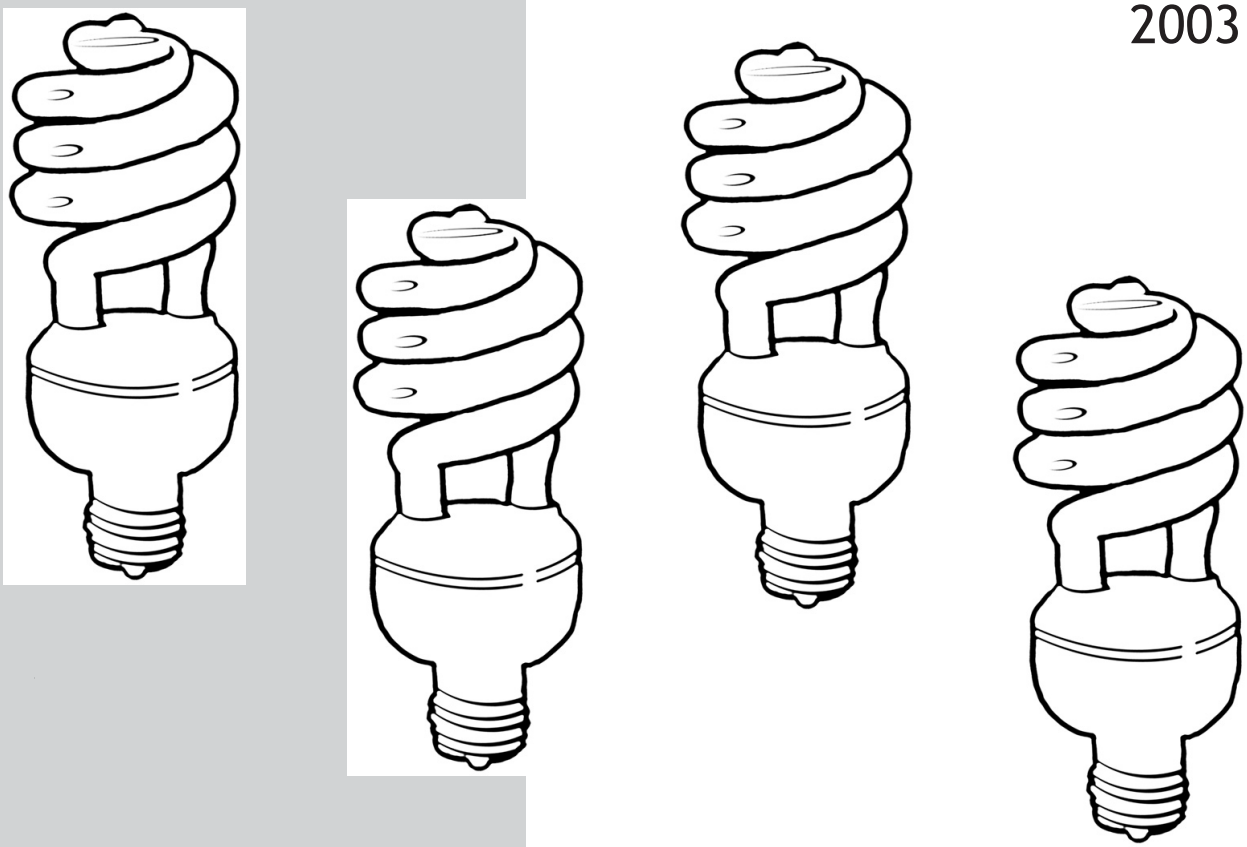
Conservation Kit Program Evaluation

Transforming the Residential Use of Compact Fluorescent Lighting

Evaluation Unit
Energy Management
Services Division
2003



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Conservation Kit Program Evaluation

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Seattle City Light

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May 2003

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Conservation Kit Program Evaluation

Transforming the Residential Use of Compact Fluorescent Lighting

Evaluation Executive Summary

A decade after electric utilities nationwide began the effort to transform the residential lighting market, the average household in Seattle owned only one compact fluorescent (CF) bulb. With an urgent need that began in 2000 to reduce utility loads, Seattle City Light in 2001 offered Conservation Kits with two newer-generation CF bulbs to every residential customer. Kit distribution to solicited respondents was followed later in 2001-2002 by mailing retail discount coupon offers to all households. The two major lighting initiatives are referred to hereinafter as the Conservation Kit and Retail Coupon Programs.

This study reports mainly on the process and impact evaluation of the Conservation Kit Program operated during 2001. The evaluation assesses the program's effectiveness at meeting six strategic objectives. The study also documents progress toward CF lighting market transformation for higher levels of efficiency in the urban residential sector. This progress incorporates impacts of supplemental CF bulb distributions and the Retail Coupon program, as well as of the Conservation Kit program.

The evaluation estimates energy savings from and the cost-effectiveness of Kit measures, as implemented in existing residential buildings throughout the utility service area. The effect of the 2001-2002 Kit, Coupon, and supplemental programs was to reduce the average system load at Seattle City Light by ***3.9 average megawatts***. This load reduction will persist for up to seven years, the average measure life for Kit CF bulbs. The Conservation Kit Program itself, at 2001 residential rates, was cost-effective to the utility at about ***1.7¢ per kilowatt-hour***. By the end of the year, ***over half a million (526,926) CF bulbs*** had been installed in area homes due to the City programs. Customers also saved ***36 million gallons of hot water and 79 million gallons in sewer flows.***

Table ES-1: Overview of Net First-Year Impacts from the Conservation Kit Program, Supplemental Distributions, and Retail Coupon Program in 2001 and 2002

Conservation Kit, Distributions, & Retail Coupon Program Impacts: First Year Energy Savings	Count	Annual MWh Impact	2002 aMW Impact	w/ 5.2% T&D Credit
Kit Immediate Effect[1]	249,874	15,620	1.783	1.876
Kit Delayed Effect[2]	49,758	3,386	0.387	0.407
Kit Spillover Purchases[3]	166,418	9,070	1.035	1.089
Conservation Kit Impact	**466,050**	**28,076**	**3.205**	**3.372**
Supplemental Bulb Distributions[4]	38,705	2,818	0.322	0.338
Distributed Bulbs & Water Measures	**504,755**	**30,894**	**3.527**	**3.710**
Retail Bulb & Lamp Coupons[5]	22,171	1,463	0.167	0.176
Combined Program Impacts	**526,926**	**32,357**	**3.694**	**3.886**

Program Design

The City of Seattle's Light Department is the largest municipal electric utility in the Pacific Northwest, and one of the largest publicly owned in the nation. Seattle City Light has 356,000 customers in the residential, commercial, industrial, and governmental sectors; the local population tops 700,000. The utility serves a 131 square mile area that includes the City of Seattle and adjacent localities north and south of the City, within the bounds of King County, Washington.

In 2001, hydroelectric plants owned by Seattle City Light provided 40% of its power, with another 27% of hydroelectric power supplied by the Bonneville Power Administration and BC Hydro; the remainder was acquired through costly wholesale purchases. In 2002, moving away from the open marketplace, Seattle City Light generated 52% of its own power, the Bonneville Power Administration and BC Hydro 34%, other hydro 7%, wind 2%, and only 5% was purchased from combustion turbine sources. In normal weather years the utility is able to supply most of its power from hydroelectric sources. The reduced output in 2000-2001 from Seattle City Light's generation facilities forced the utility to take extreme measures and actions to manage burgeoning power costs.

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1 Kit bulbs installed immediately and Kit faucet aerators, minus *free rider* adjustment.

2 Kit bulbs installed in 6-8 months after Kit distribution, and showerheads purchased due to Kit.

3 Retail-purchased bulbs attributable to Kit influence.

4 Bulb giveaways at community events.

5 Retail-purchased bulbs acquired with utility coupon.

Seattle places a high priority on acquiring power through conservation and, most recently, through wind-power and other renewable resources. In 2001, the utility invested $27 million in demand-side management programs, of which $3 million were devoted to the Conservation Kit Program.

Program planning for the compact fluorescent bulb programs began in summer 2000, the program design jelled by October, fast-track budget authority was acquired, and implementation began in earnest. Wholesale CF bulb orders were placed and customer solicitations were mailed in February 2001. Kits were delivered in April through June, and by August the program evaluation was underway. Survey and evaluation activities continued throughout 2002.

The Conservation Kit Program distributed an energy and water efficiency kit to electric utility customers in the Seattle City Light service area. Seattle City Light supplied Kit lighting efficiency products; Seattle Public Utilities collaborated to supply selected water efficiency items. City Light mailed solicitation letters to 314,064 residential customers during late February through May of 2001. The letter offered to send free of charge a "Conservation Kit" containing two compact fluorescent light bulbs, an efficient-flow bathroom faucet aerator, and a water flow-rate bag to test the efficiency of household showerheads and faucets. Conservation Kits were distributed to all 178,481 residents who responded to the solicitation letter, putting 356,962 CF bulbs into the hands of utility customers. Retail coupons were mailed to all residential customers in fall-winter, 2001-2002.

About Program Evaluation

Program evaluation is the formal study of the extent to which stated objectives are met. In evaluation one compares performance to some standards and assesses merit or worth. The steps in an evaluation are to state goals in behavioral terms, develop measurement instruments, collect data, make valid and reliable analyses, interpret findings, make recommendations, and inform decision-makers.

A process evaluation measures program operations. The evaluator monitors potential procedural barriers, looks for unanticipated ones, and provides a log of the actual program process for later use in interpreting outcomes. For conservation programs, common process measures provide accountability for cost management, program efficiency, communications, customer and contractor satisfaction, barriers to service delivery, and more.

An impact evaluation focuses on measures of program outputs and outcomes. The evaluator collects qualitative and quantitative data on outcomes, relates them to objectives and program context, assesses measures in the light of information on inputs and processes, and interprets their merit. For conservation programs, common impact measures describe participation rates, energy and water savings from treated subjects, parallel changes among untreated subjects, attribution of net impacts to the program, attainment of objectives, and program cost effectiveness.

This report documents both process and impact evaluations of the Conservation Kit Program. The evaluation study took place in two main stages: survey research (generating process evaluation information), conducted by a consulting firm, and impact evaluation, based upon further analyses performed by the utility evaluator.

Evaluating Impacts

The Conservation Kit Program impact evaluation is based on measurements from survey research with participating and nonparticipating customers conducted by the consultant, Research Innovations. Of residential customers, ***57% responded to the solicitation letter and received a Conservation Kit***. A random-sample survey was made with 1% of participants (Kit requestors) and 1% of nonparticipants (non-requestors).

Projections from the survey samples to the entire service area are made based on secondary regional research and other adjustment factors. This report contains discussion of compact fluorescent lighting issues and market transformation. It concludes with recommendations for future improvements to products and services for the residential target market. Separate sets of recommendations were formulated by the utility evaluator and by the survey research consultant.

The evaluation was designed to incorporate a second survey in 2002 for follow-up on longer-term market impacts; this was abandoned due to budget constraints. Thus this evaluation report does not directly measure the impacts of the 2001-2002 Retail Coupon Program that followed after the 2001 Conservation Kit Program.

Results from the Survey

Responses to the mailed survey questionnaires show that the majority of Kit CF bulbs were installed by year-end 2001. ***Two-thirds*** of program participants tried a CF bulb in their homes ***for the first time***, after receiving the Conservation Kit. By year-end 2001, 94% of all Kit bulbs were placed in residential lamps and fixtures. The survey research shows that ***over half of all service area households now have nearly four CF bulbs installed***. Households moved from a 12% baseline (*one* bulb) to the current 44% (*four* bulbs) of their customer-perceived saturation capacity (which they believe to be *seven-to-eight* bulbs per home).

Conservation Kit nonparticipants matched participants on most demographic characteristics. ***Many nonparticipants did not notice the offer and remain receptive to future market transformation efforts.***

The direct distribution method increased customer trust and interest in compact fluorescent lighting products. The Conservation Kit overcame some prior negative impressions of the technology, increased customer satisfaction with CF lighting, and effectively met the utility's goal to reintroduce the bulbs directly to customers and stimulate the market for CF products.

Some *free-rider* effects and significantly greater *spillover* effects were seen from respondent choices and attributions. Self-reports on subsequent bulb purchases match regional sales figures attributed to the utility's service area. The cumulative effects of the West Coast energy crisis and Northwest regional drought, combined with the efforts of Seattle City Light's Conservation Kit and Retail Coupon Programs, as well as regional Energy Star® promotions, were to multiply 2001 retail sales ***by a factor of 10*** over sales in 2000. Program participants linked their purchasing behavior to the Kit program.

What the Program Accomplished

From the 2001 survey results, we can estimate utility system load impacts and program cost effectiveness. The immediate net impact of the Conservation Kit Program, early in the year, was to lower electric utility loads by 1.9 average megawatts (aMW). By year-end 2001 the delayed lighting impact, spillover effects, and hot water-measure savings drove that load impact to 3.4 aMW. Including supplemental distributions of CF bulbs, in addition to the mailed Kits, ***the overall distribution program effect was to reduce the average system load at Seattle City Light by 3.7 aMW***. The Retail Coupon program of 2001-2002, which stimulated retail sales, brought the overall impact up to ***3.9 aMW.*** This load reduction will persist for up to seven years, the average measure life for Kit CF bulbs.

The Conservation Kit Program, at 2001 residential rates, was ***cost-effective to the utility at about 1.7¢ per kilowatt-hour***. This realized cost was below the planned cost (2.6¢), and just one-fourth of the avoided cost (6.9¢) of non-conservation power purchases in 2001. Participating residential customers are saving over $1.1 million on power bills each year (over the measure life of about seven years) from Kit products. The program also had a spillover effect on subsequent purchases that can be attributed to the Kit's influence. Those CF bulbs (which cost about 2.9¢ per kWh to purchasers) are yielding another $0.7 million in annual power bill savings for affected customers. Meanwhile the utility saved $1.3 million in 2001 from avoided annual wholesale power purchases due to the Kit's direct impact, and another $0.8 million from the spillover effect. Thus, ***in the first year the Conservation Kit Program saved participants $1.8 million and the utility $2.1 million.***

Progress Toward Market Transformation

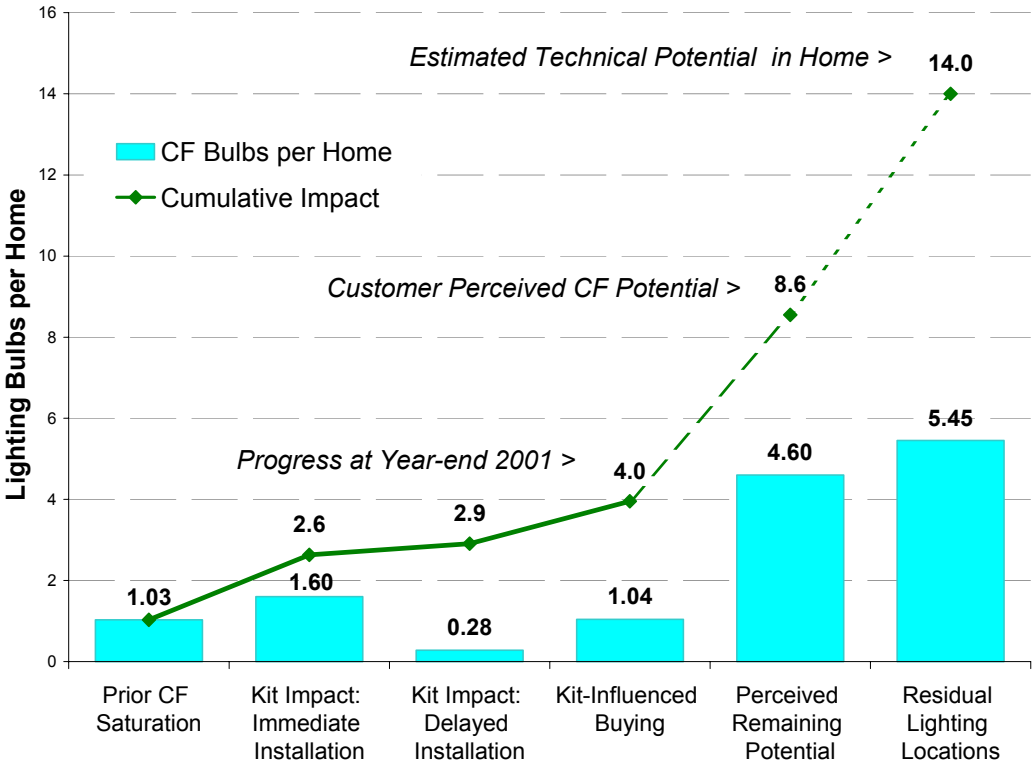
The Conservation Kit Program was effective at meeting objectives for ensuring equal opportunity, increasing customer awareness, fostering future demand, supporting the retail sector, leveraging resources through collaboration, ensuring staff efficiency, acquiring the conservation energy resource, and generating economic benefits. Not only did the Conservation Kit Program meet its stated planning objectives, but it also met the utility's overarching goal to advance market transformation for compact fluorescent lighting in the residential sector of Seattle City Light's service area.

