ceiling fan has an energy-saving CFL lighting kit, the product will not be able to receive an ENERGY STAR label without ENERGY STAR-compliant motors. NRDC is currently sponsoring research into the energy savings potential of ceiling fans and is supporting efforts to develop an ENERGY STAR specification for ceiling fans.

There currently is no industry oversight for ceiling fan specifications other than U.L. recommendations for safety. This makes comparisons of fans a difficult task, because there is no consistent rating for ceiling fan effectiveness and energy consumption.

Just how specifications should be structured creates another interesting dilemma. The energy efficiency of ceiling fans can be defined by the total energy usage (kWh) of the fan, but this is not necessarily a measure of fan effectiveness. The effectiveness (how much airflow is created) is directly related to the fan's ability to improve consumer comfort, and therefore related to ancillary energy demands consumers have for cooling or heating needs. The Florida Solar Energy Center (FSEC) recognized that the performance of fans impacts energy usage while not necessarily improving comfort levels or reducing overall cooling needs. It created a design competition in 1996 that resulted in a ceiling fan (blade) design that provided improved airflow and a reduction in energy consumption. The FSEC's prototype fan with lighting also incorporated a 20 watt circline lamp. King of Fans, a manufacturer, has purchased the rights to

the fan design and expects to have samples available to retailers in the Fall of 2000, with product available in early 2001.<sup>20</sup>

As mentioned, there are a number of energy saving opportunities from ceiling fans, including lighting, the motor, blade design, and controls. Due to the fact that many consumers are buying this product for its cooling or heating properties—functions that consumers directly relate to energy consumption—marketing ceiling fans for their energy savings capabilities may have more consumer appeal than a lighting product alone. Consumers can reduce cooling or heating costs *and* lighting costs with an efficient product. The ENERGY STAR label would be an important part in labeling this benefit for consumers.

### **6.5. Timing of Ceiling Fan Installations**

We have no definitive information on the number of ceiling fans installed in new construction versus home improvement activities. However, as will be presented in Table 12, an estimated 72% of hardwired fixture sales occur in the home improvement market. Therefore we conclude that consumers purchase the majority of ceiling fans as Do-It-Yourself projects for home improvement activities.

### **6.6. Market Characterization**

#### **6.6.1 Manufacturers**

As with other types of residential fixtures, creating an accurate census of the number of residential ceiling fan manufacturers is a difficult task. The U.S. Manufacturing Census does not provide detailed breakdowns of ceiling fan manufacturers.<sup>21</sup> One source lists over 80 manufacturers of ceiling fans in the United States,<sup>22</sup> although there are only a handful of manufacturers that have significant sales in this market. These include Casablanca, Concord, Craftmade, Emerson, Encon, Hampton Bay, Hunter, Litex, Minka Aire, Quorum, and Regency.

The large majority of component manufacturing and assembling of ceiling fixtures occurs in Asia, with Taiwan, China, and Indonesia the major producers. It is not uncommon for a single factory to assemble components for several different companies or brands.

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<sup>20</sup> Horowitz and Calwell, June, 2000.

<sup>21</sup> While the term “manufacturer” could be strictly defined as a company that has a plant or facility that is used to produce lighting fixtures, the manufacture of many lighting fixtures is subcontracted to factories where they are assembled from component parts that are manufactured by various component manufacturers. Unless otherwise noted in this report, we use the term “manufacturer” to denote the company that specifies, coordinates, markets, or otherwise serves as the brand presence for the final lighting product, even if the company lacks actual factories for production.

<sup>22</sup> *Home Lighting & Accessories* Magazine Internet database of manufacturers.  
[http://www.homelighting.com/mfr\\_listprods.cfm](http://www.homelighting.com/mfr_listprods.cfm).

Ceiling fan manufacturers focus on contract markets (non-residential) or establish relationships with dealers or mass marketers. Few sell directly to consumers, due to the fact that limited sales and marketing resources make it more efficient to process bulk sales, thereby avoiding the need to display products and respond to end-user questions and needs. We identify two distinct avenues through which ceiling fans are distributed to residential markets: lighting showrooms and mass marketers. Lighting showrooms serve specifiers (contractors, builders, designers, etc.) and consumers at the high end of the market. Mass marketers such as Home Depot, Lowe's, and WalMart directly sell ceiling fans to the consumer, although the home improvement stores also serve the contractor and builder markets. Table 4 summarizes the target markets for the largest ceiling fan manufacturers.

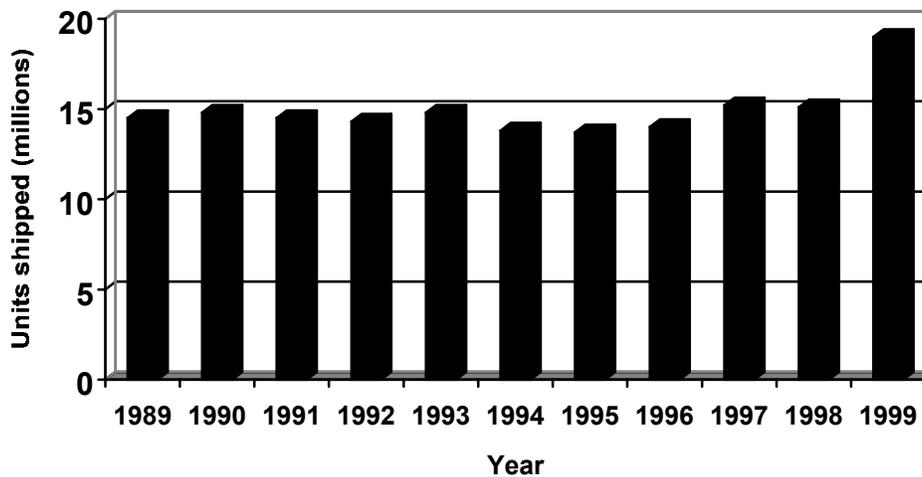
**Table 4: Target Markets for Top Ceiling Fan Manufacturers**

<b>Manufacturer</b>	<b>Product type sold</b>	<b>Primary channel</b>
Casablanca	Mid-high	Showrooms
Concord	Mid-high	Showrooms
Craftmade	Mid-high	Showrooms
Emerson	Mid-high	Showrooms
Encon	Low-mid	Mass marketers
Hampton Bay	Low-mid	Home Depot only
Hunter	Low-mid-high	Mass marketers, showrooms
Litex	Low-mid	Mass marketers
Minka Aire	Mid-high	Showrooms
Quorum	Mid-high	Showrooms
Regency	Mid-high	Showrooms

### 6.6.2 Shipments

As previously stated, there were an estimated 19 million ceiling fans sold in the U.S. in 1999. As Figure 1 shows, this represents a significant jump of 26% in sales from previous years, particularly given the fact that many in the industry describe the ceiling fan market as mature, where 1% growth rates are more the norm. From 1989 to 1998, the growth rate was 4%. Industry experts we spoke with were unable to explain why sales would increase so dramatically in a single year.

**Figure 1: Ceiling Fan Shipments**



Source: *Appliance Magazine*, Annual Statistical Review.

### 6.6.3 Distribution Channels

The vast majority of ceiling fans in the U.S. are sold through big box retailers such as Home Depot or Lowe's. Industry experts estimate that as much as 80% of sales occur through home improvement centers, franchise hardware stores, department stores, and discount department stores. A handful of manufacturers are responsible for the majority of ceiling fans sold at mass marketers; they include: Hampton Bay, Hunter, Litex, and Encon.

The largest source of ceiling fan sales in the U.S. are home improvement stores, accountable for as much as 45% to 60% of total sales.<sup>23</sup> Home Depot<sup>24</sup>, the largest of the home improvement centers is also the largest single source of ceiling fans in the country, with an estimated 4.5 million units sold annually, or 24% of total ceiling fan sales. Of these, an estimated 70 to 80%

<sup>23</sup> Personal communication with various ceiling fan manufacturers and industry experts, June and July 2000.

<sup>24</sup> More detailed information about Home Depot and other retailers can be found in Section 7.

are Hampton Bay brand and the remainder are Hunter. Hampton Bay is Home Depot's in-house ceiling fan brand, and is sourced from a number of manufacturers (factories located mainly in Asia), some of which have their own brand of ceiling fans available in other residential markets.

As Figure 2 shows, discount department stores such as WalMart and Target are estimated to be responsible for as much as 25% of ceiling fan sales. Other large department stores such as Sears account for 9% of sales directly to consumers. These stores carry fans from the manufacturers listed above, and some, like Home Depot, appear to have in-house brands too.

At the high end of the market are specialty lighting stores and lighting showrooms, which are estimated to be responsible for as much as 15% of ceiling fan sales. Wholesale distributors that cater to specifier markets often have lighting showrooms open to the public. In other cases, the showrooms themselves serve both the specifier and high-end consumer market. The largest manufacturers that serve this market include: Casablanca<sup>25</sup>, Emerson, Quorum, Craftmade, Minka Aire, Hunter<sup>26</sup>, Regency, and Concord.<sup>27</sup> The specialty lighting market is also the avenue that smaller, niche ceiling fan manufacturers use to market their products.

As Figure 2 shows, large manufacturers (or their representatives) of ceiling fans distribute products directly to large retailers. Franchise hardware stores such as Ace and True Value are independently owned, but participate with other member stores in cooperative buying agreements with manufacturers through franchise cooperatives. Lighting or electrical wholesalers, distributors, and independent sales representatives distribute ceiling fans through various channels, including lighting specialty stores, independent hardware stores and small retailers. These sources, as well as home improvement stores and some hardware stores, also supply contractors with ceiling fans.