Market transformation refers to the change in product usage over time, in this case the change from incandescent to compact fluorescent bulbs. It has been defined (Rosenberg 1996) as what occurs "when a DSM program induces a lasting change in the structure of an energy product or service market or the behavior of market actors that results in greater adoption and penetration of energy-efficient technologies."

As our survey research confirmed, before receiving the Kit solicitation, participants owned 1.03 CF bulbs on average and nonparticipants owned 0.94. By autumn participants had installed 1.60 Kit bulbs, and they expected to install 0.28 more of the remained unused Kit bulbs in the half year after the survey. Meanwhile participants went on to buy and install another 1.04 bulbs (while nonparticipants had purchased about 0.25). The result is a scenario where participants, who formerly averaged *one* CF bulb per home, now had an estimated *four* installed (Figure ES-1).

Most participants (85%) at the time of the survey felt there were still more locations in the home suitable for a CF bulb. Averaged across all participants, this group indicated the potential to install 4.6 more bulbs per household. Meanwhile most nonparticipants (72%) also felt they still had places where they could install a CF bulb, with the number of locations averaging 6.2 per household across the whole group. Summing these values, participants (8.27) and nonparticipants (7.39) were congruent in their perceptions of the combined total of lighting locations appropriate for a CF bulb. Where the product is the unit of measurement, it appears that by early 2002 participating Seattle residents had moved about halfway to their perceived saturation capacity

Figure ES-1: Market Transformation Progress Among Kit Program Participants



As an index of market transformation among participants, they have installed about 44% of their perceived maximum saturation capacity, compared to 12% before the Kit Program began. This finding describes a market segment that was in the early stages of CF bulb usage before the program, and saw a dramatic increase in bulb usage in a relatively short time. Still, participants are less than halfway to perceived saturation capacity, and perhaps a bit over one-fourth of the way to penetrating the technical potential for residential lighting applications. Among nonparticipants, a tremendous opportunity remains for the utility to introduce more residential customers to the current CF lighting technology.

Recommendations

.....Adopt Savings Estimates in Energy Conservation Accomplishments Report

Seattle City Light monitors conservation programs in an annual publication, the next issue of which will be entitled ENERGY CONSERVATION ACCOMPLISHMENTS: 1977-2002. The Conservation Kit and distribution effects are reported under the umbrella program entity for direct delivery of residential products and services, *Neighborhood Power Lighting, Appliances, and Warm Home*. The Retail Coupon effects are reported under the umbrella program entity for retail market interventions, *RetailWise Lighting and Appliances*.

Table ES-2: Performance Reporting of Program Annualized Net First-Year Impacts in 2001 and 2002

Conservation Kit, Distribution & Retail Coupon Program Impacts: First Year Savings	Count	Annual MWh Impact	2002 aMW Impact	w/ 5.2% T&D Credit
Kit Bulb Immediate Installations	285,570	15,564	1.777	1.869
Kit Bulb Delayed Installations	49,758	2,712	0.310	0.326
Kit Free Riders	(-35,696)	(-1,945)	(-0.222)	(-0.234)
Kit Water Measures	—	2,675	0.305	0.321
Supplemental Bulb Distributions	38,705	2,818	0.322	0.338
2001 Neighborhood Power	**338,337**	**21,824**	**2.492**	**2.621**
Retail Bulb Coupons	11,143	735	0.084	0.088
2001 RetailWise	**11,143**	**735**	**0.084**	**0.088**
Kit Spillover Purchases	166,418	9,070	1.035	1.089
Retail Bulb & Lamp Coupons	11,028	728	0.083	0.087
2002 RetailWise	**177,446**	**9,798**	**1.118**	**1.177**
Combined Total Impacts	***526,926***	***32,357***	***3.694***	***3.886***

From the findings of this impact evaluation, effects of the Conservation Kit, distribution, and Retail Coupon Programs shall be stated in the ACCOMPLISHMENTS report as in Table 22. The overlap between effects of the Conservation Kit spillover into retail purchasing and the effects of the retail coupon distributions is unknown, due to cancellation of the second follow-on survey designed to measure in 2002 the combined program impacts. In the absence of such information, and based on the low customer response rates to the regional coupon offers, the coupon and spillover effects are treated as additive in this

recommendation.[6] Coupons redeemed in 2002, as well as estimated spillover effects, shall be reported as occurring in 2002; all other annualized effects shall be stated as occurring in 2001, in accord with the ACCOMPLISHMENTS report principal of tracking full annualized savings acquisition in the year of program participation. Conservation Kit products and supplemental distribution CF bulbs shall be deemed to have a seven-year measure life, while bulbs purchased retail (Kit spillover and with coupons) shall be deemed to have a six-year measure life, consistent with the LightWise program.

..... Stage Another Round Aimed Toward Both Participants and Nonparticipants

Autumn 2003 will provide another seasonal opportunity, as nights grow longer, to encourage consumers to purchase and use CF bulbs. Seattle City Light can inform residents (with illustrations) of the wide variety of styles now available in stores and of their specific applications in the home. To expand the use of these products, utility informational materials can emphasize products that address outstanding customer concerns. Attention should be drawn to the wide range of bulb shapes, sizes, and light outputs, as well as bulbs appropriate for recessed fixtures or use on dimmers, and permanent fixture alternatives. Care should be taken to include messages in the major language groups typically included in Seattle City Light literature, to reach customers missed by the original solicitation.

Utility customers identified in the Kit database as nonparticipants would benefit from another, targeted Kit offer. Many of them could be converted to *New Users*, while others could be moved into the Early Adoption and Early Majority stages. It may be possible to use alternative mailing lists to target more directly the renters and apartment dwellers missed by the 2001 Conservation Kit Program.

The utility should not expend effort on another coupon program. The regional coupons were not effective at promoting sales of CF torchieres, and were less effective than expected at promoting sales of CF bulbs (the actual redemption rate was about 6.7%, compared to the 10% planned).

..... Look into Snohomish PUD Model for Follow-On Retail Boosters

Seattle City Light faces the opportunity now to work with manufacturers and retailers in a new way, now that a large proportion of residents have become users and purchasers of CF bulbs. The precedent has been set through the Kit program mass purchasing experience. At a minimum, the utility should look into the low-cost model adopted by Snohomish PUD, to maintain the momentum in residential lighting market transformation (see footnote 14 on page 5 of this report).

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[6] This recommendation incorporating spillover effects is made in accord with the observation from an outside consultant that Seattle City Light should focus more on systematically including factors that increase net savings (free drivers and other spillover effects), as well as the traditionally reported factors that decrease net savings (free riders, persistence, take-back).

Khawaja, M. Sami, Ken Seiden, Connie Colter, and Harold Schick, *[SEATTLE CITY LIGHT]* CONSERVATION PROGRAM REVIEW: FINAL REPORT, Quantec LLC (Portland OR: January 2001).

.....Evaluate Future Programs and Reassess Market Transformation Progress

While the 2001 Conservation Kit program itself was successful at leveraging resources through collaboration with other agencies, the evaluation effort was not successful in acquiring sufficient resources to carry through the original study design. The evaluation was intended to establish a baseline with the initial survey. Another survey was planned to follow in the second year, to track the combined effects of the Conservation Kit and Retail Coupon Programs upon CF-bulb market transformation in the residential sector. Due to budget constraints and cancellation of the second survey research phase, this study did not assess long-term retention, long-term satisfaction, Retail Coupon Program impacts in 2002, and ongoing market transformation.

Staging another CF-product distribution program, and following on with any retail boosters, offers the utility a second chance to reassess the ongoing transformation of the residential compact fluorescent lighting market. Survey research was effective at evaluating the 2001 Kit program. It should be supplemented in future with on-site surveys of efficient lighting opportunities in typical Seattle homes, and of retail stocking patterns for efficient and safe products that will solve consumer lighting problems.

.....Be Part of the Mercury Waste Management Solution

Seattle City Light should continue to participate in the regional dialogue about mercury waste management. Where the utility can productively take a hand toward a solution, perhaps through customer education and informational materials, information on responsible disposal should accompany any fluorescent lighting promotions.

Acknowledgments

A devoted group of utility staff have been key to advancing the use of compact fluorescent lighting in Seattle City Light's residential sector. They developed and implemented the Conservation Kit and Retail Coupon Programs during 2000-2002. A few have been working with residential CF lighting markets for the past decade. The Seattle City Light group includes Glenn Atwood, Community Conservation manager; Constance Fevold, program manager; Eugenia Morita, program coordinator; Anne Ducey and Yen Chin, research support; and Michael Little, conservation planner. The Seattle Public Utilities group includes David Broustis, Resource Conservation manager, and Mialee Jose, program manager.

The Programs

Conservation Kits, Retail Coupons, and Supplemental Distributions

About the Program Plan

In 2000, Seattle City Light saw the need for a new and broad program approach to increasing the use of efficient residential lighting. A conservation potential assessment presented to the Seattle City Council on June 15 identified compact fluorescent light bulbs and fixtures as the least-cost opportunity in the utility service territory. The impending West Coast energy crisis of 2000-2001 loomed. In mid-July, utility superintendent Gary Zarker engaged the Energy Management Services Division on the conservation potential assessment. Besides approving a commercial-industrial initiative called "10+10", he directed staff to make sure to get compact fluorescents into every household in the service area. During August-September, staff made inquiries and researched options; formal budget authority was obtained in early September, and by mid-October a written options plan had been prepared.

Seattle City Light has been an actor in fluorescent lighting transformation for over two decades, beginning with programs in the commercial sector.[7] In the residential sector, the utility lighting efforts had concentrated on existing and new construction multifamily buildings[8], until the advent five years ago of regional-based retail programs[9] sponsored by the Northwest Energy Efficiency Alliance (NEEA).

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[7] Lighting Survey and Incentive programs (1979-1983), Energy Management Surveys (1984-1992), Commercial Incentives Pilot program (1987-1991), and Energy Smart Design (1991-present), now Energy Smart Services.

[8] Multifamily Conservation programs, including the Common-Area Lighting program (1986-present), and Built Smart programs, including the Affordable Housing program (1983-present).

[9] LightWise point-of-sale program (1997-1998) and Energy Star® Lighting and Coupons (1999-2001), offered in cooperation with local electric utilities by the Northwest Energy Efficiency Alliance (NEEA).

Seattle City Light conducted research in the mid-1990s on use of a catalog offering compact fluorescent (CF) lighting products to the residential sector, in cooperation with other regional utilities.[10] That research recommended developing retail programs, finding ways to lower bulb costs, improving the quality and variety of products offered in retail stores, and helping customers make a gradual transition to CF lighting. The regional NEEA programs accomplished the first three goals, but still voluntary adoption of CF products was slow. A decade after electric utilities nationwide began the effort to transform the residential lighting market, the average household in Seattle still owned only one CF bulb.

Program developers in Seattle City Light's Community Conservation section came to recognize that a new initiative would be required to overcome the remaining barriers. While early adopters may have acquired a CF bulb during the 1990s out of curiosity, repeat sales were slow to pick up. The early selection of CF products was limited, users perceived them as not fitting many fixtures, and lighting quality did not fully meet user expectations. Since their first introduction, many of these limitations have been ameliorated by a proliferation of product designs and improved lighting quality. Utility planners considered how to overcome the remaining market transformation barriers, to move customers to try the bulbs again, or indeed, for the first time.

Program Goals & Objectives

A year before program implementation, Seattle City Light's Community Conservation group had begun exploring ways to reintroduce compact fluorescent lighting to residential customers and advance the goal of market transformation. Changes in the West Coast energy market beginning in June 2000 generated a sense of urgency. In late summer 2000 planners studied six service delivery options and sought budget authority. By October the program design jelled and implementation preparations began in earnest. The formal program goals were stated as follows:

> *A compact fluorescent light bulb (CFL) mass distribution program is to be implemented in 2001 by Seattle City Light as a means to achieve a short-term increase in energy savings. The main goals of this CFL distribution program are:*
>
> 1. *To increase customer awareness of and future demand for CFLs.*
> 2. *To acquire cost-effective conservation energy savings as soon as possible.*

In addition to the two main program goals, four subsidiary goals of a CFL program were identified:

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[10] This research and demonstration project also included regional utilities such as Puget Sound Energy/Puget Power, Snohomish County PUD, Tacoma City Light, and the Electric League of the Pacific Northwest.

Brattesani, Karen A. and Anne M. Ducey, SEATTLE CITY LIGHT COMPACT FLUORESCENT LIGHTING RESEARCH REPORT, Research Innovations for Community Conservation Section, Energy Management Services Division, Seattle City Light (Seattle WA: September 1994).

3. *To improve public relations between Seattle City Light and utility customers.*
4. *To support the retail sector component of market transformation.*
5. *To utilize collaboration opportunities and to leverage other resources.*
6. *To reduce the impact of the proposed [impending] power cost adjustment on customers.*

Program planners also identified five strategic objectives, some of which follow directly from the stated goals.

A. *Serve the broadest range of residential customers, allowing every residential customer to have an opportunity to take advantage of this program (including apartment dwellers and condo/townhome owners). — Goals 1 & 3*
B. *Help residential customers get started on reaching their 10% energy savings goal for 2001. — Goal 2*
C. *Use a delivery method that minimizes staffing intensity. — Goals 4 & 5*
D. *Help reduce Seattle City Light's purchased power bill. — Goal 6*

Delivery Options

The original program options paper [11] identified six potential program delivery methods.

Two proposed options would offer unsolicited delivery of a free CF bulb to residential customers. The utility could either:

1. Mail a free CF bulb to all residential customers; or,
2. Deliver a free CF bulb door-to-door to all residential customers.[12]

Two other options would solicit customer requests for a pair of free CF bulbs. The utility could mail a solicitation to all residential customers containing:

3. A tear-off reply card that customers send back in order to receive two free CF bulbs in the mail; or,
4. A coupon for two free CF bulbs redeemable at a neighborhood community center.

And finally, two options were proposed to utilize the retail market through a discount coupon redeemable at participating retailers. The utility could:

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[11] Fevold, Constance and Eugenia Morita, COMPACT FLUORESCENT LIGHT BULB (CFL) MASS DISTRIBUTION PROGRAM OPTIONS PAPER, Community Conservation, Energy Management Services, Seattle City Light (Seattle WA: 26 Oct 2000).

[12] Seattle City Light had prior experience with this method through the 1992 Home Water Savers program, which delivered a kit containing hot-water saving measures (showerhead, faucet aerator) to the door of every residence in the Seattle City Light service area.

5. Buy down retailers' wholesale price of CF bulbs and mail all residential customers a discount coupon; or just,
6. Send all residential customers a discount coupon.

Other options to extend benefits to a wide range of residential customers were identified to supplement the service-area wide program.

- Offer a free CF bulb to customers who complete the Home Resource Profile, an online survey that gives them information on their resource usage and ways to reduce utility bills.
- Offer a free CF bulb through Seattle City Light's Web site.
- Distribute free CF bulbs at community events, many of which take place at neighborhood and ethnic festivals.
- Distribute free CF bulbs through Block Watch Captains or similar community-based infrastructures.

Issues and Concerns

As the Community Conservation group began considering ways to reintroduce compact fluorescent lighting to residential customers and advance the overarching goal of market transformation, they had to wrestle with issues around delivery methods, reaching diverse populations, opportunities for collaboration, concerns for home safety and bulb disposal, environmental stewardship, and program timing.

Encouraging Market Transformation

Market transformation, in this evaluation, refers to the change in product usage over time, in this case the change from incandescent to compact fluorescent bulbs. Market transformation has been defined as what occurs "when a DSM program induces a lasting change in the structure of an energy product or service market or the behavior of market actors that results in greater adoption and penetration of energy-efficient technologies."[13]

Market transformation involves two key components: customer demand and manufacturer/distributor/retailer supply. Building customer awareness and demand became a primary goal for planners of new program options. They thought this could be accomplished by coordinating with ongoing utility communication initiatives, by including information in program marketing and promotion materials, and by including additional information with the CF bulbs. Support of the retail sector became a subordinate objective in order to increase the likelihood that retailers would carry CF products and customers would have the opportunity to purchase them.

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[13] Rosenberg, M., "Measuring Spillover and Market Transformation Effects of Residential Lighting Programs," Xenergy Inc, PROCEEDINGS OF THE ACEEE 1996 SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS, American Council for an Energy Efficient Economy, Washington DC (Pacific Grove CA: August 1996), 3:137-45.

Direct support of manufacturers, such as NEEA's earlier buy-down and discount efforts through the regional LightWise program, was questioned for its practicality on other than a regional basis.[14] A direct approach was rated lower in the program planning process. Seattle City Light did see a way to engage the manufacturing sector in the new program, though, by acquiring an economy of scale through direct bulk purchasing.

.....Unsolicited Delivery of CF Bulbs

In laying out program options, planners felt that any delivery mechanism that put a CF bulb in customer hands would increase awareness of this technology. However, the nearly universal opinion of conservation professionals, consulted in researching program options, was that an approach that simply gave customers CF bulbs unsolicited would result in a significant percentage not being installed. In contrast, an approach that required customers to take some action in order to receive the CF bulb would have a much higher installation rate and would strengthen their knowledge of and commitment to the technology. This sort of approach would likely improve cost-effectiveness for the utility.

Installation rates for unsolicited delivery options were initially estimated at 50%, based in part on impact results from the Home Water Savers Program carried out by Seattle City Light in 1992.[15] Planners were encouraged by City Light's experience with the earlier program that delivered unsolicited efficient showerheads to all residential customers and achieved a 65% installation rate. However, there was considerable planning uncertainty in the installation estimate for a solicited CF bulb distribution program, as no such lighting program had been attempted anywhere to date on a similar scale, to the knowledge of the planners.

.....Reaching Diverse Populations

Planners recognized that barriers to program participation exist for various populations in the community, such as low-income individuals and those for whom English is not their native language. Supplemental approaches such as distribution at community festivals and continued distribution through the utility's Neighborhood Power Project were considered as ways to address these concerns.

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[14] However, Snohomish Public Utility District did engage in a highly successful manufacturer buy-down program later, during 2002, that was developed independently of the regional NEEA/BPA CFL Retail Coupon Program. The Snohomish program entailed developing a network of 45 retailers, a distributor representing four manufacturers, and a fifth manufacturer. Lowest price bids were solicited, then a $2 manufacturer buy-down was negotiated for specific quantities. Utility coupons were tracked at the sales register, and many retailers offered additional in-store coupons. A significant and steady demand developed that continues into 2003. The utility staffing cost remains around half of a full-time equivalent position.

Personal communications: Gary Lintz, Snohomish Public Utility District (Seattle WA: 2003).

[15] Brattesani, Karen A. and Debra L. Okumo [Tachibana], SEATTLE CITY LIGHT SURVEY RESEARCH FOR THE HOME WATER SAVERS PROGRAM, PHASE I, Research Innovations and Evaluation Unit, Energy Management Services Division, Seattle City Light (Seattle WA: April 1993).

As part of the 1992 Home Water Savers (showerhead) program, the Conservation Corps delivered low-flow showerheads door-to-door. For seniors and the disabled, a showerhead installation service was offered at no cost to the customer. Planners for the new lighting program felt that this need would not be as acute with a CF light since it simply involves changing out a bulb, rather than replacing a plumbing fixture.

Interest was expressed in using community groups to deliver CF lights as a way to reduce staff requirements and program delivery costs. The Block Watch Program coordinated by the Seattle Police Department had been used in the past on a limited basis for CF light distribution through the Neighborhood Power Project. Expansion of this collaboration was suggested as a supplemental delivery opportunity.

..... Collaboration Opportunities

Three specific collaboration opportunities are worth highlighting: with Seattle Public Utilities (SPU)—Seattle's water provider, the Northwest Energy Efficiency Alliance (NEEA), and Puget Sound Energy (PSE).

When approached, the SPU Resource Conservation unit expressed interest in joining with City Light on a CF bulb distribution program, to also offer customers a free bathroom aerator—plus other materials—which would provide additional energy savings as well as water savings. They might pay for the water conservation related materials and incremental postage costs. This collaboration had the potential to make the program less costly to Seattle City Light and also provided an opportunity to demonstrate effective collaboration on behalf of customers by the two City utilities. Since the early 1990s the conservation groups in these two utilities had found a number of ways to incorporate 'green' resource measures and activities into their individual and mutual programs.

The regional energy collaborative, NEEA, had been actively engaged with the retail sector; they and their contractors could serve as valuable resources in any retailer-based option that Seattle City Light pursued. Additionally, product specifications for the proposed giveaway option could require supply of an *Energy Star*® CF bulb, in keeping with the branding efforts of NEEA to further promote market transformation and customer education about quality lighting products. However, the program would specify bulbs with a high power factor (Energy Star® only requires a mid-power factor).

Meanwhile, Puget Sound Energy, a neighboring investor-owned gas and electric utility, expressed interest in coordinating efforts with Seattle City Light, but only in a retailer-based option. The two utilities had collaborated in the past on water and energy programs, research and development.

..... CF Bulb Safety, Disposal, and the Environment

A final concern for program planners was home safety and how to deal with issues of eventual CF bulb and packaging disposal.

A factor in the decision to convert to fluorescent lighting is home safety. Lighting comprises about 10% of the typical household's energy use. The standard incandescent light bulb wastes 90% of energy input as heat and only converts 10% into light; in operation it is hot to touch and can cause burns. A compact fluorescent bulb converts

70% of energy input into light, and as a result is cool or merely warm to the touch. This makes fluorescent light a far safer choice than the third commonly used light source, halogen bulbs—which generate tremendous heat (500-1100ºF) and pose a grave safety hazard in the home. Halogen torchiere lamps have caused hundreds of home fires and serious injuries across the US. Compact fluorescents are safer and can save up to 10% of total home energy use.[16]

Garbage from multifamily buildings falls into the 'universal waste stream' category and may not contain spent fluorescent lamps. Local Household Hazardous Waste Facilities accept CF bulbs for recycling. And bulbs that burn out prematurely, during their one- to two-year warranty period, should be returned by customers to the retailer for a replacement. Disposal of CF bulbs by residential customers in single-family homes is not currently regulated. In the meantime, the law currently allows for single-family household CF bulbs to be disposed of in residential trash, although consumers are urged to wrap a spent bulb in a sealed bag to prevent cuts from glass should the bulb break.

Staff were determined that the Conservation Kit itself should reflect a responsible attitude toward the waste stream and the environment. The custom-made mailing box was specially designed of recycled content, recyclable cardboard, dimensioned to fit the contents. Vendors of bulbs were required to supply them in cardboard packaging, not plastic. All printed materials were produced on recycled content paper.

.....Timing

Planners judged that a program should be implemented as soon as practical in 2001 so that the utility would receive the greatest possible benefit from the associated energy savings. There were three other timing factors to be considered: 1) the lighting season; 2) manufacturing and supply capacity; and 3) contracting and purchasing processes.

It seemed that customers would be most receptive to lighting-related educational messages and most motivated to request or purchase and install a CF light during the lighting season, that part of the year with less daylight from September through March. It appeared that manufacturers would be able to meet program needs, even if implemented early in 2001 to all residential households. (This was confirmed during detailed implementation planning.)

Contracting and purchasing requirements, however, could have been a barrier to launching a program by March of 2001. Both a Vendor Contract and a Services Contract had to be processed through the City Executive Services Department to start delivery of the program. The Vendor Contract, which called for the supply of 100,000-340,000 bulbs, required an Request for Proposals (RFP), as did the Services Contract needed to acquire a fulfillment company to handle processing and delivery of the bulbs.

After exploring the background issues around delivery, target populations, collaboration, safety, disposal, stewardship, and timing, the planning group turned to the task of articulating program goals, objectives, and delivery options.

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[16] Fevold and Morita (2000).

The Adopted Program Design

The adopted program design incorporated Delivery Options 3 and 6. Program developers judged that these steps would best further the program objectives to encourage future purchases, promote market transformation, increase long-term use of CF lighting by residential customers, and minimize staffing intensity.[17]

..... Option 3: Kit Program

> *Mail a solicitation to all residential customers containing a tear-off reply card which customers send back in order to receive two free CF bulbs in the mail.*

The first and major phase of the adopted program involved mailing CF bulbs in a Kit to customers who respond to a mailed solicitation. The Kit would also contain an efficient bathroom faucet aerator supplied by the City water utility, Seattle Public Utilities (SPU), along with a diagnostic water flow-rate measurement bag. Planners assumed a 30% solicitation response rate, based on past experience of PacifiCorp in a give-away program and their assumption for planning a similar program for Oregon residential customers.[18] Planning projections were that 90% of Kit recipients would install bulbs and 75% would install the faucet aerator. Option 3 required the use of a fulfillment company to mail solicitation letters and Kits. Table 3 and Table 4 present quantitative and qualitative planning projections for Option 3 lighting and water energy efficiency measures (EEMs).

The key **pros** of this delivery channel include a significantly higher likelihood of bulb installation, which in turn justified distribution of two bulbs per customer. This option was viewed as having the highest anticipated energy savings. It offered the opportunity to collaborate with SPU and obtain additional energy savings by including a free bathroom aerator. This underscored the comprehensive message of resource conservation, also increasing customer awareness of combined City utility conservation efforts. This delivery method was more convenient for customers than pickup at Community Centers, and had simpler administrative and coordination requirements. This delivery method also benefited retailers by increasing customer awareness of and demand for CF technology. The estimated budget fell within available 2001 funds, even allowing for a fall retail coupon option. Finally, it had the lowest levelized cost of all six options at 30 mills, or 26 mills if an aerator were included.

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[17] Fevold and Morita (2000).

[18] Eberlee, Rebecca (Becky), personal communications with Eugenia Morita, Seattle City Light (20 September 2000).

The PacifiCorp program plan called for sending a pair of CF bulbs to 300,000 single-family households through a two-stage solicitation–return card–distribution program. They had concluded from focus groups that most customers still thought of fluorescent light technology in terms of where the industry was about six years before. The utility's strategic response was to get new products into customer hands to encourage follow-on retail purchasing.

The **cons** to this option included the estimate that only 30% of customers would actually participate, leaving 70% of our residential customer base without a CF light. On the other hand, there was a risk of over-committing the budget if there were a significantly higher than expected response rate. To address this possibility, a commitment was needed that extra funds would be available or the implementation would need to be phased in at a slower pace to manage this risk.

Table 3: Option 3 Quantitative Planning Projections

Criteria		Planning Projections at 30% Response
Program cost		$1,621,800 total
Light EEMs	Distributed	204,000 bulbs*
	Installed	204,000 bulbs*
	1st year savings	9,384 MWh = 1.07 aMW
	Levelized cost	29.92 mills
Water EEMs	Distributed	102,000 aerators & bags*
	Installed	102,000 aerators
	1st year savings	3,066 MWh = 0.35 aMW
	Levelized cost	29.36 mills

Table 4: Option 3 Qualitative Planning Projections

Criteria	Planning Projections
Timing considerations	Staggered solicitation mailings so reply cards do not all return at once; implement by March equinox
Retailer support	City Light supplies bulbs; no retailer involvement, but allows for retailer follow-up
Administrative function	Hire mailing fulfillment company to provide turnkey delivery mechanism for initial solicitation mailing, reply card processing, Kit mailing
Diverse targets	All residents receive solicitation, but requirement for customer action creates barrier for traditionally non-participating segments of the customer base
Installation likelihood	Requires proactive step (return mail tear-off reply card) from customer to receive Kit, increasing likelihood to install
Leveraged resources	Inclusion of free aerator allows collaboration with SPU

Option 3 Discussion

As we learned late in 2001, PacifiCorp disseminated results of two pilot programs conducted in Walla Walla and Yakima, Washington, to compare the effectiveness of three approaches to distributing CF bulbs to residential customers.[19] Whether directly mailed two bulbs, directly mailed one bulb with a two-for-one store coupon, or mailed an offer for two bulbs, customers responded to all three distribution methods by installing the products at a rate of more than 90%. PacifiCorp used these results to design a CF program that went into effect in October-November 2001. They projected spending $1.2 million to save 1.44 aMW from mailing two bulbs to 97,000 residential customers.

..... Option 6: Coupon Program

> *Send all residential customers a coupon for dollars off a CF bulb at participating retailers.*

The second major phase was designed to encourage CF lighting availability and offer discounts for CF bulbs purchased in retail stores, through mailing a coupon for CF bulb rebates at the sales register, and subsequently mailing a coupon rebating selected CF fixtures. A 10% response rate was assumed for this retailed-based option. This option required utilizing retailers to honor coupons at the sales register, and coordination with NEEA. Table 5 and

Table 6 present quantitative and qualitative planning projections for Option 6 lighting and water energy efficiency measures (EEMs).

The key **pros** of this option were that it supported the supply chain and promoted market transformation. This met the goal of encouraging long-term sustained use of CF lighting, accomplished by working with retailers to carry CF products and bringing customers into stores to demonstrate demand for them. Only one form of product subsidy was used, the customer coupon; there was no manufacturer buy-down of wholesale prices. The use of customer coupons was designed to help overcome the current customer barrier of high first cost, exposing more customers to CF lights in retail settings. Installation was considered likely since the customer would have to pay something for the product. It allowed for the possibility of supporting and/or coordinating with NEEA's market transformation efforts at promoting the Energy Star® label on CF lights. This collaboration was intended to further reinforce the message to retailers that regional utilities and agencies actively promote CF usage, thus motivating retailers to maintain the product in stock and increase availability over the long term to our customers.

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[19] NORTHWEST ENERGY COALITION REPORT (Portland, OR: November 2001), 20:11; www.nwenergy.org. Also, personal communications to Eugenia Morita from Steve Lindstrom, PacifiCorp.

The **cons** to this option included the effort required to sign up retailers, train their sales staff, and maintain ongoing contact. Procedures needed to be established and administered to process customer coupons and retailer invoices and to reimburse retailers. A relatively small 10% response rate was assumed, since the customer had to go to particular stores and pay some amount for the product. This resulted in relatively low expected energy savings. Finally, the subsidized price had the potential to create unrealistic price expectations for customers.