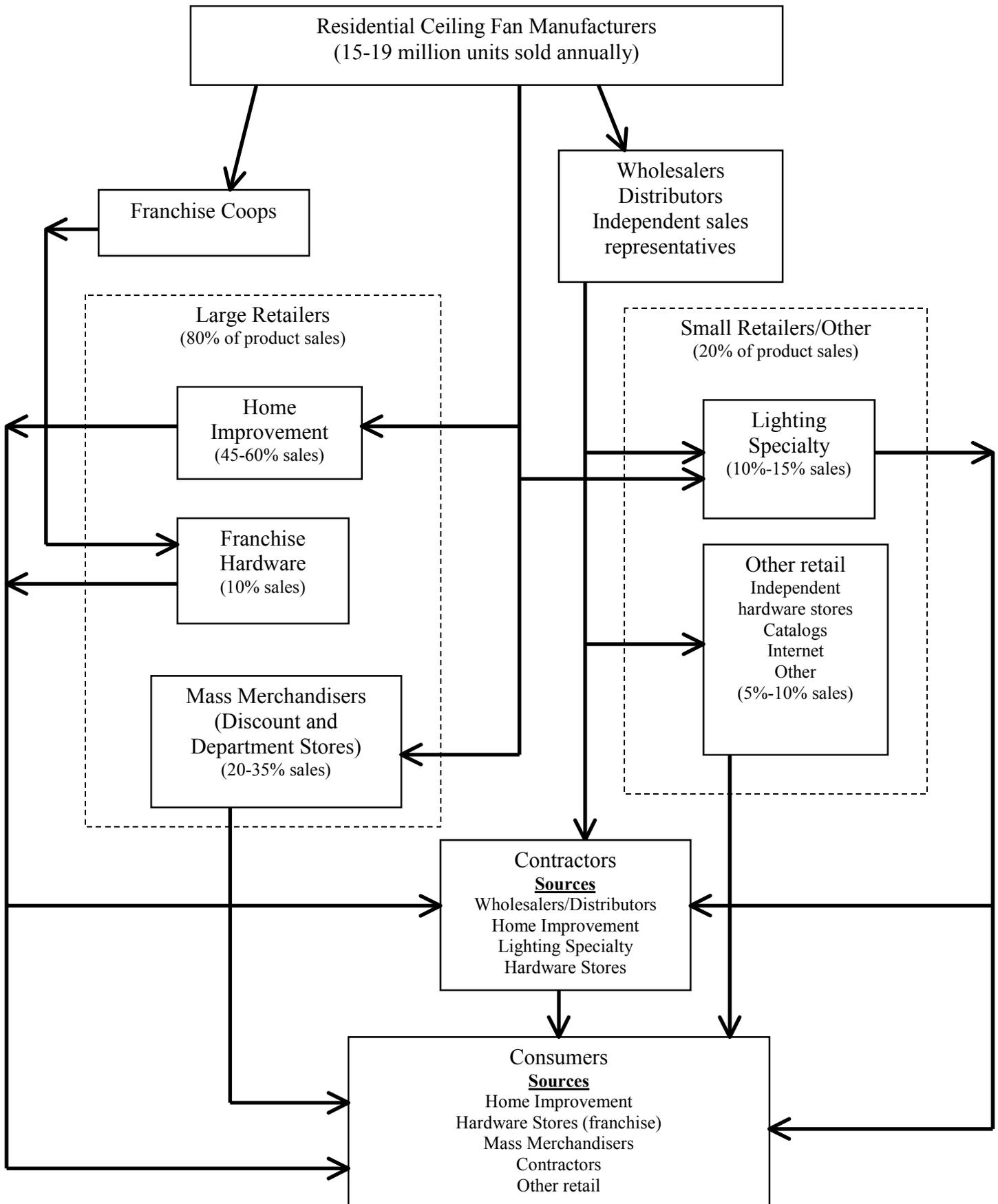
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<sup>25</sup> Casablanca was purchased by GE Capital and later sold to Hunter in 1995.

<sup>26</sup> Hunter fans is unique among manufacturers in that it serves both the high-end specialty market, while also supplying many mass marketers, including Home Depot, Sears, Kmart, True Value, and WalMart under the same brand name. Other manufacturers serve either the specialty lighting market or the mass markets.

<sup>27</sup> Personal communication with various ceiling fan manufacturers and industry experts, June and July 2000.

**Figure 2: Distribution Flows of Ceiling Fans**



## **6.7. Summary of Findings**

In summary, we believe there is significant opportunity to improve the efficiency of lighting in ceiling fans. Ceiling fans with lights account for as much as 9% to 12% of all residential fixtures sold annually. The vast majority of ceiling fans are designed to provide lighting or are capable of having lighting. Despite the fact that as much as 60% of the energy used by ceiling fans is from lighting; there is currently no CFL based ceiling fan lighting available in the residential market. CFLs are likely to be compatible with many dome and dish lighting configurations, but not can or cup designs. Provided that CFLs can produce sufficient light output from high ceiling installations and some models are capable of dimming; CFLs are likely to satisfy consumer expectations for ceiling fan lighting.

Due to the fact that ceiling fans are purchased mainly for their ability to improve the comfort of a room, consumers may be more willing to consider the energy-saving aspects of CFLs as a related fan feature than they would for other types of fixtures. Because the energy saving connection is stronger with ceiling fans than for other fixtures, the ENERGY STAR label would be an important part of identifying this benefit for consumers.

Most ceiling fans have little style variation among models, with a Victorian-style design dominating product selections.

There is a large number of ceiling fan manufacturers, but most cater to niche markets. The vast majority of ceiling fans is sold through large retailers, with home improvement centers responsible for the bulk of sales. We recommend a program implementation strategy that focuses on the major outlets for ceiling fan sales, along with the manufacturers that supply these outlets.

Achieving an ENERGY STAR rating for ceiling fans will be a complex process, that must address multiple energy-using components of fans, including lighting, motors, blades, and possibly controls. In the absence of an ENERGY STAR rating, we recommend efforts to encourage manufacturers to incorporate CFLs in add-on lighting kits. Both ceiling fan manufacturers and third-party manufacturers produce add-on lighting kits for ceiling fans.

## 7. Outdoor Fixtures

### 7.1. Product Description

Outdoor lighting fixtures are hard-wired, permanent fixtures that provide illumination primarily for safety, security, and aesthetic purposes. The U.S. DOE estimates that two-thirds of U.S. homes use outdoor lighting<sup>28</sup>, with approximately 3 to 4 lights per home.<sup>29</sup> Estimates of outdoor lighting energy consumption range from 10% to 15% of total household usage.<sup>30,31</sup> Buyers of outdoor lighting include more homeowners than renters, due to the fact that there is little incentive for renters to make permanent changes to their residence, and the fact that 66% of U.S. homes are owner-occupied.

In the front of the house, lighting is used for both utilitarian purposes (safety and security) and to make the home more attractive. Lighting in the back of the house is more utilitarian, with the goal primarily to be to illuminate large areas of space or entryways. Landscape lighting is used throughout the property.

Most residential outdoor lighting fixtures use incandescent lights, while some use high-intensity discharge (HID), and a few use CFL technology. Outdoor lighting is usually hard-wired to household wiring and controlled by indoor switches, timers, or photocells.

The long operating hours of outdoor lighting offers CFLs a number of distinct advantages over incandescent lighting sources. First, the long life of CFLs creates significant energy- and bill-savings potential for consumers. Secondly, the long operating life of CFLs reduces maintenance requirements by requiring fewer bulb change-outs. Thirdly, because light output is generally more important than light color in outdoor lighting, consumers are less likely to be concerned about the precise color rendering from an outdoor lighting source, and so may be more accepting of CFLs. When consumers buy outdoor lighting, functional issues such as safety, security, and durability are most important.<sup>32</sup> Finally, the long operating hours of outdoor lighting complement CFL performance; the cost-effectiveness of CFLs is optimized when light is used for several continuous hours each day. Table 5 shows how the lifetime of a CFL degrades with frequent cycling. Based on a 3-hour switching cycle, increasing cycling to 45 minutes decreases CFL life by 50%. A switching cycle of five minutes decreases CFL life to 20%.

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<sup>28</sup> U.S. Department of Energy, Energy Information Administration. *Residential Lighting: Use and Potential Savings*. 1993 Residential Energy Consumption Survey.

<sup>29</sup> Personal communication with various industry experts.

<sup>30</sup> Vorsatz, D., Shown, L., Koomey, J., Moezzi, M., Denver, A., and Atkinson, B. December 1997. *Lighting Market Sourcebook for the U.S.* Berkeley, CA. Lawrence Berkeley National Laboratory. LBNL-39102.

<sup>31</sup> Hescong Mahone Group. *Residential Lighting Baseline: Lighting Efficiency Technology Report*. California Energy Commission. CEC Contract #400-95-012. October 21, 1996.

<sup>32</sup> Opinion Dynamics Corporation and Regional Economic Research. *Baseline Study of the New Jersey Residential Lighting Market*. November 1999.

**Table 5: Impact of Switching Cycle on CFL Lifetime**

Switching cycle (minutes)	Life (% of rated)*
180	100%
60	70%
45	50%
5	20%

\*Ratings based on a 3-hour switching cycle.

Source: E-Source. *Lighting Technology Atlas Series*,  
Volume 1, 1997. Boulder, CO.

There are several technical considerations associated with using CFL lighting in outdoor applications. CFLs must be able to withstand the wide range of environmental conditions that outdoor lighting is typically exposed to, including moisture, heat, and cold. For some decorative designs, the size and appearance of CFLs may create design limitations, particularly in clear-glass lantern designs in which the “candle” of the lantern is an aesthetic feature of the fixture. CFLs may be more appropriate with translucent rather than clear glass designs.

### 7.1.1 Power Sources

Power sources for outdoor lighting include line voltage and low voltage. Line voltage is the traditional house current and operates at 120 volts. Low voltage systems operate under 50 volts, with the most common low-voltage systems operating at 12 volts. Low-voltage systems require a transformer to lower the line voltage. These systems can have higher initial costs, but use less energy and are considered a safer alternative to line voltage systems. The fact that low voltage systems are not subject to electrical code standards and buried line requirements makes installation easier for some Do-It-Yourself homeowners. Low voltage lighting includes some types of landscape or pathway lighting.

## 7.2. Types of Outdoor Lighting

From a functional and style perspective, there are three basic types of outdoor lighting: decorative, security, and landscape lighting. These distinctions are not consistent in the lighting industry; manufacturers and retailers market lighting fixtures in any number of configurations. Also, the categories are not mutually exclusive. For example, both decorative and landscape lighting can serve a security lighting role, some ground-mounted landscape lighting fixtures have decorative elements, and controls are not exclusively limited to flood lighting. However, by categorizing outdoor lighting by functional and style characteristics, we can isolate some of the elements that are important to consider in promoting energy saving alternatives.

The lack of a detailed and comprehensive source of U.S. shipments, imports, and exports of residential outdoor fixtures makes it difficult estimate sales volume by category. Across all categories of residential outdoor lighting, the largest volume of sales probably can be attributed to decorative lighting, followed by security, then landscape lighting.<sup>33</sup> As Table 6 shows, the California Energy Commission estimates that over 10% of all fixtures installed in homes are decorative, just over 1% are security and a similar number are other types of outdoor lighting (presumably landscape).

**Table 6: Energy Using Characteristics of Outdoor Lighting**

	<b>% of all fixtures</b>	<b>% of all watts</b>	<b>Average hours per day</b>	<b>% of all kWh</b>
Outdoor ceiling	1.8%	1.5%	3.10	2.0%
Outdoor wall flood	1.3	3.0	2.06	2.6
Outdoor lantern	8.6	6.7	2.97	8.6
Outdoor wall barn	0.1	0.1	10.55	0.4
Other outdoor	1.0	0.8	5.16	1.7
All outdoor total	12.8	12.1	2.96	15.3

Source: Heschong Mahone Group. *Residential Lighting Baseline: Lighting Efficiency Technology Report*. California Energy Commission. CEC Contract #400-95-012. October 21, 1996.

Other sources offer incomplete data or data not directly comparable. For example, according to the U.S. Census Bureau, U.S. shipments of residential outdoor fixtures in 1998 consisted of 3.2 million fixtures designed for attachment to the house and 13.7 million unattached fixtures for the garden, patio, and yard. No estimates were provided for shipments of custom lighting (lanterns, etc.). Another source of residential outdoor lighting shipments (including imports, domestic production, and exports) from 1993 estimates about 9 to 10 million units of post, yard, and landscape lighting; about 8 million units of wall and ceiling fixtures; and about 2 million units of parabolic aluminum reflector (PAR) holders.<sup>34</sup> Approximately 6% of outdoor fixture shipments in the U.S. are fluorescent; the vast majority are incandescent.<sup>35</sup> It is estimated that about 200,000 to 350,000 Energy Star outdoor fixtures were sold in 1999.<sup>36</sup>

<sup>33</sup> Personal communication with various industry experts.

<sup>34</sup> Vorsatz, D., Shown, L., Koomey, J., Moezzi, M., Denver, A., and Atkinson, B. December 1997. *Lighting Market Sourcebook for the U.S.* Berkeley, CA: Lawrence Berkeley National Laboratory. LBNL-39102.

<sup>35</sup> Opinion Dynamics Corporation and Regional Economic Research. *Baseline Study of the New Jersey Residential Lighting Market*. November 1999. (Based on 1997 U.S. Shipments)

<sup>36</sup> Personal communication with Steve Ryan of the EPA ENERGY STAR program, August 2000.

### 7.2.1 Decorative Lighting

Decorative lighting includes porch lighting (attached wall and ceiling), post-mounted, and some walk-way lighting. This category of outdoor lighting is characterized by having style-based designs; however, due to the fact that consumers primarily buy these types of lighting for safety and security purposes, consumers tend to be less focused on aesthetics than they are for indoor lighting products. While we use the term “decorative” to define this category of outdoor fixtures, there is a limited range of style categories that is likely to satisfy consumer aesthetic demands.

Many decorative lighting fixtures are adapted from various historical and occupational uses. Traditional lantern and coach styles dominate manufacturer catalogs and retail showrooms, but contemporary styles also exist. Lanterns typically share the attributes of having a metal or metal-like finish (brass, copper, nickel, antique, verdigris, etc.) along with varying degrees of window transparencies (ranging from clear to pitted to frosted). At the high end of this market, fixtures are constructed with higher quality materials and a greater diversity of style and finish quality, but many of these fixtures are still rooted in traditional lantern and coach styles.

Some consumers find matching outdoor product lines appealing and seek to install similar housing designs for porch and post-mounted lighting on their property. A recent trend in outdoor lighting is to blend indoor and outdoor lighting styles, so that a lantern used outside the front door is also used within the home in the entryway or foyer, or even other areas of the home.<sup>37</sup>

Incandescent light sources are used in the majority of decorative lighting fixtures. In lantern and coach styles, particularly those with clear window transparencies, candelabra bulbs are a popular choice, presumably for the aesthetic appeal of imitating old-style gas lamps. Some manufacturers explicitly recommend the use of transparent incandescent bulbs for aesthetic appeal of minimizing the bulb silhouette within fixtures of this style. These design considerations based on consumer preferences may prove to be considerable barriers for incorporating CFLs into such fixtures.

At the low end of the decorative lighting market are “jelly jar” fixtures, often available at prices lower than \$10 per fixture. While the design of these fixtures may not be as aesthetically pleasing as other decorative outdoor fixtures, the elongated design makes them an easy fit for CFL bulbs.

We believe that the best opportunity for energy saving lighting exists for decorative lighting due to the relatively limited style variation among models, the low light output demands that consumers have for this style of lighting and the size of this style of fixture is likely to accommodate CFLs. Decorative lighting also likely accounts for a high portion of lighting energy use. One estimate of residential lighting consumption finds 9% of all fixtures are outdoor wall-mounted fixtures and attributes 10.6% of overall lighting usage to them—the highest energy consumption of any single lighting application.<sup>38</sup> While this data does not represent the entire

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<sup>37</sup> Personal communication with Susan Grisham, *Home Lighting and Accessories* magazine, June, 2000.

<sup>38</sup> Heschong Mahone Group. *Residential Lighting Baseline: Lighting Efficiency Technology Report*. California Energy Commission. CEC Contract #400-95-012. October 21, 1996.

category of decorative lighting as we have defined it here, this data indicates that the style is widely used. Furthermore, decorative lighting is probably less likely to be used with controls than security lighting.

### 7.2.2 Security Lighting

Security lighting is primarily used for safety and security purposes and is used to illuminate large areas, or as spot lighting to illuminate doorways, pathways, and dark spots within a yard. The category includes flood- and spot-style fixtures, as well as some utilitarian jelly jar fixtures, which are also sold in decorative fixture lines. The basis of design for security lighting fixtures is largely functional; their design holds little aesthetic appeal and there is little style variation in choice of security lighting fixtures, even among manufacturers. Manufacturers differentiate product lines more on features and light source than aesthetics. Flood lighting is usually attached to the home (walls, ceilings, garage) and often used in backyards, where the lack of aesthetic appeal is perceived to be less obtrusive.

The greatest diversity of light sources among outdoor fixtures occurs within this category. Light sources for flood lights include incandescent, high pressure sodium, mercury vapor, metal halide, and halogen. Spot lights, which often have a twin spot design, are usually halogen. Jelly jar designs used for security lighting include high pressure sodium and mercury vapor. Compact fluorescent lights are used in a small number of flood and jelly jar fixtures. Besides the fact that security lighting is commonly used with controls, the desired light output of security lighting is typically high, limiting applications where CFLs can accommodate consumer expectations.

### 7.2.3 Landscape Lighting

Whereas decorative lighting and flood lighting are designed to illuminate areas of outdoor space, in landscape lighting, the effect of the lights (ability to highlight a landscape or architectural feature with light and shadow) is often more important. Landscape lighting fixtures are intended to be unobtrusive; it is common for them to be concealed within the foliage they are intended to illuminate. Manufacturer lines of landscape lighting include spot lights, floods, and products such as walk-way lighting, bollards, deck lighting, and step lighting—fixtures that are sometimes included in decorative product lines.

Due to the fact that landscape lighting is largely installed for aesthetic purposes, it is a category of outdoor lighting reserved primarily for higher-income consumers, and it is a market that is closely tied to a strong economy. As applications of landscape lighting often incorporate artistic design, consumers are likely to utilize the services of a landscape designer or lighting consultant in specifying fixtures. Landscape lighting designs vary widely, as do the costs, with consumers spending \$800 to \$1,200 for lighting a typical suburban front lawn, but as high as \$10,000 for

more elaborate full yard designs.<sup>39</sup> At the low end of the landscape lighting market are products used primarily for pathway lighting.

Landscape lighting configurations are varied and applications can be highly creative. Variations include downlighting (light source from above) to imitate moonlight or sunlight, uplighting (light source from below), or backlighting (light source creating a silhouette of object of interest against a backdrop wall or fence).

Lighting sources commonly used in landscape lighting include incandescent, halogen, and mercury vapor. In some cases, colored light sources are used for dramatic effect. Low voltage systems are also commonly used with landscape lighting design. While individual low voltage lighting fixtures are available from retailers, a popular method of marketing this style of lighting in home improvement and hardware stores is to package a family of low voltage products together. Some solar pathway fixtures are available, although those at the low-end of the market do not provide the levels of light output that many consumers expect, and one retailer from a big box home improvement store we spoke to discourages selling them based on high return rates.

The fact that many landscape fixtures require very low light output makes them a potentially good application for CFLs. However, many landscape lighting fixtures designs are physically small, which may limit applications where CFL-based fixtures can match consumer expectations.

### 7.3. Controls

Consumers use outdoor lighting for long hours daily, with many lights operated all night long. For this reason, some efforts at reducing outdoor lighting usage may be better focused on the use of controls than on the source of lighting itself. Lighting controls can be described as any device that manipulates the power inputs to the lighting fixture. At the most basic level, controls include wall-plate switches; other controls such as timers, photocells, and motion sensors automate the switching process to regulate fixture usage.

**Timers:** Control devices that include a clock to turn lights on and off at fixed intervals daily. They often are programmed to provide illumination during all or part of the hours between dusk and dawn.

**Photocells:** Control devices that sense light, and so are able to cycle lights on and off at dusk and dawn.

**Motion sensors:** Control devices that turn lights on and off by detecting movement of an object or person within its range. Infrared motion sensors that detect body heat are commonly used in residential applications.

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<sup>39</sup> American Lighting Association. *Landscape Lighting Brightens Your Life*.  
[www.americanlightingassoc.com/resources/feature\\_detail.cfm](http://www.americanlightingassoc.com/resources/feature_detail.cfm)

These controls may be used alone, or in combination with others. An example of a device that combines control technologies is a photocell that turns a light on at 30% of its strength at dusk, increasing to 100% brightness if motion is detected.

### 7.3.1 CFLs and Controls

The EPA/DOE ENERGY STAR specification for outdoor lighting fixtures currently requires that all qualifying products have some form of control. Those qualifying for the label through the “light source” option, or Option A, must have automatic shut-off during daylight hours. Those qualifying through the “operating time” option, or Option B, must also have automatic shut-off during daylight hours; and automatic shut-off within a maximum of 15 minutes of either a manual on signal, or not motion in the fixture’s field of view. The second option does not stipulate lamp performance, therefore these ENERGY STAR compliant fixtures often are incandescent or high output lamps.

The cost-effectiveness of CFLs is optimized when light is used for several continuous hours each day. CFL performance degrades with frequent on/off cycling that would be associated with motion sensors. Electronic timers may also reduce CFL operating life because the constant stream of electrical current degrades various components (starters, cathodes).<sup>40</sup> Due to the fact that CFL performance may be compromised when used with some controls, careful attention must be paid when coupling the two.

It should also be recognized that promoting the use of non-CFL lighting sources presents a philosophical and practical challenge to some in the energy efficiency community, even when these sources are coupled with controls. There is a concern that promoting such products does not achieve the best energy savings opportunities that might exist. Furthermore, if the controls are disabled, poorly adjusted, or vandalized, there is concern that the savings potential of the flood light with control will be diminished or permanently lost.

In this research, we did not uncover any new control applications or technologies for CFLs. Given the fact that cycling controls are not appropriate for CFLs, we do not recommend further pursuing them as part of this study.

## 7.4. Energy-Savings Potential

Outdoor lighting accounts for 10% to 15% of total household lighting energy use. This is due to the fact that most homes have outdoor lighting, and the lights are used for multiple hours each day. The DOE estimates that in approximately half the homes with outdoor lighting, the combined wattage of all outdoor lights is over 150 watts. Four out of ten homes turn their lights on for the evening, and the remainder either leave the lights on all night, or have them controlled

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<sup>40</sup> E-Source. *Lighting. Technology Atlas Series*, Volume 1, 1997. Boulder, CO.

in some way.<sup>41</sup> It is estimated that outdoor lights are used an average of almost 3 hours per day.<sup>42</sup> The vast majority of outdoor lighting is incandescent, not energy saving CFLs.

### **7.5. ENERGY STAR Specifications for Outdoor Fixtures**

The ENERGY STAR lighting fixture program includes a specification for outdoor fixtures. The specification is technology neutral. As Table 7 shows, there are two ways to qualify, by performance of the light source and by operating time. The spec for the light source is set such that currently only CFL fixtures qualify. The operating time provides various control options and does not require a minimum performance level.