Table 5: Option 6 Quantitative Planning Projections

Criteria	Planning Projections at 10% Response
Program cost	$223,280 total
Light EEMs Distributed	34,000 bulbs
Installed	34,000 bulbs
1st year savings	1,564 MWh = 0.18 aMW
Levelized cost	31.78 mills

Table 6: Option 6 Qualitative Planning Projections

Criteria	Planning Projections
Timing considerations	Sign up retailers to have stock on hand and to honor coupons in store
Retailer support	Gets retailers signed up and customers in stores
Administrative function	Hire consultant to coordinate with retailers, monitor stores for stock, handle invoices and coupons
Diverse targets	Potential to create physical and economic barriers, due to requiring customer to go to store and pay for part of cost
Installation likelihood	Requires proactive step (going to store and buying product), increasing likelihood to install
Leveraged resources	No SPU involvement; leverage NEEA resources to work with retailers

Option 6 Discussion

Program Option 6 was implemented in September 2001 through April 2002. In autumn 2001 Seattle City Light mailed out a $6-off coupon for any Energy Star® labeled CF bulb, 13-Watts or higher, sold at a participating retail store. The coupon was included in bills mailed during the September-October bimonthly cycle (09/10-11/07) to take advantage of the start of the lighting season. The coupon was redeemable at the cash register through

December 31, 2002, with no mail-in rebate required. A list of participating retailers in the Seattle City Light service area was included with the coupon.[20] Customers were also able to access a web site to get an updated list of participating stores, as more stores were added over time. This offer was limited to one coupon per household. Coupons were only distributed in residential customer bill envelopes during the single billing cycle, and were not available over the telephone, through the web site, or at the store.

Seattle City Light reached an agreement with the Bonneville Power Administration in which the BPA would fund the CF Coupon Program in exchange for a reduction in the amount of power purchased by Seattle City Light. The original $6-coupon expiration date of March 31, 2002 was modified to December 31, 2001, to accord with the closing date of the BPA's "Phase 3"efforts.

Seattle's $6-off coupon was part of a region-wide campaign to discount Energy Star® qualified CF bulbs. The coupon campaign was a collaborative effort of the Bonneville Power Administration, the Northwest Energy Efficiency Alliance, 90 electric utilities and 1,400 retailers in the Pacific Northwest region. By the end of 2001, regional utility customers redeemed more than 3.3 million coupons, accounting for half of all the energy-saving bulbs sold—6.5 million bulbs. By comparison, sales figures in the previous twelve months of 2000 were about 380,000 bulbs in the entire region.

Seattle City Light also participated in the BPA's "Phase 4" effort, distributing a second retail discount coupon in January-February 2002 residential bills. This coupon, which expired April 30, 2002, gave customers a $15 discount off the price of any Energy Star® labeled CF torchiere floor lamp.[21]

Selected Supplemental Options

> *Distribute free CF bulbs at community events, and distribute free CF bulbs through Block Watch Captains or similar community-based infrastructures*

The adopted strategy combined the two main delivery options along with supplemental efforts. These included a continued collaboration with the Block Watch organization,[22]

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[20] The list of $6-coupon retailers included: most Ace Hardware stores, Bartell Drugs, City People's Mercantile, Chubby & Tubby, Fred Meyer, Hardwick's, Home Depot, Limback Lumber, Logan Lumber, Longs Drug, Lowe's Home Improvement, Madison Market, McLendon Hardware, Morgan's Electric, PCC Natural Markets, Skyway Super Value Foods, most True Value Hardware stores, and Walgreen's.

[21] The list of $15-coupon retailers included: Chubby & Tubby, Fred Meyer, Home Depot, Logan Lumber, McLendon Hardware, Seattle Lighting, and World Lighting.

[22] Block Watch is a Seattle Police Department, Community Outreach, prevention and safety program. Begun as a national program, it is based on the principal that neighbors working together are the first and best line of defense against crime. The Seattle program began in 1972, and has seen significant involvement and success. Just seven years after the program began, it was recognized as an "Exemplary Project" by the United States Department of Justice's National Institute of Law Enforcement and Criminal Justice. Roughly 30% of Seattle neighborhoods are currently involved in Block Watch, compared to a national average of 8-11%.

distribution through the Neighborhood Power Project,[23] and presence at community festivals, to allow Seattle City Light to distribute the greatest number of CF lights cost-effectively and in the shortest time possible. Supplemental distributions helped ensure that CF bulbs would actually be installed and used in the most optimal places (those with the highest usage), to better assure predicted savings and associated levelized costs.

From Plan into Action

As the planned program approached implementation and a residential customer database was extracted from the utility customer information system, the projection of eligible customers dropped from 340,000 to somewhat below 320,000. Table 7 describes the expected impacts from energy efficiency measures proposed for the Conservation Kit Program.

Potential energy savings were projected at 110 kWh per Kit, comprised of 51 kWh per 15-W bulb, 43 kWh per 23-W bulb, and 15 kWh per faucet aerator. Potential water savings were estimated at 400 kWh per Kit from both faucet aerators and showerheads (acquired and installed as a result of testing with the Kit flow-rate bag, in homes requiring both measures). Budgets were projected for two potential levels of customer response to the Kit solicitation letter: 30% and 40%.

The potential for energy and water savings from the Kit aerators and flow-rate bags (meant to encourage showerhead replacements) was limited by the impact of prior Seattle utility programs. Between 1992 and 1999, about 47% of bathroom faucet aerators had been replaced in single-family all-electric homes and homes with non-electric heat, through the Home Water Savers, Warm Home, and Neighborhood Power Programs. Over 50% of faucet aerators had been upgraded in multifamily units with electric heat, through the Home Water Savers and Multifamily Conservation Programs (not to mention the impact during 1994-2000 of Seattle Public Utilities conservation programs). The prior impact of utility-supplied high-efficiency showerhead measures had reached into 60% of current single-family homes and multiplex units, and into 51% of current multifamily (5+unit) dwellings.

Immediately in 2001, program planners sought funding on a fast track for the new program. City of Seattle Council Ordinance 120253 (February 2001) was enacted; among other things, it authorized Seattle City Light to administer a residential efficiency program during 2001 to conserve electric resources, including distribution of CF bulbs. The initial budget to mount the Conservation Kit Program, established from the utility's general fund (March 2001), included about $1,438,000 for CF bulbs and $407,000 for the distribution contractor. This level of funding was planned to meet the expected 30% customer response rate, with some modest leeway for the 40% contingency.

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[23] Neighborhood Power is a City interdepartmental effort, led by City Light, that employs a community-based strategy to promote conservation and neighborhood-building programs in selected areas of Seattle. The project goal is to conserve valuable resources such as energy, water, and a clean environment. The annual projects also provide benefits to participating residents and business owners, such as saving money on utility bills, improving comfort and safety, and building a stronger community.

Table 7: Expected Impact of Energy Efficiency Measures (EEMs)

Implementation Planning Projections[24]	30% of customers with 100% EEM installation	40% of customers with 100% EEM installation
Response rate	96,000 Kits	128,000 Kits
Program cost per customer	$14.80	$14.70
ANNUAL ELECTRIC SAVINGS, LOAD REDUCTION, AND WATER SAVINGS		
Light & Water EEMs	10,560 MWh 1.2 aMW	14,080 MWh 1.6 aMW
Water EEMs	38,400,000 gallons	51,200,000 gallons

* The initial plan contained the assumption that Seattle City Light had 340,000 residential customers eligible for program services; several months after plan adoption, this estimate was revised downward to 320,000.

Once initial batches of solicitation letters were sent out and responses began to flow in, it became apparent that more money would be necessary to meet demand, up to a newly projected 50% response rate. Council Ordinance 120322 (April 2001) provided $525,000 in supplemental funds to purchase more CF bulbs. A third source of supplemental funds came by redistributing resources from other program budgets of the Energy Management Services division (May 2001), as response rates moved past 50% on the way to nearly 60%. Another $375,000 was allocated for bulb purchases and the distribution contract was increased by about $420,000. In the end, program budgets that started at $1.8 million reached nearly $3.2 million (see Appendix A), due to customer demand.

[24] Morita, Eugenia, "SCL's Conservation Kit Program: Highlights," Community Conservation, Energy Management Services, Seattle City Light (Seattle WA: 23 February 2001).

The Impact Evaluation

Seattle City Light, Seattle, Washington

Evaluation Objectives

Research Questions

This evaluation was designed to determine whether the Conservation Kit Program achieved the following aims, restated from the program goals and objectives.

1. Did the Kit program improve public relations between Seattle City Light and utility customers?
   - Did it serve the broadest range of residential customers?
   - Did it allow every residential customer to have an opportunity to take advantage of this program (including apartment dwellers and condo/townhome owners)?
2. Did the Kit program increase customer awareness of and future demand for compact fluorescent lighting?
   - Did it increase customer awareness of CF lighting?
   - Did it increase future demand for CF lighting?
3. Did the Kit program support the retail sector toward home lighting market transformation?
   - Did it use the retail sector to move the home lighting market from incandescent sources to fluorescent products?
4. Did the Kit program utilize collaboration opportunities and leverage other resources?
   - Did it collaborate with and leverage the resources of other agencies?
   - Did it use a delivery method that minimizes staffing intensity?
5. Did the Kit program acquire cost-effective conservation energy savings as soon as possible in 2001?
   - Did it help residential customers get started on reaching their 10% energy savings goal for 2001?
   - Did it acquire conservation energy savings cost-effectively?

6. Did the Kit produce immediate economic benefits and reduce the impact on utility customers of the proposed rate adjustment for power costs?
   - Did it help reduce Seattle City Light's purchased power bill?
   - Did it help reduce energy bills for Seattle City Light residential customers?

Methodology

Seattle City Light launched a process and impact evaluation in mid-2001, starting with a survey of program participants and nonparticipants. The evaluation design was framed to minimize data acquisition costs while capturing indicators of program free-riders, spillover effects, and the status of the Seattle-area market trends in residential use of CF lighting. In service of the evaluation objectives, a mailed survey was implemented in fall 2001–winter 2002, six months after Kit distribution. The survey research was designed to assess:

- Prior use of and satisfaction with CF bulbs
- Installation rates for the Kit bulbs and faucet aerator, as well as satisfaction with Kit bulbs
- Subsequent purchases during 2001 of CF bulbs and showerheads
- Differences between participants (Kit requestors) and nonparticipants (non-requestors)
- Barriers to requesting the Kit or using the Kit products

The survey assessed impacts of the Kit faucet aerator and water flow-rate bag, as well as spillover effects from the Kit Program on retail activity (through subsequent purchases during 2001 of CF bulbs and showerheads). A long-term survey was scheduled to follow in 2002. This two-survey method had been used with success for a similar mass distribution showerhead program mounted by Seattle City Light in 1992.[25]

The mailed survey, designed jointly by the utility program evaluator and the survey research consultant, was fielded by the utility. Proportional stratified 1% random samples were drawn from a program database of all residential customers. Survey instruments were mailed in fall 2001–winter 2002; 40% of subjects returned completed questionnaires, for respondent samples of 629 participants and 581 nonparticipants. This number included a second group of nonparticipants sent a revised questionnaire due to low initial survey response.

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[25] Brattesani, Karen A. and Debra L. Okumo [Tachibana] (1993).

Brattesani, Karen A. and Debra L. O. Tachibana, SEATTLE CITY LIGHT SURVEY RESEARCH FOR THE HOME WATER SAVERS PROGRAM, PHASE II, Research Innovations and Evaluation Unit, Energy Management Services Division, Seattle City Light (Seattle WA: March 1994).

The survey results provide a 4% level of precision on proportions near 50%, with a 95% confidence interval. Group differences were analyzed using chi-square statistics for frequency data. Results are reported for items showing differences significant at the probability levels of $p<.000$ to $p<.05$.

The short-term survey was scheduled to go into the field immediately after Labor Day. Mail-out was held back to avoid initiating the survey during the week of September 11, 2001. Subsequent anthrax threats to the US postal system caused apprehension that residents would reject survey-related mail. This was a difficult time to ask customers to respond, given their other concerns, so extra efforts were made to elicit their interest in the survey. These efforts included design features (layout and color); posting directly from Seattle City Light in envelopes with the utility return address; multiple follow-ups via a reminder postcard and booklet re-mailings; and alerting customers to the CF bulb $6 retail coupon offer enclosed with autumn bills.

The responses to specific survey questions enabled the calculation of program impacts such as annualized megawatt-hour (MWh) energy savings, average megawatt (aMW) utility load reduction in 2002, annualized gallons of reduced water and waste-water (sewer) flows, and levelized cost in mills per MWh (or, cents per kWh) of program energy savings. The bases for these calculations are shown in Table 8 through Table 12.

Parameters and Algorithms

A variety of sources contributed parameters for use in calculations of Conservation Kit Program impacts. These included Seattle City Light's recent residential customer characteristics survey, a light metering study by Tacoma City Light, and technical potential analyses by the Northwest Power Planning Council for Seattle City Light's service area, along with prior and current water metering studies.

Throughout this impact evaluation, calculation of energy savings has been based upon a weighted average value of 54.5 kWh annually per installed CF bulb. This parameter was derived from the product of Seattle City Light residential sector characteristics (RCCS reports[26] of dwelling and space heating types); assumed wattages (before and after installation of Kit bulbs); hours of use by lamp location (Tacoma City Light study[27]); proportion installed by location (Dethman study[28] planning projections; survey research

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[26] Geist, Arlene M., 2000 RESIDENTIAL CUSTOMER CHARACTERISTICS SURVEY, Financial Planning Unit, Finance Division, Seattle City Light (Seattle WA: December 2001).

Households by residential subsector: 13% single-family electric space heat, 32% multifamily electric space heat, and 55% residential non-electric space heat (mainly single-family).

[27] Tribwell, Lyle S. and David I. Lerman, Tacoma Public Utilities, "Baseline Residential Lighting Energy Use Study," PROCEEDINGS OF THE 1996 SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS, American Council for an Energy Efficient Economy, Washington DC (Pacific Grove CA: August 1996), 3:153-160.

Estimated hours of usage per day: 4.7 porch (exterior) or entry-hall, 3.9 kitchen, 3.1 living-dining room, 1.7 bathroom, 1.3 bedroom, 2.0 laundry-utility room, 2.0 den-office, 1.0 garage, and 1.3 other.

actuals)[29]; and assumptions about take-back, removal/replacements, and space heat interaction (NWPPC).[30] The expected energy savings *before* adjustments for removal/replacement, take-back, and space heat interaction were 67.5 kWh per bulb per year.

The Northwest Energy Efficiency Alliance reports that 5.5% of regional compact fluorescent lighting retail sales during 2001 may be attributed to residents in the area served by Seattle City Light. Total annual regional market effects were 31.13 average megawatts (aMW) excluding utility coupons and giveaways, with the average bulb saving 66 kWh per year.[31]

The Alliance further states that in 2001 retailers reported 11,143 CF bulb $6 coupon redemptions by Seattle City Light customers. While those coupons bore a December 31, 2001 deadline, retailer reports continued into 2002 on another 9,922 CF bulb $6 coupon redemptions, as well as 1,106 CF fixture (torchiere) $15 coupon redemptions. This brings the total number of coupons redeemed up to 22,171, or customer response rates of about 6.7% for the bulb coupons (distributed in September-October 2001 Seattle utility bills) and 0.3% for the fixture coupons (distributed in January-February 2002 bills). The response rate expected by NEEA for each coupon was 10%.

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[28] Dethman, Linda, RESIDENTIAL ENERGY EFFICIENCY LIGHTING SURVEY (Seattle WA: August 1991).