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<sup>41</sup> U.S. Department of Energy, Energy Information Administration. *Residential Lighting: Use and Potential Savings, 1993 Residential Energy Consumption Survey*.

<sup>42</sup> Heschong Mahone Group. *Residential Lighting Baseline: Lighting Efficiency Technology Report*. California Energy Commission. CEC Contract #400-95-012. October 21, 1996.

**Table 7: Energy Star Specifications for Outdoor Fixtures**

<b>Option A: Light Source</b>	
<b>Energy Efficiency Characteristics</b>	<b>Performance Specifications</b>
Maximum input power	150 watts
System efficacy (Lumens per watt) Up to 70 watts 71 to 150 watts	$\geq 40$ Lumens per watt $\geq 50$ Lumens per watt
Mechanical	Lamp holder will operate only lamps that perform to the input power range of the fixture.
<b>Operating Characteristics</b>	
Re-set	Resets automatically to automatic mode within 24 hours of a manual override or testing operation.
Shut-off	Automatic shut-off during daylight hours
<b>Reliability</b>	
Warranty for defects in materials and manufacturing	Repair or replacement of defective parts of the fixture housing or electronics (except lamp) for 2 years from the date of purchase. Written warranty must be included with fixture when purchased.
Safety	Fixtures must be tested and listed by UL, ETL, CSA or other independent agency acceptable for compliance with NFPA 70, National Electric Code including listing for damp or wet locations (Articles 410-4a and Article 100).
<b>Option B: Operating Time</b>	
<b>Energy Efficiency Characteristics</b>	<b>Performance Specifications</b>
Maximum input power	250 watts
Shut-off	Automatic shut-off during daylight hours; and automatic shut-off within a maximum of 15 minutes of either a manual on signal, or no motion in the fixture's field of view.
<b>Operating characteristics</b>	
Re-set	Resets automatically to automatic mode within 24 hours of a manual override or testing operation.
Lamp start	Lamp must continuously illuminate within 1 second of being switched on. For manufacturers using magnetic ballasts and quick start lamps, lamps <u>must</u> be included with fixtures when shipped from factory.
<b>Reliability</b>	
Warranty for defects in materials and manufacturing	Repair or replacement of defective parts of the fixture housing or electronics (except lamp) for 2 years from the date of purchase. Written warranty must be included with fixture when purchased.
Safety	Fixtures must be tested and listed by UL, ETL, CSA or other independent agency acceptable for compliance with NFPA 70, National Electric Code including listing for damp or wet locations (Articles 410-4a and Article 100).

Source: EPA/DOE ENERGY STAR program

As of September 30, 2000, there are 284 ENERGY STAR-qualifying outdoor lighting fixtures from 15 manufacturers.<sup>43</sup> (Table 8)

**Table 8: ENERGY STAR Qualifying Manufacturers of Outdoor Fixtures**  
(as of September 30, 2000)

<b>Company</b>	<b>Number of Products</b>	<b>Suggested use</b>
Teron Lighting, Inc.	108	Rated for wet locations
CLI Fixtures, Inc.	59	N/A
Heath Zenith	31	Outdoor wall mount suitable for wet locations, eave mount suitable for wet locations
Lights of America	20	Wall-mount welcome light, area light, wall-mount light, ground flood light, pole-mount area light
Sea Gull Lighting Products, Inc.	17	N/A
Enertron Technologies, Inc.	16	Outdoor landscape, outdoor building, wall-mounted, pool area, pathway, garage, deck area, wall- or ceiling-mounted, driveway, security
Brownlee Lighting	10	Various uses including: Porch, garage, exterior entry, ceiling- and wall-mounted, post-mounted.
Westerfield Co.	7	Porch, garage, patio, wall-mounted, entrance
U.S. Energy Technologies, Inc.	4	Outdoor porch
Technical Consumer Products	3	Any room
USPAR Ent. Inc.	3	Patio, passages, wall-mounted
Evergreen Lighting, Inc.	2	Outdoor
MaxLite SK America, Inc.	2	Porch, garage
Catalina Lighting	1	Outdoor lantern
Light Process Company	1	Landscape

Source: EPA/DOE ENERGY STAR program

<sup>43</sup> Product counts from some manufacturers may include style variations on the same model.

## **7.6. Timing of Outdoor Fixture Installations**

Most outdoor fixtures are installed when a new home is built, or as part of a decorating or replacement activity in an existing home. Within each of these markets, there are some notable marketing opportunities for specific types of lighting. For example, in higher-end markets, landscape lighting generally is not installed during new construction due to the fact that many landscape features that will be highlighted by the lighting (trees, shrubs, gardens, etc.) have not matured or been installed yet. Homeowners wait until the physical landscape features are in place before having a designer assist with their specifications. The timing of renovation and replacement purchases of landscape and decorative outdoor lighting is often in the spring, when the weather gets warmer and people focus on the outdoors for the first time in the year. This is in contrast to the typical indoor lighting market timing, which tends to occur in the darkest months of the year, from October through March. Security lighting, however does become a greater focus for consumers as the days grow shorter and lighting needs become more pronounced.<sup>44</sup>

In renovation or retrofit activities, consumers may tie outdoor fixture purchases to other home improvements, such as patios or deck additions. Also, rather than thinking of outdoor lighting for the entire property at one time, some homeowners make lighting additions separately for the front and backyards; the timing of these additions is not necessarily simultaneous. Fixtures in the front of the home are chosen to create a welcoming atmosphere, with decorative fixtures for the front entry and drive. Meanwhile, fixtures in the back are chosen for more utilitarian purposes, and tend to include less expensive security lighting.

Contractors are usually involved in the specification process in new construction. The homeowner is the likely specifier of outdoor fixtures in existing homes. More detail on the specification of lighting fixtures in new construction can be found in Section 8.3.

In the renovation market, younger, less affluent consumers will go to home centers for outdoor lighting products, rather than having a custom design, or working through a showroom.

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<sup>44</sup> *Home Lighting and Accessories Magazine*. “Wanna Increase Your Outdoor Lighting Sales? Let’s Take it Outside.” April 2000.

## 7.7. Market Characterization

### 7.7.1 Manufacturers

The residential outdoor lighting market is diverse, not only with multiple product categories, but also with hundreds of manufacturers, many of which are privately owned and provide products that are not limited to residential lighting applications. This makes creating a count of the number of residential outdoor fixture manufacturers a difficult task. Whereas the U.S. Census Bureau reported 107 residential fixture manufacturers in 1998, with 39 manufacturers of outdoor fixtures designed for attachment to the house and 29 manufacturers of unattached outdoor fixtures for the garden, patio, or yard, another source revealed over 230 companies manufacturing outdoor fixtures.<sup>45, 46</sup> The vast majority of fixture manufacturers are small, privately owned establishments. The U.S. Census reports that over half of the residential lighting fixture manufactures (all types) have fewer than 10 employees.<sup>47</sup>

With hundreds of manufacturers offering outdoor lighting fixtures, there are many small companies that carry limited product lines within each of the outdoor lighting categories. The largest outdoor fixture manufacturers also tend to carry the widest lighting selections overall, with product lines for both indoor and outdoor fixtures. Some of the largest manufacturers of outdoor lighting are listed in Table 9.

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<sup>45</sup> U.S. Census Bureau. *Electric Lighting Fixtures*, Current Industrial Reports. 1998.

<sup>46</sup> *Home Lighting & Accessories* Magazine Internet database of manufacturers.  
[http://www.homelighting.com/mfr\\_listprods.cfm](http://www.homelighting.com/mfr_listprods.cfm).

<sup>47</sup> U.S. Census Bureau, *Residential Electric Manufacturing*. Manufacturing Industry Series. 1997.

**Table 9: Large Manufacturers of Outdoor Lighting**

	<b>Product lines</b>	<b>Types of outdoor products</b>	<b>Has ENERGY STAR products<sup>48</sup></b>
Cooper/Regent	Outdoor, sconces, pendants, track lighting	Decorative, security	Yes
Genlyte Thomas	Outdoor, bath, ceiling, chandelier, display, fans, fluorescent, foyer, pendant, recessed, sconce, track	Decorative	No
Hinkley	Outdoor, table lamps, foyer, sconces, chandelier, bath	Decorative	No
Kichler	Outdoor, bath, chandelier, floor lamps, foyer, pendants, semi-flush/ceiling, table lamps, torchieres, wall mounted	Decorative, landscape	No
Progress	Outdoor, chandeliers, bath & vanity, close-to-ceiling, hall & foyer, pendants, recessed, under cabinet, sconces, track	Decorative, landscape	Yes
Sea Gull	Outdoor, chandeliers, foyer, pendants, ceiling, fluorescent, under cabinet, bath, ceiling fans, low voltage, recessed, track	Decorative, landscape	Yes

Among the largest outdoor fixture manufacturers, three have ENERGY STAR qualifying products: Sea Gull, Progress, and Cooper/Regent.

Another difficulty in determining market share among fixture manufacturers is the fact that many companies market products under multiple brand names. This brand marketing approach allows companies to create different product lines to cater to different market segments, perhaps with one product line geared to mass marketers and a higher-end product line geared to lighting showrooms.

<sup>48</sup> A complete list of Energy Star manufacturers of outdoor lighting fixtures is in Table 8.

### 7.7.2 Shipments

The U.S. Department of Commerce Census Bureau estimates that 17 million residential outdoor fixtures were shipped in the U.S. in 1998.<sup>49</sup> This estimate likely understates actual sales of outdoor fixtures in the U.S. It is based on the Current Industrial Reports, which only counts production and shipments of fixtures manufactured in the U.S. Due to lower manufacturing costs, much outdoor fixture component manufacturing and assembly occurs in Asia; with Taiwan, China, and Indonesia being the major producers. Fixtures containing brass work, a popular element of many outdoor decorative fixtures, are one example of fixtures that are manufactured almost exclusively overseas due to strict U.S. environmental regulations and labor costs.<sup>50</sup>

Fixtures from U.S. companies that manufacture overseas are counted as imports, but it is difficult to determine the portion of imports that are directly attributable to U.S. companies as opposed to foreign-based imports. Furthermore, comprehensive details on individual product types for U.S. production, imports, and exports are not available through the Census Bureau or other known data sources. The type of thorough data collection that would be necessary to accurately quantify the market shares of each outdoor lighting category is beyond the scope of this study.

### 7.7.3 Distribution Channels

As Figure 3 shows, the distribution channel from manufacturers is most often routed to a wholesaler, showroom, or retailer. Most manufacturers do not have the interest or resources to sell directly to builders, electrical contractors, or consumers. However, some, such as Genlyte Thomas, Progress, and Seagull have national builder programs to promote products through contractor channels, with actual sales and customer service provided through a network of distributors. Consumers obtain outdoor fixtures directly through retailers or contractors. A recent study in the Northeast found that nearly two-thirds of consumers buying outdoor fixtures purchase them from home improvement stores.<sup>51</sup> If contractors are involved in fixture specifications, usually building trade contractors (builders, electrical, designers, architects) specify decorative and security lighting, whereas landscape lighting involves a landscape designer. Landscape designers may be affiliated with a lighting specialty store or a landscape service. The landscape lighting market is unique among lighting categories in that landscape lighting designers often offer complete landscaping services and have no affiliation with the building trades.

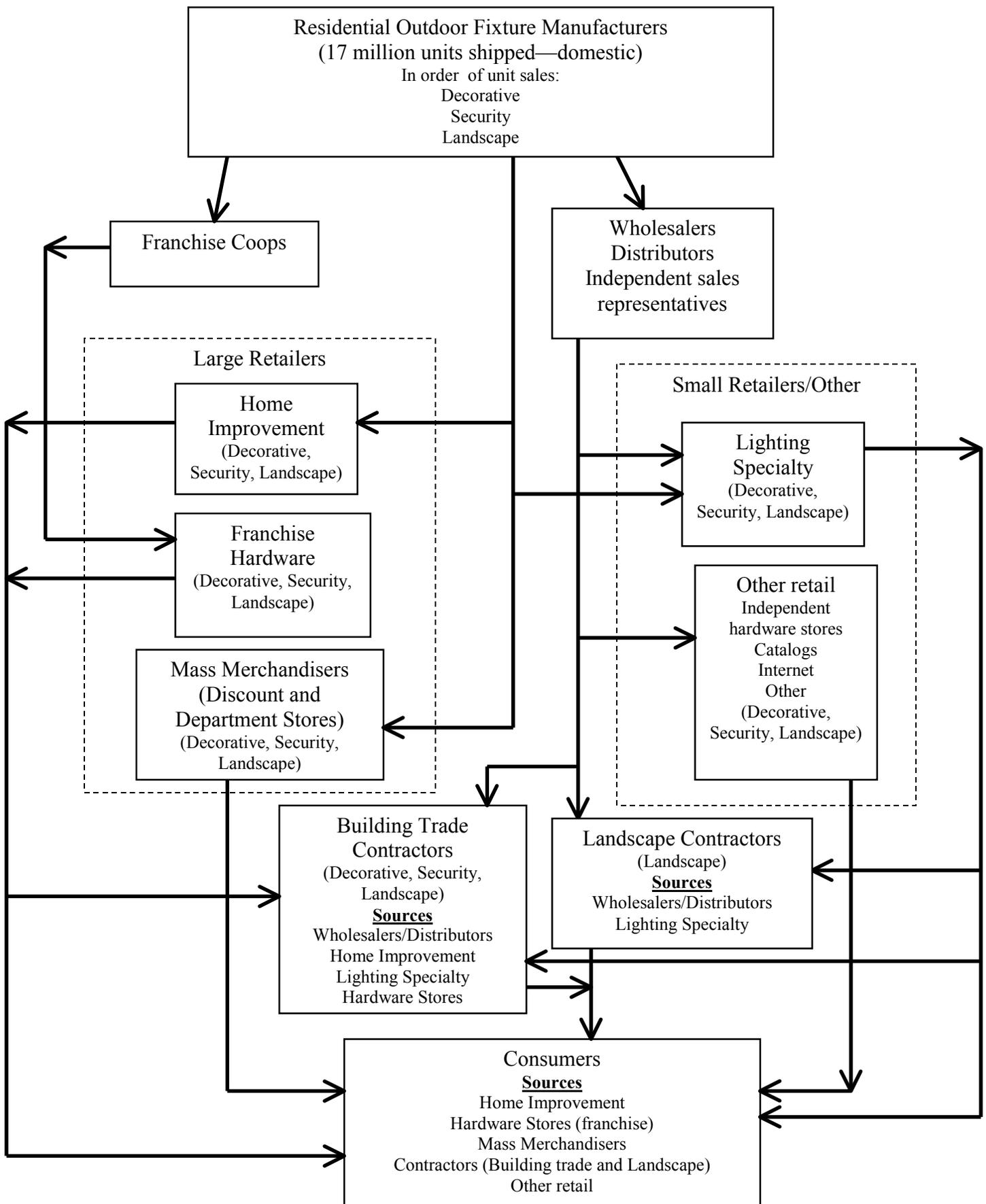
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<sup>49</sup> U.S. Census Bureau. *Electric Lighting Fixtures*, Current Industrial Reports. 1998.

<sup>50</sup> Vorsatz, D., Shown, L., Koomey, J., Moezzi, M., Denver, A., and Atkinson, B. December 1997. *Lighting Market Sourcebook for the U.S.* Berkeley, CA: Lawrence Berkeley National Laboratory. LBNL-39102.

<sup>51</sup> Opinion Dynamics Corporation and Regional Economic Research. *Baseline Study of the New Jersey Residential Lighting Market*. November 1999.

**Figure 3: Distribution Flows of Outdoor Fixtures**



## **7.8. Summary of Findings**

We categorize outdoor lighting into three basic groups: decorative, security, and landscape lighting. We believe the best opportunity for energy saving CFLs exists among the decorative category of outdoor lighting; this category includes porch lighting for walls and ceilings and post-mounted lighting for driveways and walkways. Decorative lighting is characterized by having a limited style selection that is dominated by lantern-style fixtures. Most of these fixtures are large enough to accommodate CFLs.

Consumer expectations about decorative outdoor lighting are compatible with CFLs, provided they can perform in wide temperature conditions and wet locations. Consumers have low light output demands for decorative fixtures, and the long life of CFLs benefits consumers by requiring fewer bulb change-outs. Characteristics such as slow start-up, color rendering, and flickering that impede consumer acceptance of CFLs in indoor applications are unlikely to be important to consumers for outdoor lighting.

Some types of landscape lighting may be appropriate for CFLs due to limited style selections and low light output demands. However, CFLs are unlikely to meet consumer expectations for security lighting due to high light output needs. A greater emphasis on the use of controls with security lighting may be appropriate for energy-saving program marketing efforts.

There are a large number of outdoor fixture manufacturers. The largest among them carry a vast array of products for *both* outdoor and indoor use. As with ceiling fans, the largest markets for outdoor fixtures exist among large retailers, particularly with home improvement centers. We recommend that implementation strategies focus on promoting efficient decorative outdoor lighting in these retailers, along with the manufacturers that supply these outlets.

## 8. Fixture Purchase Occasions

There are three basic purchase occasions that drive consumers to buy ceiling fans and outdoor lighting fixtures.<sup>52</sup>

**Decorating/Replacement**—Involves no major construction work. It includes sprucing up a home with new colors, furnishings, etc; replacing broken or malfunctioning lamps and fixtures; and adding more light for specific tasks.

**Renovation/Remodeling**—Work that involves major construction or changing the amount of livable floor space.

**New Construction**—Projects that involve the complete construction of a new home. More information on fixture specifications in the new construction market can be found in Section 8.

### 8.1. Home Improvements and Maintenance

Decorating, replacement, renovation, and remodeling can all be described as home improvement activities. Quantifying expenditures on fixture additions for these activities is not easily done, because the Census Bureau, which compiles home improvement and maintenance expenditures, does not necessarily include fixtures in its estimates. In 1998, over \$120 billion was spent on home improvements and repairs for owner-occupied and rental properties in the United States<sup>53</sup> (Table 10). About one-third of it was spent on maintenance and repairs, 27% on alterations within residential structures, 23% on major replacements, 9% on outside additions and alterations, and 8% on additions to residential structures. Seventy-two percent of all home improvement and maintenance expenditures were spent on owner-occupied, single-unit dwellings.

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<sup>52</sup> Except where otherwise noted, the remainder of this report contains information that applies to both ceiling fans and outdoor lighting.

<sup>53</sup> The U.S. Census Bureau defines improvements as capital expenditures that add to the value or useful life of the property. Improvements consist of additions to residential structures, alterations within residential structures, additions and alterations on property outside residential structures, and major replacements. Maintenance and repairs consist of expenses that were incurred to keep a property in ordinary working condition, but not as additional investments in the property.

**Table 10: Expenditures for Home Improvements and Maintenance**  
(Millions of dollars)

		<b>United States</b>	<b>Northeast</b>	<b>Midwest</b>	<b>South</b>	<b>West</b>
1998	Total	\$120,661	\$27,860	\$31,155	\$31,119	\$30,526
	Improvements	\$81,334	\$19,385	\$21,933	\$20,035	\$19,983
	Maintenance and Repairs	\$39,326	\$8,476	\$9,222	\$11,084	\$10,543
1997	Total	\$118,569	\$29,953	\$28,945	\$33,205	\$26,465
	Improvements	\$79,993	\$21,898	\$20,548	\$20,672	\$16,874
	Maintenance and Repairs	\$38,576	\$8,055	\$8,397	\$12,533	\$9,591
1996	Total	\$114,919	\$22,212	\$28,001	\$37,453	\$27,253
	Improvements	\$77,922	\$14,707	\$20,377	\$24,911	\$17,927
	Maintenance and Repairs	\$36,997	\$7,505	\$7,624	\$12,542	\$9,326
1995	Total	\$111,638	\$25,611	\$28,536	\$32,307	\$25,229
	Improvements	\$69,639	\$15,499	\$20,103	\$19,188	\$14,847
	Maintenance and Repairs	\$42,047	\$10,113	\$8,432	\$13,120	\$10,382

Source: U.S. Census Bureau, Expenditures for Residential Improvements and Repairs.

On a regional basis in 1998, households in the Northeast and West spent the most on home improvement and maintenance expenses; households in the South spent the least, which is not surprising given new construction and manufactured housing placement activity in the region (as will be seen in Table 13 and Table 14).

**Table 11: Per Household Expenditures for Home Improvements and Maintenance (1998)**

	<b>Expenditures per Household</b>
United States	\$1,213
Northeast	\$1,430
Midwest	\$1,301
South	\$894
West	\$1,437

Source: U.S. Census Bureau, Expenditures for Residential Improvements and Repairs, 1998 and American Housing Survey, 1997.

The home improvement market appears to drive sales of hardwired fixtures, accounting for 72% of sales, with the replacement market responsible for the bulk of those sales. As Table 12 shows, the new construction market accounts for about 28% of hardwired fixture sales.

**Table 12: Fixture Sales by Purchase Occasion**  
(000s)

	<b>Hardwired Fixtures</b>
New Home	41,988
Renovation/Addition	19,242
Replacement	86,170
<b>Total</b>	<b>147,400</b>

Source: Opinion Dynamics Corporation and Regional Economic Research. *Baseline Study of the Northeastern Residential Lighting Market*. June 3, 1998. And *Baseline Study of the New Jersey Residential Lighting Market*. November 1999. Northeast Energy Efficiency Partnerships.

Based on Current Industrial Reports—Dept. of Commerce, American Housing Survey, 1997.