Estimated percent installed by location—*In single-family electric and in non-electric space heat households:* 60% porch (exterior), 11% entry-hall, 12% kitchen, 17% living-dining room; —*In multifamily electric households:* 15% entry-hall, 35% kitchen, 20% living-dining room, 15% bathroom, 15% bedroom.

[29] The Kit survey reported the following actual percentages installed by location—*In single-family electric space heat households:* 17% porch (exterior), 7% entry-hall, 14% kitchen, 34% living-dining room; 4% bathroom, 10% bedroom, 7% laundry-utility; 7% den-office; —*In non-electric space heat households:* 18% porch (exterior), 6% entry-hall, 12% kitchen, 26% living-dining room; 6% bathroom, 11% bedroom, 9% laundry-utility; 12% den-office; —*In multifamily electric households:* 5% porch (exterior); 8% entry-hall, 16% kitchen, 40% living-dining room, 10% bathroom, 15% bedroom, 1% laundry-utility; 5% den-office.

[30] Eckman, Thomas, NORTHWEST CONSERVATION AND ELECTRIC POWER PLAN, Northwest Power Planning Council and Regional Technical Forum.

Estimated impact of *take-back* (20% on exterior porch lighting, 5% on interior locations), *removal/replacements* (12%), and *space heat interaction* (0% on exterior porch lighting, 0% with nonelectric space heating, and 22% on interior locations with electric space heating). Note that *take-back* is not to be included in total resource cost (TRC) calculations, although it would be included in levelized cost from the utility perspective.

[31] Northwest Energy Efficiency Alliance, "Energy Star® Residential Lighting," 2001 MARKET ACTIVITIES REPORT (Portland OR: 2002).

Table 8: Calculation of Energy Savings Impacts of Kit Lighting Measure Distribution

Lighting Measure Impacts	Calculation of Annual kWh
Customers sent solicitation	Database customer count
Requested Kits delivered	Database Kit count (Kits)
Immediate Kit effect: *Kit bulbs installed immediately*	Kits * 54.5 kWh * 1.60 bulbs/home^
Delayed Kit effect: *Kit bulbs installed in 6-8 months*	Kits * 54.5 kWh * 0.40 bulbs/home^ * 23% likely to do / 33% who did not install^
Cumulative Kit effect	Immediate Effect + Delayed Effect
Free rider effect on immediate installations	Kits * 54.5 kWh * (-0.20) bulbs/home^
Net program effect from Kit bulbs	Immediate Effect + Delayed Effect – Free Riders
Nonparticipant CF bulb purchases: *After spring 2001, survey report*	(Customer count – Kit count) * 54.5 kWh * 0.25 bulbs/home^
Participant CF bulb purchases: *After receiving Kit, survey report*	Kits * 54.5 kWh * 1.04 bulbs/home^
Total CF bulb purchases: *During intervening period Summer-Fall 2001, survey report*	Participants + Nonparticipants [97% of NEEA estimated annual sales]
PNW regional CF bulb retail sales: *CF bulb sales during all of 2001, NEEA report*	Regional sales count (Sales)
Seattle area CF bulb retail sales: *During all of 2001, NEEA calculation*	Sales * 5.5% attribution * 31.13 aMW * 8,760 hours/year / 66 kWh/bulb

^ Indicates variables drawn from results of survey research (see Table 25, Table 26, Table 29, Figure 8).

The installation rate for CF bulbs distributed through community events and infrastructures was deemed to be 75%. This value was selected by program planners to represent a conservative value midway between the evaluated 65% installation rate seen in the early 1990s for unsolicited showerheads (through the Home Water Savers Program) and the 90% installation rate expected for solicited CF bulbs (through the Conservation Kit Program). In the absence of measurement data for this distribution route, the evaluation likewise adopts 75% as the installation rate parameter.

With respect to the Mariners baseball game distribution, an additional factor was introduced to represent the 20% proportion of game attendees expected to have originated from residences in the Seattle City Light service area.

Table 9: Calculation of Energy Savings Impacts of Other Non-Kit Distributions

Other Direct Distributions of Bulbs	Calculation of Annual kWh
Block Watch (BW) distribution: to "Night Out" event participants for porch lights	17,000 * 75% installation rate * 45W * 1000 * 6.7 hours/day * 365
Low-Income (LI) distributions: to government and non-profit housing providers and past participants in the Low-Income Multifamily Pgm	32,606 * 75% installation rate * 54.5 kWh weighted average
Mariners Game distribution	10,000 * 20% in service area * 75% installation rate * 54.5 kWh weighted average
Other Distribution Impact	BW Impact + LI Impact + Mariners Impact

Table 10: Calculation of Energy Savings Impacts from Lighting and Water Measures

Lighting & Water Impacts	Calculation of Annual kWh
Kit Faucet aerators installed	Kits * 0.50 aerators/household^ *((15 kWh * 75% SF * 66% electric water) + (80 kWh * 25% MF * 75% electric water))
Showerheads installed: Based on use of water flow-rate bag	Kits * 0.014 showerheads/household^ *((450 kWh * 75% SF * 66% electric water) + (250 kWh * 25% MF * 75% electric water))
Program Total Water Measure Impact	Aerator Effect + Flow Bag>Showerhead Effect
Net Program Effect from Bulbs	Immediate Effect + Delayed Effect – Free Riders
Adjusted Kit Spillover Effect: Subsequent Participant purchases attributable to Kit	Kits * 54.5 kWh * 1.04 bulbs/home^ * 26% influenced by Kit / 29% who bought^
Program Total Bulb Impact	Immediate Effect + Delayed Effect – Free Riders + Spillover
Program Overall Impact	Total Bulb Impact + Total Water Measure Impact

^ Indicates variables drawn from results of survey research (see Table 29, Table 36, Figure 12, Figure 15).

In the Seattle City Light service area, 66% of single-family homes and 75% of multifamily units use electricity for domestic hot water. Currently residences in the utility service area are comprised of 75% single-family and 25% multifamily dwellings.[32] Seattle residences house, on average, 2.5 persons per single-family home and 1.7 persons per multifamily unit.

On the basis of these demographic factors, the average Kit is estimated to produce 11 kWh in annual savings from the faucet aerator (22 kWh per installed aerator) and 4 kWh from the flow-rate bag (270 kWh per installed showerhead).

Water savings from faucet aerators and showerheads were studied most recently in Seattle by Seattle Public Utilities, with funding from the US Environmental Protection Agency. This study found overall annual water savings of 1.0 gallon per person per day from new faucet aerators and 0.5 gallon per minute from efficient showerheads.[33] Average home occupancy is 350 days per year, according to two 1994 metering studies.[34] Other assumptions drawn upon to estimate hot water savings include the 1994 metering study observations that hot water taps flow at 128 degrees Fahrenheit (°F) and showers are adjusted to 103°F. In the Seattle area, source water enters the home at a year-round average temperature of approximately 53°F.[35]

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[32] Geist (2000).

[33] DeOrea, William B., Allan Dietemann, Tim Skeel, Peter W. Mayer, David M. Lewis, and Jenna Smith, SEATTLE HOME WATER CONSERVATION STUDY: INDOOR RETROFIT RESULTS, Resource Conservation, Water Division, Seattle Public Utilities with Aquacraft, Inc. (Seattle WA: 2002).

[34] These metering studies found annual energy savings per high-efficiency bathroom faucet aerator of 15 kWh in single-family homes and 80 kWh in multifamily units (which often lacked a prior aerator). The same studies found annual energy savings per high-efficiency showerhead, installed based on flow-rate measurement reduction, to be 450 kWh per primary showerhead in single-family homes and 250 kWh in multifamily units. Showerheads installed without pre-screening flow rate measurement saved 300 kWh per primary showerhead in single-family homes and 200 kWh in multifamily units.

SBW Consulting, Inc. and William Hopkins, ENERGY EFFICIENT SHOWERHEAD AND FAUCET AERATOR METERING STUDY: SINGLE-FAMILY RESIDENCES, SBW-9414, Puget Sound Power and Light Company (Bellevue WA: 1994).

SBW Consulting, Inc., Curtis Hickman, and Seattle City Light, ENERGY EFFICIENT SHOWERHEAD AND FAUCET AERATOR METERING STUDY: MULTIFAMILY RESIDENCES, SBW-9408, Bonneville Power Administration (Portland OR: 1994).

[35] Personal communications: Tim Skeel, Seattle Public Utilities, and Warren Sklar, Seattle City Light (Seattle WA: 2002, 1994).

Table 11: Calculation of Water Savings Impacts from Water Measures

Water Measure Impacts	Calculation of Annual Gallons Water & Sewer Flows
HOT & COLD WATER	
Installed Kit Faucet Aerator Effect	Aerators * 1.0 gal/day * 350 days * ((2.5 persons * 75% SF) + (1.7 persons * 25% MF))
Installed Showerhead Effect: Based on use of water flow-rate bag	Showerheads * 0.5 gal/min * 350 days * 7 minutes * ((2.5 persons * 75% SF) + (1.7 persons * 25% MF))
Total Water Measure Impact	Aerator + Flow Bag>Showerhead Effects
HOT WATER ONLY	
Installed Kit Faucet Aerator Effect	Hot & Cold Water Aerator Effect * ((103 faucet temp – 53 sourcewater temp) / (128 tap temp – 53 source temp) °F)
Installed Showerhead Effect: Based on use of water flow-rate bag	Hot & Cold Water Showerhead Effect * ((103 shower temp – 53 source temp) / (128 tap temp – 53 source temp) °F)
Hot Water Measure Impact	Aerator + Flow Bag>Showerhead Effects
ELECTRICALLY-HEATED WATER ONLY	
Installed Kit Faucet Aerator Effect	Aerators * 1.0 gal/day * 350 days * ((103 – 53) / (128 – 53)) * ((2.5 persons * 75% SF * 66% electric) + (1.7 persons * 25% MF * 75% electric))
Installed Showerhead Effect: Based on use of water flow-rate bag	Showerheads * 0.5 gal/min * 350 days * 7 minutes * ((103 – 53) / (128 – 53)) * ((2.5 persons * 75% SF * 66% electric) + (1.7 persons * 25% MF * 75% electric))
Electric Hot Water Measure Impact	Aerator + Flow Bag>Showerhead Effects

Program cost data are reported from the City of Seattle "Summit" financial information management system. They are drawn from activity (work order) numbers 70538.01 (the Kit program) and 70538.02 (the Coupon program) for the thirteen accounting periods of 2001. Measure costs include purchases from SunPark Electronics Corporation, TCP: Technical Consumer Products, Inc., and Niagara Conservation Corporation. Delivery costs include payments to K/P Corporation (the Kits) and ECOS Consulting, Inc. (the Coupons). Direct labor and overhead costs include activities of organization units 481 (Community Conservation) and 484 (Division Support: Evaluation). CF bulb stock purchases used in other distributions during 2001-2002 are excluded from calculation of the Conservation Kit levelized cost.

Table 12: Parameters for Average Costs per Kit and Kit Cost-Effectiveness

Program Expenditures	Nominal Dollars
SCL for Kit Program:	
Labor & expenses (administration)	103,749
Contractor (delivery)	618,966
CF bulb stock (measures)	2,143,200
SCL Subtotal Cost of Kit Program: Excluding non-Kit CF bulb stock	$2,865,735
SPU-Water for Kit Program: Aerator stock & water flow-rate bags	194,544
Total Cost of Conservation Kit Program: SCL-WO-70538.01 (Kit) plus SPU-Water costs	$3,060,279
2001 Other expenditures	
Kit Program Evaluation (labor & expenses)	22,250
Retail Coupon Program (labor & expenses)	7,065
Other distribution CF bulb stock (measures)	438,907
Subtotal other expenditures	468,219
SCL for Kit Program (labor & expenses)	2,865,735
Total 2001 Residential Light Programs: SCL-WO-70538.01 & .02	$3,333,954
2002 Expenditures	
Kit Program Evaluation (labor & expenses)	31,475
Retail Coupon Program (expenses)	20,092
Other distribution CF bulb stock (measures)	10,047
Total 2002 Residential Light Programs: SCL-WO-70538.01 & .02	$61,614
Retail Coupons: NEEA–BPA expenses	
2001 $1 Fees paid to SCL for administration	11,143
$6 Coupons paid to retailers for CF bulbs	66,858
2002 $1 Fees paid to SCL for administration	11,028
$6 Coupons paid to retailers for CF bulbs	59,532
$15 Coupons paid to retailers for CF fixtures	16,590
Total Retail Coupon Program (N = 22,171)	$165,151

The Utility levelized program cost is calculated as program expenditures divided by the present value of lifetime energy savings. Costs include the purchase of measures, Kit delivery, and program administration. The present value of energy savings applies a three-percent discount per year to the future stream of savings, to represent Seattle City Light's borrowing rate of interest. This discount is applied over the 7.2-year average life of compact fluorescent bulbs (weighted by installed location and expected operating hours)[36], the 5-year life of efficient faucet aerators, and the 15-year life of efficient showerheads. To judge cost-effectiveness, the levelized cost is compared to the avoided cost of buying energy in other markets.

The program evaluation cost ($53,725) may be represented as a percent of overall program cost (approximately 1.5%). Expenditures for the evaluation were lower than originally budgeted due to a reduction in planned survey activities. The evaluation plan called for two surveys, one to be fielded in 2001, within five months of Kit delivery, and the other to be fielded a year later in 2002. This proposed design was based on observation from prior experience. Examining long-term impacts was crucial in a prior evaluation of the 1992 Home Water Savers Program. An important finding from that study was the lengthy delay between unsolicited program distribution and the self-installation of showerheads by many residents. Installation rates rose from 43% short-term to 65% over the course of the year after Home Water Savers Kit distribution.[37] A similar difference in the case of the 2001 Conservation Kit Program could result in a two-million kilowatt-hour error in savings estimates, or about 0.2 average megawatts of utility load reduction, without acquisition of the second data point. Nevertheless, due to severe utility budget limitations in 2001-2002, the long-term survey specified in the consultant contract was not funded as proposed.

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[36] The average lifetime is based on a product life of 10,000 hours and estimated hours of usage per day by location: 4.7 porch (exterior) or entry-hall, 3.9 kitchen, 3.1 living-dining room, 1.7 bathroom, 1.3 bedroom, 2.0 laundry-utility room and 2.0 den-office (capping total life in any location at 9 years). The weighted average lifetime adjusts for the proportion of bulbs installed in each location, by subsector (single-family, multifamily) and space heat fuel (electric, nonelectric).

[37] Brattesani and Okumo Tachibana (1993, 1994).

Tachibana, Debra (ed.) et al., ENERGY CONSERVATION ACCOMPLISHMENTS: 1977-2001, Evaluation Unit, Energy Management Services, Seattle City Light (Seattle WA: 2002).

Overview of Impact Findings

In spring 2001, Seattle City Light sent solicitation letters to 314,064 residential customers, offering a free Conservation Kit upon return of a reply postcard. Requested Kits were then sent to 178,481 of these customers (57%). These Kits contained 356,962 CF bulbs. 178,481 faucet aerators, and 178,481 water-flow bags.

The technical potential for lighting energy savings, had *all* customers requested the Kit and installed *both* CF bulbs contained in it, was 34,233 megawatt-hours (MWh)—over 34 million kilowatt-hours (Table 13). This level of energy savings would have reduced Seattle City Light's average system load by 4.111 average megawatts (aMW) including the credit for savings from avoided transmission and distribution line losses (or, 3.908 aMW without the 5.2% T&D credit).

The technical potential for lighting energy savings from *participating* customers, had they installed both CF bulbs, was 19,454 MWh, which would have reduced the average system load by 2.336 aMW (or, 2.221 aMW without the T&D credit).