## 8.2. Retail Sources for Fixtures

In home improvement and maintenance activities, there is a large do-it-yourself market. Consumers find residential fixtures in a wide variety of retail stores that range from home improvement stores to hardware stores to department stores to lighting specialty stores. The store that consumers shop in depends somewhat on the type of fixture being purchased. For example, consumers buying ceiling fans are most likely to go to a home improvement store, unless they are buying a higher-end fan, which can be found at a lighting specialty store. Consumers buying decorative and security outdoor fixtures go to home improvement stores and hardware stores, whereas a consumer in a high-end, custom home may utilize a landscape contractor to assist in landscape lighting. Contractors (builders, electrical) are occasionally involved in the specification of fixtures for renovation and remodeling work.

### 8.2.1 Home Improvement Stores

Home improvement stores dominate the market for replacement fixtures or those purchased for a renovation or remodeling project; one recent study in the Northeast found that nearly two-thirds of consumers buying outdoor fixtures and about half of those buying indoor fixtures purchase them from home improvement stores.<sup>54</sup> Home improvement stores are also a source of fixtures

<sup>54</sup> Opinion Dynamics Corporation and Regional Economic Research. *Baseline Study of the New Jersey Residential Lighting Market*. November 1999.

for many contractors. These stores carry selections of decorative, security, and landscape outdoor fixtures within the low- to mid-price ranges.

Two national chains, Home Depot and Lowe's (900 and 556 stores respectively), lead the do-it-yourself (DIY) market among home improvement stores. The nation's third largest home improvement chain, HomeQuarters/Builders Square, filed for bankruptcy in June 1999, leaving only Menard's (Midwest) and HomeBase (West) with small regional holds in the home improvement market.

Last year, Home Depot accounted for \$30.2 billion in sales. It is the nation's 6<sup>th</sup> largest retailer and growing.<sup>55</sup> This growth could be significant for the lighting industry, as several developments are occurring within the company. First, the chain is expanding with the Expo Design Center, a 15-store chain that carries high-end lighting, appliances, carpets, and kitchen and bath fixtures, with plans for 200 stores within five years. Secondly, while Home Depot has displaced many small hardware stores, it is now trying to compete for the customers who prefer a smaller hardware store venue by opening Villager's Hardware in 3 locations in New Jersey.<sup>56</sup> Thirdly, Home Depot announced in June 2000 that it is acquiring Georgia Lighting, a leading specialty lighting designer, distributor, and retailer based in Atlanta. It is expected that this acquisition will strengthen Home Depot's sourcing, training, and merchandising from the low end to the high end of the lighting market.<sup>57</sup>

While Home Depot has a strong and apparently gaining hold on the lighting market (from both the consumer and contractor position, and covering the lower- to higher-ends of the market), the company has a reputation for being a tough negotiator with manufacturers. Buying decisions are made on a regional basis, but buying agents or regional "team captains" also make product recommendations to other team captains in their areas of expertise. This sharing of information can have significant influence on the buying decisions by other regions.<sup>58</sup> Biannually, Home Depot also conducts product reviews, inviting existing vendors to review the terms of their supply contracts, and allowing new vendors to make their pitches.<sup>59</sup> While the opportunity to be a supplier means widespread distribution, many manufacturers are reluctant to comply with Home Depot's stringent product specifications, quantities, and tight price margins. This probably inhibits niche fixture manufacturers selling products in this market. When Home Depot is unable to gain the desired market share or contract terms in a particular product category with existing brands, it sometimes bypasses them by creating its own. The Hampton Bay line of ceiling fans it carries is one such example. Hampton Bay is actually a brand manufactured by a handful of suppliers for Home Depot. Eliminating national marketing costs, Home Depot gains a better profit margin, and manufacturers are able to utilize some of their excess capacity. The only other competing brand name for ceiling fans in the stores is Hunter.

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<sup>55</sup> American Express Top 100 Retailers. *Stores* magazine. July 2000.

<sup>56</sup> *Forbes* Magazine. "Under Construction". Bruce Upbin. January 24, 2000.

<sup>57</sup> Press release, "The Home Depot Announces Plans to Acquire Georgia Lighting." Atlanta, June 3, 2000.

<sup>58</sup> Calwell, C.; Granda, C.; Gordon, L.; Ton, M. *Lighting the Way to Energy Savings: How Can We Transform Residential Lighting Markets? Volume 1: Strategies and Recommendations*. Natural Resources Defense Council. December 1999.

<sup>59</sup> *Forbes* Magazine. "Profit in a Big Orange Box." Bruce Upbin. January 24, 2000.

Lowe's, based in Wilksboro, NC, is Home Depot's largest competitor, but about half the size. With \$12.2 billion in sales, Lowe's is the nation's 20<sup>th</sup> largest retailer.<sup>60</sup> Its stores are located mostly in the Southeastern part of the country, but a 1999 acquisition of Eagle Hardware & Garden (Renton, WA) expanded its territory to include stores in the West. Lowe's makes vendor deals at the national level for its stores, but does not have the cutthroat reputation of Home Depot among suppliers.

### 8.2.2 Hardware Stores

Many hardware stores, including national chains and independently operated stores, closed their doors during the 1990s due to competition with big-box home improvement stores. Two national hardware chains, Ace and True Value, continue to thrive.

The Ace Hardware chain consists of 5,100 affiliated stores, all independently owned and operated. Ace offers its member stores the benefit of bulk purchasing power to negotiate supplier contracts at more competitive prices than stores could receive on their own. It also creates its own Ace brands in some product lines. Among the lighting fixtures that Ace stores carry are ceiling fans and decorative, landscape, and security lighting.

The True Value hardware chain is part of the TruServ company and consists of 10,500 independently owned stores across the nation, with \$14 billion in sales. As a cooperative, its stores purchase lighting products directly through a corporate fulfillment center, eliminating direct contact with manufacturers. Like Ace, this enables member stores to use the volume purchasing power of the cooperative, which makes them more price competitive and allows them to consolidate the costs of distribution, operation, and promotion. For some product lines, TruServ creates private label brands.<sup>61</sup> Among the lighting fixtures that True Value stores carry are ceiling fans and decorative, landscape, and security lighting.

### 8.2.3 Mass Merchandisers

Large discount department stores sell a variety of product lines that usually include light bulbs, some portable lamps, and a limited selection of hard-wired fixtures. Selections of ceiling fans and outdoor lighting at mass merchandisers are more limited than at other retailers previously mentioned, and the product lines tend to be lower-end. Due to the wide product lines sold in these stores, there has been a problem in making sales personnel knowledgeable about lighting fixtures and energy-saving fixtures in particular. The largest mass merchandisers that sell ceiling fans and outdoor fixtures include Wal-Mart, Sears, KMart, and Target (the nation's top four retailers, in order)<sup>62</sup>.

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<sup>60</sup> American Express Top 100 Retailers. *Stores* magazine. July 2000.

<sup>61</sup> TruServ. [www.truserv.com](http://www.truserv.com).

<sup>62</sup> American Express Top 100 Retailers. *Stores* magazine. July 2000.

## 8.2.4 Lighting Specialty Stores

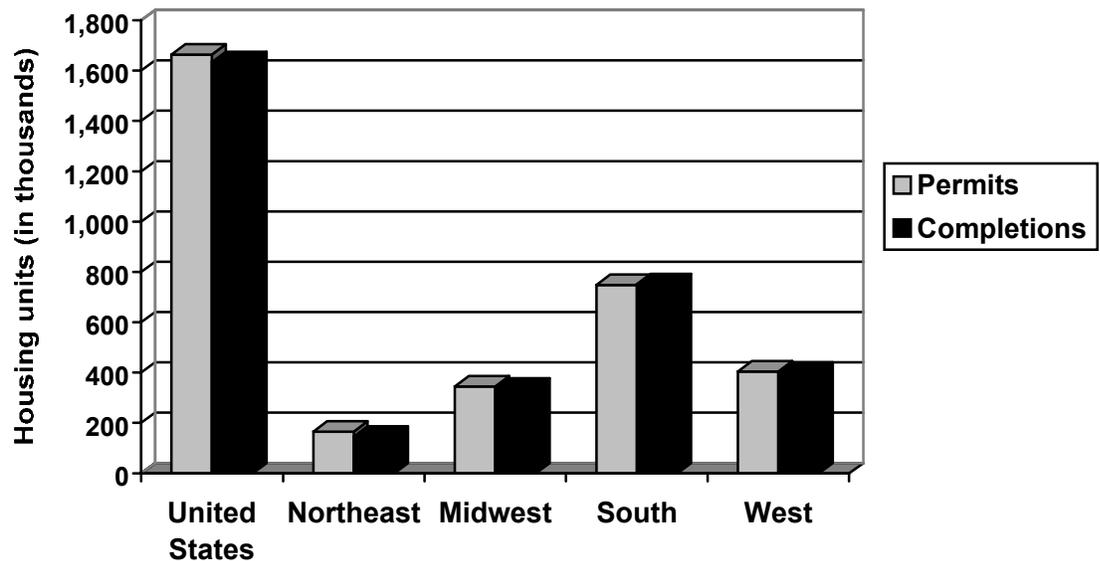
Lighting/electrical specialty stores typically carry a wide variety of fixtures and more unique product lines that might include those from niche manufacturers. Often, these companies are lighting distributors who have showrooms open to the public. They cater to the contractor and higher-end consumer market, and have among the most knowledgeable sales staffs. The majority of lighting specialty stores are independently owned, while a few, such as Lamps Plus, are larger chains.

### 8.3. Fixture Specifications in New Construction

A typical newly constructed home has 25-35 permanent lighting fixtures installed. This creates a significant opportunity for energy-saving lighting fixtures to be installed in multiple quantities per household. Missing out on the installation of energy-saving lighting products in the new construction market creates lost opportunities; consumers who are satisfied with the lighting specifications in their new home are unlikely to make any changes, and therefore potential energy savings are “lost.” The new construction market is also important because building and decorating trends in the new construction market influence the practices found in updating older housing. Understanding the who, what, when, where, and how of fixture specifications is an important part of identifying opportunities for energy-saving lighting fixtures in this market.

As Figure 4 shows, in 1999, there were nearly 1.7 million building permits for new homes authorized in the U.S. The South had the most building activity, with 749,000 permits; the Northeast had the slowest activity, with 165,000 permits. As Table 13 shows, since 1995 in the U.S., there has been a 25% increase in building permits issued.

**Figure 4: New Construction Activity in 1999**



**Table 13: New Construction Activity in the U.S.**

(Number of housing units in thousands)

		United States	Northeast	Midwest	South	West
1999	Permits	1,664	165	345	749	404
	Completions	1,633	145	336	752	400
1998	Permits	1,612	159	327	725	401
	Completions	1,474	137	305	672	360
1997	Permits	1,441	142	300	636	364
	Completions	1,401	134	296	634	336
1996	Permits	1,426	137	318	623	347
	Completions	1,413	125	305	637	346
1995	Permits	1,333	124	297	583	329
	Completions	1,313	127	288	581	317

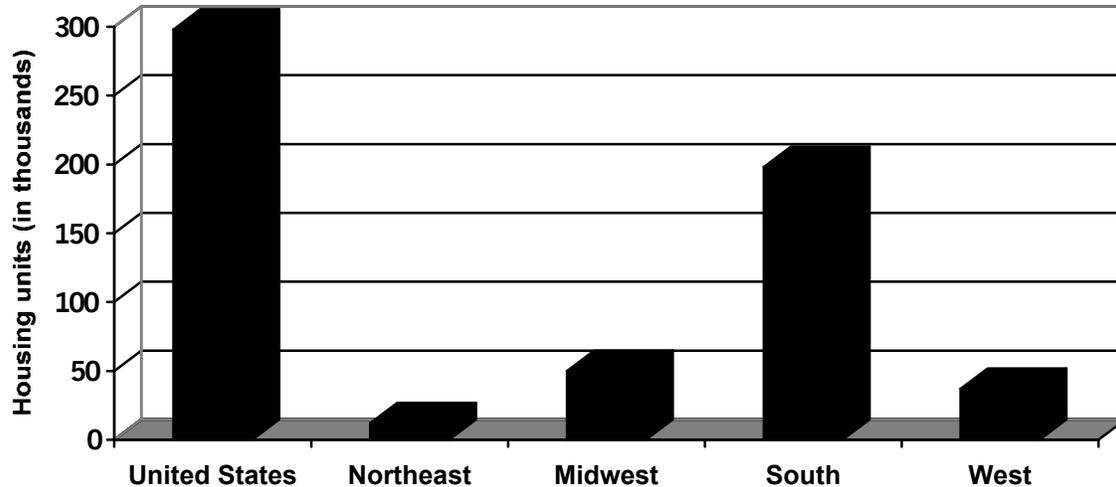
Source: U.S. Census Bureau, Construction Statistics.

### 8.3.1 Manufactured Homes

A separate category of new construction is manufactured homes. Manufactured homes are factory made dwellings (minimum 8 feet wide by 40 feet long) that are designed to be towed on their own chassis to a site. Manufactured homes do not require a permanent foundation and include multi-wides and expandable manufactured homes, but do not include travel trailers, motor homes, or modular housing. They are located both inside and outside of manufactured home communities such as parks, courts, and subdivisions. Manufactured homes are built to the federal building Housing and Urban Development (HUD) code, rather than local building codes. As Figure 5 shows, in 1999, there were nearly 300,000 manufactured homes placed in the U.S. Two-thirds of manufactured homes were placed in the South, while only 4% were placed in the Northeast. As Table 14 shows, the number of manufactured home placements in 1999 was at the lowest levels in the past five years.

Manufactured housing assemblers typically outfit homes with a variety of appliances and amenities, including some basic lighting fixtures. The lighting packages they use tend to incorporate fixtures for the high use areas of the home such as outdoor porch lights and kitchen and bathroom lights. Current lighting specification practices may be influenced through existing voluntary efficient building programs, or through HUD code modifications.<sup>63</sup>

<sup>63</sup> Calwell, C.; Granda, C.; Gordon, L.; Ton, M. *Lighting the Way to Energy Savings: How Can We Transform Residential Lighting Markets? Volume 1: Strategies and Recommendations*. Natural Resources Defense Council. December 1999.

**Figure 5: Manufactured Home Placements in 1999****Table 14: Manufactured Home Placements**

(Number of housing units in thousands)

	United States	Northeast	Midwest	South	West
1999	298	12	50	198	37
1998	369	15	58	246	50
1997	338	15	56	220	48
1996	338	16	59	218	45
1995	319	15	58	203	44

Source: U.S. Census Bureau, Construction Statistics.

### 8.3.2 Decision Makers in Original Fixture Specifications

In the general population, people living in the household make the vast majority of decisions about lamp and fixture purchases. However, decisions about the original fixture installations in new construction can be a complicated process, involving not only the homeowner, but also those who are involved in the building process.

Table 15 has been adapted from work conducted by Lawrence Berkeley National Laboratory and depicts specifiers of hardwired lighting technologies for homes in the new construction. The horizontal axis is arranged in order of increasing home cost and the vertical axis is arranged to approximate the chronological order of outsider involvement in a lighting project relative to the

household resident. The market actors indicated above the “homeowner” tend to make decisions either before or apart from the ultimate resident. The market actors indicated below the “homeowner” are generally hired to assist in lighting design or product selection. The diagonal trend from upper left to lower right indicates the increasing resident involvement in lighting selection as the home types become more expensive. We assume this specification process is similar for both indoor and outdoor fixture selections.

**Table 15: Specifiers for Hardwired Fixtures for New Homes**

<b>Market Actor</b>	<b>Tract Home</b>	<b>Semi-Custom</b>	<b>Custom</b>
Builder	<b>Likely</b>	<b>Likely</b>	Possibly
Electrical Contractor	Possibly	<b>Likely</b>	Possibly
Homeowner	Unlikely	<b>Likely</b>	<b>Likely</b>
Interior Decorator	Unlikely	<b>Likely</b>	<b>Likely</b>
Lighting Designer	Unlikely	Possibly	<b>Likely</b>
Residential Architect	Unlikely	Possibly	<b>Likely</b>

Source: Shown et al, “Lighting Market Source Book for the U.S.”, 1997.

A survey that ODC recently conducted indicated that home buyers and builders are the primary decision makers in the specification process for fixtures in new construction, but electrical contractors, architects, and interior designers also influence specifications.<sup>64</sup> The survey did not differentiate among various fixture types, so we cannot provide details about ceiling fans or various categories of outdoor fixtures. Three-quarters (76%) of consumers living in newly constructed homes say multiple parties are involved in the decision-making process for the original fixtures installed in their homes. Sixty-one percent of home buyers are personally involved in the original specifications for their indoor fixtures. As Table 16 shows, according to consumers, among the types of people who are very involved in the specification of indoor fixtures, the home buyer or someone in the household (44%) makes the final decision about fixture choice more often than the builder (33%).

Among those with outdoor fixtures, 65% say multiple parties are involved in the choice of fixtures. Consumers have slightly less personal involvement in the selection of outdoor fixtures for their newly constructed homes; 52% of consumers offer input into the specifications. As Table 16 shows, among those who are very involved in outdoor fixture specifications, builders and homeowners are equally likely to be the final decision maker in the choice of outdoor fixtures installed.

<sup>64</sup> The information presented through the remainder of the report is adapted from a study that ODC conducted on behalf of the major utility companies in New Jersey in 1998. Except where otherwise noted, this information is based on the specification of all types of fixtures installed during new construction, including indoor and outdoor fixtures. *Baseline Study of the New Jersey Residential Lighting Market*. November 1999. Northeast Energy Efficiency Partnerships.

Results from the new home construction survey suggest a higher mix of semi-custom or custom homes in the New Jersey market. The significant involvement of electrical contractors and homeowners is consistent with semi-custom or custom homes.

**Table 16: New Construction – Involvement of Key Decision Makers in Original Fixture Specifications**  
(Weighted)

		Homeowner	Builder	Electrical contractor	Architect	Interior designer	Other
	Ultimate decision maker (n=505)	44%	33%	7%	4%	1%	-
Indoor Fixtures (n=550)	Highly involved	45%	51%	39%	20%	10%	5%
	Somewhat involved	16%	20%	21%	12%	9%	2%
	Not involved at all	36%	22%	28%	52%	69%	72%
	Ultimate decision maker (n=188)	40%	39%	9%	-	-	-
Outdoor fixtures (n=484)	Highly involved	45%	56%	35%	16%	7%	5%
	Somewhat involved	7%	12%	22%	12%	5%	3%
	Not involved at all	42%	23%	32%	57%	78%	77%

In the survey and depth interviews with builders, we found that the specification process for fixture placement and choice of style varies by builder, and sometimes by the type of housing construction. Builders say they or their agents (electrical contractors, in-house procurement staff) are primarily responsible for the original fixture specifications in newly constructed homes. When builders exclusively handle fixture specifications, it is often done through in-house purchasing/procurement agents or sales staff. Smaller builders routinely use sub-contractors for building material acquisitions and are likely to rely on electrical contractors to make fixture specifications.

Builders say homeowner involvement in fixture specifications depends on the builder and project, but is usually guided by the builder. A general rule is that the more expensive and customized the home, the more input the homeowner has in the specification process. In semi-custom, tract, and multi-family homes, fixture choice is primarily the builder's decision, with very little, if any input from the home buyer (particularly if homes are built on speculation). However, there are exceptions.

Builders use electrical contractors to install all lighting fixtures and sometimes electrical contractors are involved in specifications. Builders say architects and designers are involved in this process for a limited number of projects.

Nearly every builder creates a standard lighting “package” to specify the fixtures that need to be installed in new homes. This package is designed to provide the basic lighting needs in a home. For example, the builder might plan to specify twenty lighting fixtures in a new home. Included in the specifications might be a chandelier for the foyer, another for the dining room, six porcelain fixtures for the hallways and basement, four for the bathroom, two outdoor lights for the entry way, and so on.

Some builders offer only the basic lighting package in the homes they build. Others allow upgrades to the package (at additional cost to the home buyer) or base the package on a lighting budget or credits, rather than actual selections. We spoke with a builder of tract homes who creates a lighting allowance for home buyers and refers them to local retailer. Clients go to the showroom, and make their fixture selections based on specifications outlined by the builder. If home buyers do not choose fixtures from the selected retailer, the builder installs the basic fixture package (usually simple porcelain fixtures), which the home buyer may later replace.

Builders often limit customer input into the fixture specification process (as with other finishing items like choice of carpeting and plumbing fixtures) to minimize the potential for project delays. In addition, to avoid potential conflict with the building warranty that some state or local authorities require builders to provide on new homes, builders want to keep the specifications as simple as possible.

Builders of tract homes have a unique opportunity to influence customer choices with the fixtures they showcase in their model home. The model home is a builder’s sales center. In it, builders use decorators to create an image of “home” to sell to potential buyers – including color choices for the walls, selections of floor coverings, and choices of lighting fixtures. These choices not only help to sell the home, but also influence home buyer fixture choices.

*“We have a model, and then we have a decorator who picks out the light fixtures for the model, and the decorator actually sets the tone, because most people will follow along. If they see it and they like it, then they try to duplicate it. Even if they can’t afford to get it from our supplier, they generally try to copy whatever we did. That’s the way it works. Like, our foyer fixtures, the one that we use in the model, you’ll generally see it throughout the development.”* (quote from Building Contractor in New Jersey)

Builders of custom homes often work with the home buyer, and sometimes the architect, interior designer, and electrical contractor during the fixture specification process. In this scenario, the builder likely makes some lighting suggestions, then takes the home buyer to a showroom to make specific selections.

As Table 17 shows, nearly four out of ten (38%) consumers who make fixture choices with someone involved in the building process say these people provide them with a limited choice of fixtures or make specific suggestions about particular models of light fixtures. A similar number (38%) of consumers say others involved in the process provide general information about fixtures, such as through catalogs, but do not restrict their choices of fixtures or make specific

recommendations. A small number of consumers (9%) go to a lighting showroom or store with the builder, electrical contractor, etc. to make indoor fixture selections.