Table 13: Technical Potential and Actual Energy Savings from CF Bulbs Distributed by the Conservation Kit Program

Lighting Measure Impacts ***(from Plan Option 3)***	**Count**	**Annual MWh Impact**	**2002 aMW Impact**	**w/ 5.2% T&D Credit**
Customers sent solicitation	314,064	*34,233**	*3.908**	*4.111*
Requested Kits delivered	178,481	*19,454**	*2.221**	*2.336*
Immediate Kit Effect: Kit bulbs installed immediately	285,570	15,564	1.777	1.869
Delayed Kit Effect: Kit bulbs installed in 6-8 months	49,758	2,712	0.310	0.326
Cumulative Kit Effect	**335,328**	**18,275**	**2.086**	**2.195**
Free Rider Effect on Immediate Installations	(-35,696)	(-1,945)	(-0.222)	(-0.234)
Net Effect from Kit Bulb	**299,632**	**16,330**	**1.864**	**1.961**

* Technical potential from 100% response and 100% installation

The actual annualized program *gross* impact was 18,275 MWh from cumulative bulb installations by year-end 2001, or 94% of the technical potential for participating customers (Table 13). Of this amount, 85% were acquired immediately and 15% resulted from installations delayed over the six to eight months following Kit delivery.

The free-rider adjusted effect is equivalent to 91 kWh per delivered Kit. Free riders, who by self-report on the survey would have installed CF bulbs during this period on their own without using the Kit, comprised about 11% of the observed savings.[38] This estimate of *free-ridership* reduces the *net* savings directly attributable to the Conservation Kit bulbs to 16,330 MWh, with a system load impact of 1.961 aMW, including the credit for T&D savings (or 1.864 aMW without the credit).

Besides direct energy savings from the Kit CF bulbs, there was a measurable spillover effect from the Conservation Kit Program.[39] Based on participant self-reports, nearly 90% of subsequent CF bulb purchases during the remainder of the year were influenced ('a lot' or 'a little') by use of the Kit products. This *spillover* effect of the program increases the *net* savings indirectly attributable to the Conservation Kit bulbs by up to 9,070 MWh in additional annualized energy savings (Table 14).

The Conservation Kit also contained water efficiency measures that produce electric energy savings by reducing hot water usage. Half of program participants installed the Kit faucet aerator and 1% acquired and installed a new efficient showerhead based on testing with the Kit water flow-rate bag. These actions resulted in additional annualized energy savings of 2,675 MWh. Faucet aerators produced an average 11 kWh and showerheads produced 4 kWh per delivered Kit.

The net annual impact from Kit bulbs, faucet aerators, and customer-purchased showerheads produced an overall total of 106 kWh saved per Kit. This corresponds very favorably to the planning projection of 110 kWh, comprised of 95 kWh from lighting measures and 15 kWh from water measures.

By year-end 2001 the full impact of the Conservation Kit Program (Option 3) generated 28,075 MWh in net annualized electricity savings and drove the overall net system load impact down by 3.205 aMW. Including the 5.2% credit for avoided transmission and distribution line losses, this amounts to an average load reduction of 3.372 aMW—*one percent of the residential system load.*

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[38] Survey respondents were asked how likely it was that they would have purchased a CF bulb during the Kit distribution period, spring 2001. Twenty-one percent replied that they were 'very likely' to do this on their own. This estimate of *free riders* reduced the participant installation rate by 0.2 bulbs, down from 1.6 to 1.4 Kit bulbs per home.

[39] Rosenberg (1996) has defined *spillover* as "any reduction in energy consumption or demand that is due to a DSM program, other than reductions due to measures or actions taken by participants as a part of the program." Including those purchases influenced even 'a little' by the Kit may result in a generous estimate of the program spillover effect.

Rosenberg, M., "Measuring Spillover and Market Transformation Effects of Residential Lighting Programs," Xenergy Inc, PROCEEDINGS OF THE ACEEE 1996 SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS, American Council for an Energy Efficient Economy, Washington DC (Pacific Grove CA: August 1996), 3:137-45.

What is more, Seattle City Light conducted three other supplemental activities during 2001 to introduce CF bulbs into the hands of residential customers. The utility distributed free CF bulbs at community events and through community-based infrastructures.

Table 14: Annualized Net Impacts from Lighting and Hot Water Efficiency Measures Delivered or Influenced by the Conservation Kit Program

Lighting & Water Measure Impacts ***(from Plan Option 3)***	**Count**	**Annual MWh Impact**	**2002 aMW Impact**	**w/ 5.2% T&D Credit**
Net Effect from Kit Bulb	299,632	16,330	1.864	1.961
Adjusted Spillover Effect: Subsequent Participant purchases attributable to influence of Kit	166,418	9,070	1.035	1.089
Total CF Program Impact	**466,050**	**25,400**	**2.900**	**3.050**
Kit Faucet aerators installed	89,241	2,001	0.228	0.240
Showerheads installed: Based on use of water flow-rate bag	2,499	674	0.077	0.081
Total Water Measure Effect	—	2,675	0.305	0.321
Overall Net Impact of Kit Program	**—**	**28,075**	**3.205**	**3.372**

Table 15: Combined Impact of Conservation Kit with Other Direct Distributions of CF Bulbs to the Seattle City Light Community During 2001

Lighting & Water Measure Impacts ***(of distribution options)***	**Bulb Count**	**Annual MWh Impact**	**2002 aMW Impact**	**w/ 5.2% T&D Credit**
Block Watch (BW) Distribution: to "Night Out" event participants for porch lights	12,750	1,403	0.160	0.169
Low-Income (LI) Distributions: to government and non-profit housing providers and past participants in the Low-Income Multifamily Program	24,455	1,333	0.152	0.160
Mariners Game Distribution	1,500	82	0.009	0.010
Supplemental Distribution Impact	**38,705**	**2,818**	**0.322**	**0.338**
Kit Program Net Impact	466,050	28,075	3.205	3.372
Combined Distribution Impacts	**504,755**	**30,893**	**3.527**	**3.710**

The most significant impacts resulted from the installations estimated to result from distribution of nearly 60,000 CF bulbs to Block Watch participants, low-income housing providers and City/County programs, and attendees at a local Mariner's baseball game. It is calculated that about 65% of those bulbs (38,705) were installed in the Seattle City Light service area during 2001, resulting in another 2,818 MWh of net annualized energy savings and 0.322 aMW of system load reduction—0.338 aMW with the T&D savings adjustment (Table 15).

The impact during 2001 of the Conservation Kit Program (Option 3), combined with the supplementation distribution option, was to generate *30,893 MWh in annualized electric energy savings* and reduce Seattle City Light's system load by 3.527 aMW. Including the 5.2% credit for avoided transmission and distribution line losses, this amounts to an *average load reduction of 3.710 aMW.*

Table 16: Combined Impact of Conservation Kit, Other Direct Distributions, and Retail Coupon Program in 2001 and 2002

Lighting & Water Measure Impacts ***(of Options 3 & 6 + distributions)***	**Bulb Count**	**Annual MWh Impact**	**2002 aMW Impact**	**w/ 5.2% T&D Credit**
Kit Program Net Impact *(Option 3)*	466,050	28,075	3.205	3.372
Distributions *(supplemental option)*	38,705	2,818	0.322	0.338
Retail Coupon Program *(Option 6)*	22,171	1,463	0.167	0.176
Combined Programs Impact	**526,926**	**32,357**	**3.694**	**3.886**

The combined impact during 2001 of all three options—the Conservation Kit (Option 3), the Retail Coupon Program (Option 6), and the supplementation distribution option—was to generate ***32,357 MWh in annualized electric energy savings*** and reduce Seattle City Light's system load by 3.694 aMW. Including the 5.2% credit for avoided transmission and distribution line losses, this amounts to an ***average load reduction of 3.886 aMW***. In the process, ***Seattle residents installed over half a million new CF bulbs***.

Impact Results by Objective

Did the Conservation Kit Program improve public relations between Seattle City Light and utility customers?

All 314,064 residential customers of Seattle City Light did have the opportunity to participate in the Conservation Kit Program, having received the mailed solicitation letter. However, about half of nonparticipants responding to a follow-up survey did not notice the solicitation letter offering the Kit.

.....Range of Service

Did the Kit program serve the broadest range of residential customers?

Neither the Conservation Kit Program nor the evaluation survey addressed customer language barriers. While the solicitation letter and reply card could have contained text in the major language groups typically included on Seattle City Light literature, appropriate translations were not made nor inserted. As a result, non-response to the Kit solicitation letter and to the follow-on survey likely was biased by the unknown proportion of customers who do not have a fluent English-reading person in the household to screen mail. A blurb (in English) about the program was included in the utility publication, "Light Reading," which is enclosed with all residential power bills.

Besides the Conservation Kit (Option 3) and Coupon (Option 6) distributions, the utility had determined to distribute free CF bulbs at community events, and distribute them through Block Watch captains or similar community-based infrastructures. Free bulbs were distributed at the Central Area Community Festival in July 2001. The 2001 Neighborhood Power project in the Central Area of Seattle distributed bulbs at the Unity on Union Event, Juneteenth Celebration, and Jazz Fest. Free CF bulbs were distributed through Block Watch captains to "Night Out" participants for their porch-lights; of the 17,000 handed it, it is estimated that 12,750 were installed. The giveaways were not targeted to non-English speaking minorities.

Seattle City Light also supplied 32,606 CF bulbs to various government and non-profit low-income housing providers[40], and to the City Office of Housing for distribution at workshops and to past participants in the Low-Income Multifamily (weatherization) program. About three-fourths of these bulbs are assumed to be installed during 2001.

Finally, 10,000 CF bulbs were handed out at a local Seattle Mariner's baseball game; it is estimated that about 1,500 were installed within the Seattle City Light service area. Uncounted are bulbs supplied to City of Seattle Mayor's Office to distribute during neighborhood visits, as coordinated with the small-commercial $mart Business Rebate Program.

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[40] Besides the Office of Housing, these low-income housing providers include (in descending order of number of bulbs distributed): Seattle Housing Authority (SHA), Housing Resources Group, Archdiocesan Housing Authority, Capitol Hill Housing Improvement Program (CHHIP), Pioneer Human Services, Plymouth Housing Group, South East Economic Development (SEED), Union Gospel Mission, Low-Income Housing Institute (LIHI), YWCA, Downtown Emergency Services Center, Mount Baker Housing Association, Seattle Emergency Housing, Bergen Place (LATCH), Fremont Public Association, Aloha Inn, Parkview Services, Delridge Neighborhood Development Center, Seattle Habitat for the Humanities, and Harmony House at Sand Point. Later, in 2002, CF bulbs were also supplied to King County Housing Authority (KCHA).

..... Equal Opportunity

> *Did the Kit program allow every residential customer to have an opportunity to take advantage of this program (including apartment dwellers and condo/townhome owners)?*

Among Conservation Kit participants, fewer than 1% of survey questionnaires mailed in September 2001 were undeliverable by the Postal Service. This population appears to have resided in stable numbers at the same location sent the Kit solicitation letter six months earlier.

Among nonparticipants, the first sample approached for the September survey resulted in 7% undeliverable mail; the second sample approached two months later in November yielded 13% undeliverable mail. Compared to participants, this population had fewer "good addresses" in the customer database extract by autumn, indicating more mobility than among participants. The 6% increase in undeliverable nonparticipant mail between September and November suggests, by back projection, that it is likely most Kit solicitation letters did reach their intended destinations among nonparticipants, but that the impending move-out reduced the recipient's awareness of, or interest in responding to, the Kit Program solicitation.

From these inferences, it appears that all 314,064 residential customers of Seattle City Light did have the opportunity to participate in the program, having received the mailed solicitation letter. However, it is also clear that about half of nonparticipants did not notice the solicitation letter offering the Kit. We called this group the nonparticipant Passive Group, as they felt they did not receive the Kit offer, did not recognize it as an offer, or did not act upon the offer. (By contrast, those in the other half who mentioned a reason for not participating beyond missing the notice are called the Nonparticipant Choice Group, because they chose not to use CF bulbs at the time of the offer.)

Of interest, a large proportion of the Nonparticipant Passive Group asked in hand-written comments on their questionnaires whether they could still receive the Kit. They appeared genuinely interested in trying the CF bulbs. In all, the great majority of nonparticipants (77%) did not participate at least in part due to some stumbling block related to the program solicitation, their own response, or delivery of the product.

Because so many nonparticipants said they did not recall the Kit offer, demographic analyses compared the Passive group with the Choice group. The Choice Group was significantly different from the Passive group only in number of household members. Choice Group respondents were more likely to have a subset with four living in their home, whereas those in the Passive group were more likely to have a subset with five or more home occupants. No other demographic variables differentiated these two nonparticipant groups.

The unsolicited requests for the Kit from nonparticipants who did not recall the offer suggest a tremendous opportunity to introduce more utility customers to CF bulbs. Whether they did not receive the offer, did not notice it, or did not consider it important at the time cannot be determined by the survey data. It is possible that busy residents needed additional offers or reminders to kindle enough interest to send for the Kit. Taken as a rule of thumb in advertising, an audience needs multiple exposures to an ad before

buying a new product. The survey itself may have been the crucial influential promotion that prompted requests for the Kit.

Regardless of the explanation for failing to request the Kit, many nonparticipants have now heard enough about CF bulbs to raise their awareness, and are willing to try them. The nonparticipants who made a conscious decision not to participate, in contrast, are the least likely converts to CF lighting. In particular, those who said their lights were on dimmers or in recessed fixtures, approximately 16% of nonparticipants, might be excluded from the group of potential CF bulb customers until affordable CF bulb technology addresses those applications.

Did the Conservation Kit Program increase customer awareness of and future demand for compact fluorescent lighting?

The Conservation Kit Program was effective both at increasing customer awareness and at bolstering future demand among residential customers for compact fluorescent bulbs. The Conservation Kit overcame some prior negative impressions of the technology, increased customer satisfaction with CF lighting, and effectively met the utility's goal to reintroduce the bulbs directly to customers and stimulate the market for CF products. According to survey responses, the direct distribution method increased customer trust and interest in the product, and made an important contribution to transformation of the residential market for CF lighting.

.....Customer Awareness

Did the Kit program increase customer awareness of CF lighting?

The Conservation Kit Program introduced a large proportion of utility customers to compact fluorescent bulbs. Two-thirds (66%) of program participants tried a CF light bulb in their homes for the first time when they received the City's Kit. Across all households in the service area, 57% were program participants; hence, the Conservation Kits were responsible for transforming 38% of all the households in Seattle City Light's service area into CF bulb *New Users*.

Those who had tried CF bulbs before receiving the Kit offer are called *Early Buyers*. Approximately a third of all respondents were Early Buyers; they were found in the same proportion among both program participants and nonparticipants. One-third (33%) of all Seattle City Light customers were Early Buyers, another 38% became New Users due to the program, and 29% remained non-users of CF lighting at the time of the survey.

Early Buyers were more often homeowners, residents of single-family homes, male respondents, those who have larger households, and those with household incomes of $60,000 or more. In contrast, New Users were more likely than Early Buyers to be renters, apartment dwellers, female respondents, have fewer members in their households, and have lower household incomes, less than $60,000. The smaller the household, the more likely the Kit participant was a New User (and had not used CF bulbs before the Kit program).

The demographic profile of new CF bulb users makes sense in that those who live in one-person households and have lower incomes would be less likely to have spent money to

try (relatively expensive) CF bulbs. Apartment dwellers overlap with renters, and are also more likely to have lower incomes than homeowners. They may be reluctant to spend extra money on household lighting that would remain with the apartment after they move. Of interest is that women were more likely to be new CF bulb users than men were. Lower income customers are less likely on their own to use unfamiliar, higher-cost products (this group includes many women). However, the program was successful at encouraging people with these demographic features to use the Kit CF bulbs and consider purchasing more.

The large proportion of residents who said they used a CF bulb for the first time when they received the City's Kit indicates that the Conservation Kit Program was a vital force in increasing awareness of and transforming the Seattle market for CF bulbs. This program offered a relatively expensive item free of charge. The demographic findings suggest that such a direct distribution program is a particularly effective method of introducing a product to a market segment who would be reluctant to purchase CF bulbs on their own but stand to benefit most by the resulting energy savings.

Participants also indicated high levels of satisfaction with Kit bulbs compared to bulbs previously purchased and used in the home. The greater satisfaction with the Kit bulbs suggests that program participants noticed the design and technological improvements characteristic of the newer bulbs. The findings also suggest that customers will be more likely to use CF bulbs if the first bulbs they try have the latest technology. Among the 66% of participants trying a CF bulb for the first time, the Kit program increased their opportunity to become aware of the benefits of CF lighting.

Future Demand

Did the Kit program increase future demand for CF lighting?

Some free-rider effects and significantly greater spillover effects were seen from respondent choices and attributions. Their self-reports on subsequent CF bulb purchases match regional sales figures (NEEA 2002) attributed to the utility's service area. Program participants themselves linked their purchasing behavior to the Kit program.

Program participants comprised a market segment that was in the early stages of CF bulb use before the program, and saw a dramatic increase in bulb use in a relatively short time. The Conservation Kit Program, which was Seattle City Light's main 2001 effort to promote CF lighting, combined with auxiliary coupon promotions, made great strides toward increasing demand for CF bulbs.

Nearly one-third (30%) of program participants bought additional CF bulbs after receiving their Kits. Participants who had purchased more installed an average of 4.0 additional bulbs. Calculated for the entire participant sample, participants installed an average of 1.04 additional purchased bulbs per household, after implementing Kit measures. That is, subsequent purchases alone doubled the number of CF bulbs that participants used as a group before receiving the Kit offer. These increases represent a change in the buying habits of participants, as they have begun to purchase CF bulbs on their own.

By contrast, a small fraction (8%) of nonparticipants reported purchasing CF bulbs between the time of the Kit offer and the time of the survey. These nonparticipants had

installed an average of 3.1 additional bulbs during that time period. Calculated for the entire nonparticipant sample, nonparticipants installed an average of 0.25 additional purchased bulbs per household.

Participants say that the Kit program had a favorable impact on their subsequent bulb purchases. More than half of the participants who bought more bulbs said the program influenced their purchase "a lot," and more than three-quarters said the program influenced them at least "a little" to buy more bulbs. Attributing savings from these "spillover effect" bulbs to the Kit program results in an estimated 9,070 MWh of energy savings, in addition to the 16,330 MWh net effect from Kit bulbs, for a total Kit program impact of 25,400 MWh from compact fluorescent bulbs (Table 17).

Individuals generally are reluctant to admit their behavior was influenced by outside forces such as advertising, for example. That participants linked their behavior to the Kit program is another indication of the effectiveness of the program and its method of giving residents a sample product to test and use. Once they could try the products in their homes, participants were more willing to buy more.

Table 17: Net Kit Program Bulb Effect, Including Spillover Bulb Purchases Attributable to the Kit Program

Lighting Impacts	Count	Annual MWh Impact	2002 aMW Impact	w/ 5.2% T&D Credit
Net Effect from Kit Bulb	299,632	16,330	1.864	1.961
Adjusted Spillover Effect: Subsequent Participant purchases attributable to influence of Kit	166,418	9,070	1.035	1.089
Total CF Program Impact	**466,050**	**25,400**	**2.900**	**3.050**

A further indication of the program's impact is that participants were more sure than were nonparticipants that they would purchase more bulbs in the future. Over one-third of program participants, compared to one-quarter of nonparticipants, said they were "very likely" to purchase one or more CF bulbs in the next six-to-eight months. In contrast, only a small fraction (6%) of participants compared to 18% of nonparticipants said they were "not at all likely" to buy a CF bulb.

Additional utility promotions of CF bulbs during 2001, such as the distribution of bulbs through community outreach programs, overlapped the Kit program and survey period. The slight overlap of the Kit program with the retail discount coupon mailing from Seattle City Light may have augmented the subsequent purchases. Given the continued promotion of CF bulbs and fixtures, evidence of increased demand and further CF bulb installations would have been measurable by the end of 2002, at the time scheduled for the long-term evaluation survey. The full impact of the coupon distribution and other promotions could only be assessed in a follow-up tracking study.

However, the direct impact of coupon redemptions seems very modest. As noted under METHODOLOGY, the Northwest Energy Efficiency Alliance has stated that in 2001 retailers reported 11,143 CF bulb $6 coupon redemptions by Seattle City Light customers. Retailer reports continued into 2002 on another 9,922 CF bulb $6 coupon redemptions, as well as 1,106 CF fixture (torchiere) $15 coupon redemptions. This brings the total number of coupons redeemed up to 22,171, with customer response rates of about 6.7% for the bulb coupons (distributed in September-October 2001 Seattle utility bills) and 0.3% for the fixture coupons (distributed in January-February 2002 bills). This could represent no more than 5% of retail CF bulb sales estimated for Seattle City Light customers during summer-fall 2001 (see Table 18).

Did the Conservation Kit Program support the retail sector toward home lighting market transformation?

..... Retail Sector Support

> *Did the Conservation Kit Program use the retail sector to move the home lighting market from incandescent to fluorescent products?*

Certainly the Conservation Kit and Retail Coupon Programs were jointly responsible for a considerable increase in CF bulb purchasing during 2001. Seattle City Light itself purchased wholesale over 436,000 CF bulbs directly from lighting manufacturers. The Northwest Energy Efficiency Alliance attributes 227,249 in retail CF bulb sales during the year to the Seattle City Light service area (which comprises 5.5% of the Pacific Northwest region). Survey respondents corroborate this level of sales. Based on their reports, Seattle City Light residential customers purchased 219,516 CF bulbs during summer-fall 2001, or 97% of those accounted for by regional sales figures (Table 18). For comparison, CF bulb sales in 2000 were only a fraction of this level (about 21,000, or 9%).

Hence the cumulative impacts of the West Coast energy crisis and Northwest regional drought, combined with the efforts of Seattle City Light's Conservation Kit and Retail Coupon Programs, as well as NEEA's Energy Star® promotions, were to multiply retail sales by a factor of 10. The Kit program influenced the retail sector indirectly, by introducing CF bulbs to many customers for the first time, and reintroducing the technology to early adopters. The Coupon program followed on by using the retail sector directly to encourage bulb purchases through a wide variety of stores and outlets.

Table 18: Retail Purchase of CF Bulbs by Program Participants and Nonparticipants Subsequent to the Conservation Kit Offer

Lighting Measure Impacts	Count	Annual MWh Impact	2002 aMW Impact	w/ 5.2% T&D Credit
Nonparticipant CF Bulb Purchases: After spring 2001, by survey report	33,896	1,847	0.211	0.222
Participant CF Bulb Purchases: After receiving Kit, by survey report	185,620	10,116	1.155	1.215
Total CF Bulb Purchases: Customer reports during intervening period of Summer-Fall 2001	**219,516**	**11,963**	**1.366**	**1.437**
Seattle Area CF Bulb Retail Sales: CF bulb sales during all of 2001 by NEEA report for PNW region	227,249	14,998	1.712	1.801
Retail Coupons Redeemed: 2001 September-December 2002 January-April	11,143 11,028	735 728	0.084 0.083	0.088 0.087

There was a concern during the planning stage that a bulb give-away would set unrealistic expectations in consumer minds about retail prices. When asked what would be a fair price, most stated a value between $2-$6, with a median value of $4. Interestingly, by October 2002 one could observe newspapers ads by IKEA and Fred Meyer (with in-house store coupon) for CF bulbs at less than $2 apiece.

Did the Conservation Kit Program utilize collaboration opportunities and leverage other resources?

To deliver the Conservation Kit and Retail Coupon Programs, Seattle City Light collaborated with two major partners, the Northwest Energy Efficiency Alliance (NEEA) and Seattle Public Utilities (SPU).

.....Collaboration

> *Did the Conservation Kit Program collaborate with and leverage the resources of other agencies?*

In 2001 and 2002, Seattle City Light worked with NEEA and the Bonneville Power Administration to deliver the Retail Coupon Program, in which a number of other urban-area utilities also participated. With NEEA, Seattle City Light recruited many retail stores to honor the coupons for bulbs and fixtures, to boost in-store stocks of CF lighting products, and to host point-of-purchase displays. City Light personnel also staffed booths at retail outlets to provide educational services and promote the program directly to shoppers. Moreover, the CF bulbs purchased by Seattle City Light for the Conservation Kit Program carried the *Energy Star*® designation, in keeping with the branding efforts

of NEEA to further promote market transformation and customer education about quality lighting products.

Meanwhile an important partner with Seattle City Light on many programs in the past, the SPU Resource Conservation unit, joined with City Light to offer customers a free bathroom aerator and flow-rate measurement bag in the Kit. These measures provided additional energy savings from hot water, as well as cold-water savings. Since the Kit package went over one pound in weight before addition of the water products, these products did not trigger any incremental postage, so SPU was not called upon to contribute to the program mailing costs. The inter-agency collaboration did not make the program any less costly to SCL, but it did demonstrate effective collaboration on behalf of customers by the two City utilities.

The water measures included in the Conservation Kit were planned to save residential households 400 gallons in annual water and waste-water flows and 35 kWh in energy consumption. The actual results were annual savings of 442 gallons and 15 kWh per Kit participant household, based on actual installation rates and an updated water metering study (DeOrea et al. 2002). The water measures included in the Conservation Kits resulted in considerable utility bill savings for participating customers (Table 19).

Table 19: Water and Waste-water Impacts of the Conservation Kit Program

Water Measure Impacts on Water & Sewer Flows	Count	Annual Gallons Water	Annual Gallons Sewer
HOT & COLD WATER			
Kit Faucet aerators installed	89,241	71,839,005	71,839,005
Showerheads installed: Based on use of water flow bag	2,499	7,040,933	7,040,933
Total Flow Reductions	**—**	**78,879,938**	**78,879,938**
ELECTRICALLY HEATED WATER ONLY			
Kit Faucet aerators installed	89,241	32,405,638	32,405,638
Showerheads installed: Based on use of water flow bag	2,499	3,176,073	3,176,073
Total Flow Reductions	**—**	**35,581,711**	**35,581,711**

The average SPU residential customer in 2001 paid a rate of 0.41¢ per gallon for potable water and another 0.60¢ per gallon for waste-water (sewer) service. At these rates, the water savings attributable to Conservation Kit aerators and showerheads installed as the result of flow-rate bag testing (78,879,938 gallons) would have yielded annualized residential customer bill savings of $796,688: $323,408 for potable water and $473,280 for waste-water. This amounts to about $4.46 per delivered Conservation Kit.

Participants who installed the Kit aerator saved 805 gallons and $8.13 per year on water and sewer costs, at 2001 rates; while participants who purchased and installed an efficient showerhead, as a result of testing with the Kit flow-rate bag, saved another $11.55 per year. The result of collaboration between Seattle City Light and Seattle Public Utilities was a ***combined annualized reduction in utility bills to customers of $2,674,468 at 2001 rates.***

.....Staffing Intensity

> *Did the Conservation Kit Program use a delivery method that minimized staffing intensity?*

By hiring a fulfillment house to mail the solicitation letter, field responses, and mail Conservation Kits to participating customers, Seattle City Light minimized the number of utility staff and work-hours needed to deliver the program. By mailing the retail coupons with electric bills during a regular billing cycle, the utility also minimized distribution-mailing costs.

As a result, 76% of program funds were able to go directly to acquiring CF bulb and faucet aerator stocks, at $13.10 per Kit. Seattle City Light administration (staff labor and expenses) was held to only 58¢ per Kit, or 3% of the overall program cost. This is important during times when a utility cannot 'staff up' with permanent employees and must make do with existing resources. The remaining 20% of total program costs went for fulfillment house labor and mailing expenses.

Seattle City Light's administrative cost of $103,749 includes $98,538 for staff labor, which represents 1.6 full-time equivalent employees for the year. For a program that yielded 2.6 aMW in direct net energy savings and 1.1 aMW in spillover effects (with T&D credits), this is an incredibly low in-house staffing intensity. This performance measure does not include the temporary resource of staffing by the delivery contractor.

Did the Conservation Kit Program acquire cost-effective conservation energy savings as soon as possible in 2001?

As shown below, the Conservation Kit Program acquired conservation energy savings cost-effectively, well below the cost of energy production, and did so beginning early in the year 2001. By mid-year more than half of the program's impact had been felt, and by year-end the Kit program reduced residential-sector system loads by 1%. The program cost of energy to Seattle City Light was 17.7 mills per kWh, and the combined City utility cost of energy was 16.9 mills—only 59% and 64% of the planned costs, respectively. These measurements exclude the value to Seattle Public Utilities of water and wastewater savings from Kit products, and the value to customers of savings from purchased showerheads and CF bulbs.

..... Energy Savings

> *Did the Kit program help residential customers get started on reaching their 10% energy savings goal for 2001?*

In 2001, Seattle City Light asked customers to provide immediate help by cutting back on energy use. Local television meteorologists were enlisted in a special campaign urging citizens to "Save 10% At Home and At Work." Residential customers responded by reducing their 2001 energy consumption to 3,050,903 MWh from the 2000 level of 3,317,251 MWh—a drop of 266,348 MWh. The average residential customer cut annual energy use from 10,473 kWh to 9,454 kWh per household—down by 10%.[41]

The Conservation Kit Program made a contribution to this campaign. The early impact of the Kit among participants was 17,565 MWh in savings from the immediate installation of CF bulbs and faucet aerators.[42] Later in the year another 13,502 MWh of savings came on line as participants installed acquired showerheads, most of the remaining Kit bulbs, and additional bulbs purchased at retail outlets (Table 20).[43] The timing of installation for supplement distribution products is uncertain, so those effects are not included here.

Table 20: Potential Gross Energy Savings from Kit Program and Participant Purchases

Lighting & Water Measure Impacts	Bulb Count*	Annual MWh	2002 aMW	w/ 5.2% T&D Credit
Immediate Kit Effect: All Kit products installed immediately in spring 2001	285,570	17,565	2.005	2.109
Delayed Kit Effect: All Kit products installed in next 6-8 months	49,758	3,386	0.387	0.407
Cumulative Kit Effect: Installations by year end 2001	**335,328**	**20,951**	**2.392**	**2.516**
Participant CF Bulb Purchases: After receiving Kit, by survey report	185,620	10,116	1.155	1.215
Cumulative Impact of Kit + Purchases	**520,948**	**31,067**	**3.546**	**3.731**

* Count of bulbs only; excludes counts of aerators and showerheads

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41 SEATTLE CITY LIGHT 2001 ANNUAL REPORT (Seattle WA 2002).

42 Immediate energy savings: 14,764 MWh from Kit bulbs and 3,391 MWh from Kit aerators.

43 Delayed energy savings: 2,572 MWh from Kit bulbs plus 660 MWh from showerheads. Also added are 9,597 MWh in potential savings from bulbs purchased in summer-fall 2001.

As a result of the Conservation Kit distribution and their own subsequent actions, participating residential customers potentially reduced their electricity consumption through home CF lighting by as much as 31,067 MWh. This reduction comprised about 12% of the observed 10% reduction in energy use, or 1% of total residential sector energy consumption in 2000. If all residential customers had participated, the total sector energy use would have been reduced by 2%—simply by changing a few light bulbs in each home.[44] This level of gross energy savings reduced Seattle City Light's average system load by 3.731 average megawatts (aMW), including the credit for savings from avoided transmission and distribution line losses (or, 3.546 aMW without the 5.2% T&D credit).