In the selection of outdoor fixtures, many consumers who are influenced by builders, electrical contractors, etc. say they, not the building professional, really take the lead on the selection (30%). Other consumers say those involved in the building process give them very specific suggestions (27%) about fixtures or go to a lighting showroom or store with them to make selections (21%). Some consumers say those involved in the building process offer some general suggestions (17%) without restricting their choices of outdoor fixtures.

**Table 17: How Others Are Involved in Fixture Specification If Homeowner is Final Decision Maker**

(Weighted)

		<b>Overall</b>	<b>Builder</b>	<b>Electrical contractor</b>	<b>Architect</b>	<b>Interior designer</b>	<b>Other</b>
	n	119	94	107	54	39	16
<b>Indoor fixtures</b>	Gave a limited choice of fixtures or made specific suggestions about particular models of fixtures	38%	45%	38%	48%	26%	22%
	Provided general info about fixtures, but didn't restrict choices or make specific suggestions	38%	42%	41%	40%	47%	26%
	Went to a lighting showroom or store with homeowner to assist in fixture selection	9%	6%	8%	6%	19%	27%
	Decision was homeowners'	4%	4%	2%	4%	3%	3%
	n	52	35	47	27	15	8
<b>Outdoor fixtures</b>	Decision was homeowners'	30%	24%	31%	42%	51%	12%
	Gave a limited choice of fixtures or made specific suggestions about particular models of fixtures	27%	33%	29%	22%	18%	32%
	Went to a lighting showroom or store with homeowner to assist in fixture selection	21%	25%	24%	18%	15%	26%
	Provided general info about fixtures, but didn't restrict choices or make specific suggestions	17%	13%	14%	18%	17%	18%

The vast majority of consumers (86%) who get suggestions about fixtures from those involved in the building process (builders, electrical contractors, etc.) agree with some of the selections. Only 10% of homeowners who receive suggestions about indoor fixture specifications from others accept all of these suggestions, and 4% accept none of them.

Consumers receive suggestions for outdoor fixture specifications in a similar way. Again, the vast majority (91%) agree with some of the suggestions they receive from others, with only small numbers accepting all the suggestions (5%) or rejecting all suggestions (2%). (Table 18)

**Table 18: New Construction – Homeowner Acceptance of Lighting Suggestions**  
(Weighted)

	<b>Indoor Fixtures</b>	<b>Outdoor Fixtures</b>
n	100	28
Agreed with some of the suggestions	86%	91%
Accepted all of the suggestions	10%	5%
Did not agree with any of the suggestions	4%	2%

### 8.3.3 Timing of Specifications and Budget

Builders establish the lighting budget and make most fixture specifications during the project planning phase, prior to construction. The lighting budget is a function of the overall budget and size and type of home being built, with bigger, more customized homes have larger lighting budgets or credits. A very simple lighting package may allow for a budget of \$500 to \$1,000. Since much of this planning is organized by builders, new home buyers are not as knowledgeable about how lighting budgets are established. Survey findings show that about half of consumers (53%) say no lighting budget is established before indoor fixtures are chosen. Others say that a budget is established exclusively for lighting (27%) or is included in a budget for “extras” or other items (11%).

The budget for outdoor fixtures is managed in a similar way to that for indoor fixtures, although slightly more consumers (61%) say there is no outdoor lighting budget. Twenty-two percent say a budget is established exclusively for lighting or is included in a budget for “extras” or other items.

**Table 19: New Construction – Status of Lighting Budget**

(n=513, weighted)

	<b>Indoor Fixtures</b>	<b>Outdoor Fixtures</b>
Budget exists just for lighting	27%	22%
Lighting budget included in “extras” for other items	11%	7%
No lighting budget is established	53%	61%
(Don’t know/Refused)	9%	10%

Planning fixture specifications and lighting budgets prior to construction allows builders to estimate materials costs more accurately and helps to ensure that builders will be in compliance with permit plans, which contain details about the home’s electrical system and must be filed with the state. Adding extra electrical outlets or more hard-wired fixtures to a new home after building plans have been filed is likely to disrupt the inspection process, causing delays and cost increases at the end of a project.

#### 8.3.4 Timing of Fixture Purchase and Installation

Fixtures installed in newly constructed homes are ordered in advance, but are rarely purchased until just before installation in order to minimize the potential for breakage and to reduce handling/storage needs. Builders say that retailers/wholesalers usually have an inventory of fixtures on hand, or require a short period of time to fill orders.

*“The choice is made before we start construction, so if I’m going to build fifty houses or forty houses, I make the selection [of fixtures] for those fifty or forty houses, and then it’s up to the electrician to make sure he gets them there. Usually he’ll bring them in – have them in stock, and if a homeowner of a particular house wants to upgrade, she deals directly with him, he finds out what she wants, and he makes sure he orders it.”* (quote from Building Contractor in New Jersey)

As Table 20 shows, the vast majority of consumers living in newly constructed homes say that most of the permanent hardwired indoor and outdoor fixtures were installed during the construction phase or before they moved in.

**Table 20: New Construction—Timing of Fixture Installation**

(n=550, weighted)

	<b>Indoor Fixtures</b>	<b>Outdoor Fixtures</b>
During the construction phase or before moving in	89%	85%
After moving into the home	7%	9%
(Other)	2%	1%

### 8.3.5 Sources of Fixture Purchases

Builders establish relationships with fixture suppliers, which include retailers and distributors. Smaller, custom builders tend to work with local lighting stores, while larger production builders have accounts with wholesale lighting distributors/producers. Builders who do not make fixture acquisitions themselves often have electrical contractors take responsibility for fixture purchases.

The relationships that builders and electrical contractors establish with lighting retailers and distributors serve many purposes. First, having an established relationship with lighting vendors simplifies one step in the complicated business of building a home. Secondly, better pricing deals can be negotiated with bulk purchasing arrangements. Thirdly, builders can rely on vendors to have the fixtures in stock and to provide service if the fixtures are defective.

### 8.3.6 Builder Familiarity with Energy-Saving Lighting

Builders say energy efficiency is not a priority in their selection of fixtures. Builders claim to be familiar with energy-saving lighting products, but few specify them in the homes they build. The extent of energy-saving lighting specifications is generally limited to standard fluorescent lighting, but this style of lighting is used in very limited applications.

Our discussions with builders revealed that as a group, many builders lack extensive knowledge about energy-saving lighting. Few specifically name “compact fluorescent lighting” when defining energy-saving lighting products, and some merely refer to it as “fluorescent lighting.” One builder defined an energy-saving fixture as one that *“doesn’t have too many bulbs in it”* another describes the fixtures as those that use *“long-lasting bulbs.”*

When thinking about compact fluorescent fixtures, some builders consider them to be more appropriate for the commercial sector than the residential sector. This is largely due to higher

lighting demand (more lights, longer usage hours) by commercial users, which can translate to more significant cost savings through the use of energy-saving lighting.

### 8.3.7 Builder Perspective on Not Installing Energy-Saving Fixtures

Lack of customer demand is the primary reason why builders say they do not specify energy-saving lighting fixtures in the homes they build. Builders say they may get one customer request for energy efficient lighting every year or two. Because it is not a priority among customers, most builders do not explore energy-saving fixture options.

*“Market demand. If the customer wants it, we’ll install it, but people aren’t interested in the energy packages any more. We tried selling them, and couldn’t sell them. We actively marketed those packages, and people just didn’t want to spend the money.”* (quote from Building Contractor in New Jersey)

Builders feel the higher price of energy-saving fixtures compared to alternatives is another barrier to widespread use. Builders struggle with the need to reduce costs in the building process, which is one of the reasons why in all but custom homes they tend to install no-frills fixtures.

*“The homeowner has to make it [energy-saving lighting] some kind of priority, which I’ve never heard any homeowner asking for, so if the homeowner started to ask for it, then we’d obviously have to respond. There’s so many things that have increased in price in home building, I wouldn’t want this to be another one, so if we can do this without an increase in our present budget, then I would think it would be a possibility.”* (quote from Building Contractor in New Jersey)

Builders associate energy-saving lighting with other energy-saving features, such as insulation and heat pumps. With the large number of energy demands residential consumers have, builders do not believe that lighting alone significantly impacts electric bills. Therefore, they are unlikely to make energy-saving lighting options a focus in marketing information provided to home buyers. However, some builders say they are interested in exploring opportunities for incorporating more energy-saving technologies, including lighting, into the homes they build. They see a greater market for energy-saving upgrades in custom-built homes.

Based on their limited experience with energy-saving lighting fixtures, builders report no problems with the quality of the fixtures relative to non-energy-efficient fixtures. The limited customer feedback builders receive about energy-saving is positive. However, while acknowledging that energy efficient lighting has improved over the years, many builders have lingering concerns about the technical limitations of CFLs or the perception that there are technical limitations.

*“They don’t look like an incandescent fixture. They may not react exactly the same way when you turn the switch on. They take just a little second longer to warm up. They may cost three or four times, if not more, times the incandescent fixture. I think that from that standpoint, the builder will look at the price factor. I guess as they become competitive with others, more builders will use them.”* (quote from Building Contractor in New Jersey)

### 8.3.8 Important Characteristics in Builders’ Choice of Fixture

Cost is the most important factor in builders’ choice of fixtures, followed by aesthetics. Energy efficiency is not a consideration for most builders. All fixture choices must be UL approved to meet NJ building code standards.

Builders say that home buyers involved in the specification process are concerned mainly with fixture appearance. Although builders say it is rare for home buyers to request energy-saving fixtures, builders are willing to accommodate such client requests.

### 8.3.9 Fixture Retrofits in New Construction

Builders say that homeowners who have not participated in the selection of lighting fixtures for their new home are likely to replace them soon after moving in. This is one of the reasons why the basic lighting package that builders use often includes the simplest porcelain fixtures, which fill the need for lighting at a minimum cost. One builder estimates that up to 75% of the fixtures he specifies are eventually replaced by the new homeowner to match their decorating preferences. One builder says the only fixtures he specifies to higher standards are those intended for the kitchen or outdoor use because the new homeowner is likely to replace his choices in all other areas.

About one-third of the respondents (32%) living in newly constructed homes who were not the ultimate decision maker in fixture selections removed at least one of the original indoor fixtures and 12% removed at least one of the outdoor fixtures. As Table 21 shows, the primary reason why homeowners replace of indoor and outdoor fixtures is style.

**Table 21: New Construction—Reasons Why Fixture Replacements are Made**  
(Open-end, multiple response, weighted)

	<b>Indoor Fixtures</b>	<b>Outdoor Fixtures</b>
n	142	32
Style	51%	61%
Need more/less light	14%	2%
Fixture was broken	9%	8%
Other	26%	31%

Fixture retrofitting is a priority task for new home buyers. As Table 22 shows, the majority of replacements of indoor (74%) and outdoor (59%) fixtures occur within three months after the home buyer moves into the new home.

**Table 22: New Construction – When Homeowners Make Fixture Replacements**  
(n=142, weighted)

	<b>Indoor Fixtures</b>	<b>Outdoor Fixtures</b>
n	142	32
Within one month of moving in	33%	24%
One to three months	41%	35%
Four to six months	14%	23%
Seven to twelve months	6%	15%
One year or more after moving in	1%	3%

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