More than half (57%) of these savings were acquired early in 2001. Because the Kits were distributed in spring 2001, they do appear to have helped residential customers get a start on reaching their 10% savings goal for the year. Progress toward the utility's load curtailment goal was likely aided by the Retail Coupon Program distributions in September-October 2001 in customer electric bills, which further encouraged retail purchases of qualifying CF bulbs.

.....Cost-Effectiveness

Did the Kit program acquire conservation energy savings cost-effectively?

As shown in Table 21, the Conservation Kit Program expended $2,865,735 for CF bulb stocks (measures), the fulfillment house contractor (delivery), and Seattle City Light labor and expenses (administration). Per Kit, these costs amounted to $12.01 for measures, $3.47 for delivery, and $0.58 for administration. Seattle Public Utilities expended $194,544, or an average of $1.09 per Kit, for faucet aerator stocks and water flow-rate bags (measures). This brought the total Kit cost to $17.15 each. The program evaluation cost, an additional $53,725, represents about 1.5% of the overall conservation cost. Expenditures for the evaluation were lower than originally budgeted due to a reduction in planned survey activities.

The Utility levelized program cost is calculated as program expenditures divided by the present value of lifetime energy savings. Costs include the purchase of measures, Kit delivery, and program administration. The present value of energy savings applies a three-percent discount per year to the future stream of savings, to represent Seattle City Light's borrowing rate of interest. This discount is applied over the 7.2-year average life of compact fluorescent bulbs (weighted by installed location and expected operating hours), the 5-year life of efficient faucet aerators, and the 15-year life of efficient showerheads. To judge cost-effectiveness, the levelized cost is compared to the avoided cost of buying energy in other markets.

The levelized cost of the Conservation Kit Program is computed using the following parameters. Total utility cost was $3,060,279, comprised of $2,337,564 for the purchase of measures (bulbs, aerators and bags), $618,966 for Kit delivery, and $103,749 for program administration (Table 21). The cost to customers of purchasing bulbs in retail

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[44] Heating degree-days were virtually identical in the two years: 4,970 (2000) and 4,993 (2001); these values match the thirty-year average for 1970-1999.

stores during 2001 is assumed to be $10 per bulb; replacement showerheads also cost about $10. The annual energy savings per participant are 142 kWh. The net energy savings attributable to the program as a whole were 28,075 MWh, providing 3.37 megawatts of average load reduction (3.20 aMW, without the 5.2% T&D credit for avoided transmission and distribution line losses). The weighted-average lifetime of all Kit products, including lighting and water measures, is 7.3 years. The present value of these savings is 1,014 kWh per participant over the life of the measures, or 181,025 MWh for the program overall.

The levelized cost to Seattle City Light of the Conservation Kit Program was 17.7 mills (1.77¢) per kWh. Including energy savings from the water measures, the program cost the combined City utilities 16.9 mills. The Option 3 Kit program was planned to deliver the energy resource at 29.9 mills to Seattle City Light and 26.4 mills to the combined City utilities. The program was successful at meeting and significantly exceeding this objective.

Table 21: Conservation Kit Program Levelized Cost in Mills per kWh

Expenditures	Total Dollars	Average per Kit	Levelized per MWh*
SCL for Kit Program:			
Labor & Expenses (administration)	$ 103,749	$ 0.58	$ 0.64
Contractor (delivery)	618,966	3.47	3.81
CF bulb stock (measures)	2,143,020	12.01	13.20
Total excluding non-Kit stock	2,865,735	16.06	17.66
SPU-Water for Kit Program: Aerators & water flow-rate bags	194,544	1.09	10.39
Total Kit Program Costs	**$3,060,279**	**$17.15**	**16.91**

* Levelized cost in mills per kilowatt-hour, or dollars per megawatt-hour; 3% discount rate, with average measure lifetimes of 7.2 years (bulbs), 5 years (aerator), and 15 years (showerhead).

Incorporating the cost to customers of Kit-attributable spillover purchases, the participant cost was 28.7 mills for bulbs acquired due to the Kit's influence, and the total Service Area cost was 26.1 mills. These costs are very competitive with the costs of energy alternatives, whether internal to the Utility (owned generation) or from external markets. Clearly the Kit program acquired energy savings below Seattle City Light's 69 mill (6.9¢) per kWh cost of delivering energy in 2001, including deferred power costs.[45] For comparison, during 2001 the average residential rate was 6.2¢ per kWh. From these findings we may conclude that the program did, indeed, acquire cost-effective conservation energy savings.

[45] The SEATTLE CITY LIGHT 2001 ANNUAL REPORT shows $36.04 as the *Net power cost per MWh delivered* (p.36), and a footnote indicates the average price of power per MWh delivered would have been $69.41 without the deferral of wholesale power purchase costs from 2001 to future years.

Did the Conservation Kit Program produce immediate economic benefits and reduce the impact on customer of the proposed rate adjustment for power costs?

The Conservation Kit Program produced significant economic benefits for the utility and for participating customers. On an annualized basis, the Kit reduced wholesale power purchases by over $2.1 million. Meanwhile, participating residential customers lowered their own electric bills by $1.9 million and water/wastewater bills by $0.8 million—for a combined annualized reduction in City utility bills to customers of $2.7 million at 2001 rates.

.....Customer Bills

> *Did the Kit program help reduce energy bills for Seattle City Light residential customers?*

The average Seattle City Light residential customer paid a rate of 6.21¢ in 2001. At this rate, the direct energy savings attributable to Conservation Kit CF bulbs (18,275 MWh) yielded annualized residential customer bill savings of $1,134,878. Additional CF bulbs purchased and installed by participants and nonparticipants subsequent to the Conservation Kit offer (11,963 MWh) yield additional annualized residential customer bill savings of $742,902.

For participating customers, the cumulative impact of Kit and purchased CF bulbs was a reduction in an individual annual household energy bill of $10. To put this in perspective, the U.S. Department of Energy estimates that, nationwide, residential lighting accounts for nearly 2,000 kilowatt-hours (1,946 kWh) annually per home.[46] Tacoma City Light (Tribwell & Lerman 1996) found in the Pacific Northwest that annual lighting energy averaged 1,818 kWh per single-family home. In all-electric homes, lighting comprises about 11% of household energy use, and 19% in homes without electric space and water heat. At 2001 electric rates, consumption of 2,000 kWh would amount to $121 per year for Seattle customers. Hence the Conservation Kit Program reduced participant home lighting bills by about 8%.

.....Purchased Power

> *Did the Kit program help reduce Seattle City Light's purchased power bill?*

At an average $69.41 per MWh cost of delivering energy in 2001, the direct energy savings due to Conservation Kit CF bulbs (18,275 MWh) yielded annual wholesale purchase power savings of $1,268,468.

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[46] "National Lighting Inventory and Energy Consumption Estimate," U.S. LIGHTING MARKET CHARACTERIZATION, VOLUME I, United States Department of Energy (Washington DC, 2002), www.eren.doe.gov/buildings/documents .

Additional CF bulbs purchased and installed by participants and nonparticipants subsequent to the Conservation Kit offer (11,963 MWh) yield additional annual wholesale purchase power savings of $830,352.

By the end of 2001, residential energy savings (37,195 MWh) from the combined Conservation Kit, supplemental distribution, and Retail Coupon programs, along with CF bulbs purchased by nonparticipants, yielded ***annual wholesale purchase power savings of $2,581,705.***

Lessons Learned

At the conclusion of the Conservation Kit, supplemental distribution, and Retail Coupon Programs, the evaluator met with planning and operational staff to debrief on their experience. Following are some of their observations on what worked well, what might be done differently, and how circumstances surrounding the program affected the outcome.

Speaking with Program Staff

..... Time Crunch and Bureaucracy

"Caution prevailed at a time when the energy crisis called for bold action, and presented rare opportunities for those with the courage to reach for them."

"The program was under severe time constraints, once the decision-makers finally said 'yes' to the plan. The utility and the City are not set up to move fast, specifically when it comes to contracting and purchasing mechanisms."

"We had too many elliptical discussions with the utility contracting officer. The fastest approach was to use the emergency purchase order process. The emergency procedure is for one-time purchases under a cost ceiling. To acquire bulbs and keep up with demand, we had to make repeated purchases, which did not meet emergency purchase rules. Purchase ordering goes beyond the utility boundary to pull in the City contracting officer—which slowed things down. So, we then had to switch over to regular vendor contracting, which is took more time."

..... Choice of Manufacturer Brands

"Name brand manufacturers have not been in the forefront of promoting new efficient lighting technologies at affordable prices. For better or worse, offshore companies—primarily ones with manufacturing bases in the People's Republic of China—are the ones that have taken this stance. Rather than pay substantially more to buy CF bulbs from a name brand company, we chose to promote the technology in a more generic manner and rely on consumers to either choose the more expensive name brand product or accept a more generic brand when they purchased additional bulbs."

"The bulbs we gave away were, unfortunately, not available retail. For new users, this made it more problematical to follow-up with a retail purchase. They would be inclined, if they liked the bulbs, to look for the same product in the store, would not find it, and might be diffident about choosing a different brand."

"The reason for choosing the manufacturers we did is because there were not any 'Tier I' manufacturers who had affordable prices and could meet the delivery schedule. Our specs worked, they were tough, and provided a way to say 'no' to the 'Tier III' manufacturers. The specs required, for instance, a high power factor—that was essential —and the Energy Star® label." [See Appendix A for more on product specifications.]

"We relied on the Energy Star® brand as the identifier of quality, rather than a name brand."

"It was important to us to ensure that the program distributed good quality products. The Lighting Design Lab[47] was concerned about this; they were aware of other projects that had been done elsewhere with products that were not top notch. We used good screens for vendors, including cost, warranty, references and experience."

.....Post Office and Reply Return Address

"There was a problem with addresses on the solicitation letter response envelope. We wanted the return address for Kit requests to read 'Seattle City Light', so that customers would associate the program with us. The envelope was addressed to a post office box belonging to K/P Corporation. The Post Office, seeing 'Seattle City Light,' sent some batches directly to Key Tower [the utility building] rather than the PO Box (as many as 50 per week). These we had to batch up and forward to K/P Corp for fulfillment; and sometimes they came back to Key Tower a second time via the Post Office!"

"Using 'Seattle City Light' in the return address met the goal of associating us with the program, in customer minds, but it did create a return mail problem. In this instance we were the victims of our own success and high response rate."

"Another problem is that some customers chose to use the prepaid return-mail envelope to send in bill payments (to save on a stamp), which of course caused them to be misrouted and delayed on their way to the correct destination." [This was a problem with the survey research return-mail envelopes, too.]

"In retrospect, we should have had a pre-program informational meeting with the Post Office in advance. This might have averted a 'bad press' item that appeared in a local newspaper column, where carriers complained about carrying around the high volume of Kit boxes to customer homes. The irony in that situation is that the U.S. Postal Service gave Seattle City Light an award for innovative use of the mail system!"

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[47] The Lighting Design Lab, operated since 1989 by Seattle City Light and currently co-funded by the Northwest Energy Efficiency Alliance (NEEA), provides lighting specifiers with technical assistance and demonstrations of energy efficient lighting and daylighting strategies. The Lab mission is to bring about long-term changes in the regional lighting marketplace.

..... Timing of Program Start

"We originally wanted to mount this program in October 2000, before the winter lighting season. The delay in executive decision making had a downside for acquiring and distributing the bulbs. By slipping into 2001, we started to hit the Chinese New Year, which impacts production schedules. (These bulbs are manufactured in China, which shuts down for two weeks in late winter.)"

"It was hard to get the product. Utilities in California were simultaneously ordering. Vendors had to stage deliveries. Our orders cleaned out the West Coast warehouses and we had to wait for manufacturers to make more of the product. Then, the Chinese New Year intervened in overseas production."

"The program could have and should have been started around the date when we change from Daylight Savings Time to Standard Time. Failing that schedule, it could have been tied into the holidays of light in December and January. In the end it got off the ground 'as soon as possible,' even though customer interest in both lighting and the energy crisis may have faded somewhat by April 2001."

"Getting the Kit out during the fall lighting season was the ideal. Due to realities of the planning and implementation process, though, the solicitation letter wasn't mailed until the end of February, which was later in the lighting season than hoped for. The potential for tightening or 'shaving' the timeline to improve the program process was probably about a month—if the plan could have been completed in September instead of October. Once budget authority was confirmed, contracting went as fast as the City would allow."

..... Option Choices Driven by Budget Limits

"We wondered initially how the two-step approach would work (solicitation, then delivery). We did not send out any follow-up (like a postcard) after the initial letter. Maybe we should have. We could not get the initial budget for a blitz distribution as in the Home Water Savers Program [of 1992]. These bulbs cost us nearly $6 apiece. Even though it would have been cost-effective from an energy savings point-of-view, there just was not the absolute budget available up front, even with the two supplements." [See Appendix A, *Budget and Expenditures*.]

"Even though Kit recipients had to take an action to receive the Kit (that is, return a reply card), we chose to make that action as minimal as possible, to ensure as high a response rate as possible. In the process we unfortunately lost the opportunity to gain more substantive individual commitments to conservation (as with a 'pledge card'), that we could have used subsequently to encourage more far-reaching behavior changes."

"We should have taken the time to translate the materials into the major non-English languages prevalent in Seattle. At the minimum, there should have been a line in each language on the solicitation letter or an enclosed card."

"The collaboration with Seattle Public Utilities worked well. We got great support from the City graphics department, which produced the materials and printing on-time."

.....Mercury as Hazardous Waste

"One of the things we learned along the way is that handling mercury in the waste stream has to be solved regionally, beyond Seattle City Light's span of control. Dialogue has been ongoing since 2000 among the City utilities, King County, the Metropolitan Council, the State of Washington, the Northwest Energy Efficiency Alliance, the Zero Waste Alliance, environmental groups, recycling and reclamation companies, retailers who carry light bulbs, and many interested parties to find solutions to handling waste containing mercury. One possibility for the future is to have collection bins for spent bulbs at neighborhood grocery stores and pharmacies."

"We have learned that the small amount of mercury contained in CF bulbs, although not insignificant when magnified by the large number of bulbs distributed, is still far less hazardous to our environment than the atmospheric mercury emissions avoided by this program. This is due to reduced burning of fossil fuels at electric plants to supply lighting energy. Seattle City Light continues to participate in the regional cooperative effort to develop long-term solutions for handling burned-out CF bulbs in the future."

"An important concern that emerged, as the Conservation Kit and Retail Coupon Programs developed, was how to handle disposal responsibly. It was clear that recipients of free Kit CF bulbs had to be informed of the presence of mercury in the lamps, the importance of environmentally proper disposal, and the availability of recycling at two Household Hazardous Waste Collection Facilities in Seattle/King County."

CF bulbs contain a small amount of mercury sealed in the glass tubing, which is what makes the phosphorescent powder lining the tube light up brightly. The tube fluorescent lighting found in virtually every commercial office space operates in the same way. No mercury is emitted from the bulbs during normal operation or when they have burned out. However, breakage of the glass tubing can release mercury into the environment. A 15-watt CF bulb has about 4 milligrams of mercury in it to assist with starting and to shine brightly. A troy ounce of mercury equals 31 grams, so 4 milligrams is about a one-thousandth of that amount. That amount of mercury is about the volume that would fill the size of the period at the end of this sentence. By comparison, a standard four-foot fluorescent tube used in a business office contains 20 milligrams of mercury. According to the Environmental Protection Agency, broken fluorescent lights make up about one percent of the country's mercury contamination. [48]

As another example of mercury hazards in the home, one typical home fever thermometer contains as much mercury as one-hundred household CF bulbs. King County (in which Seattle is located) has offered a thermometer exchange program to reduce holdings of mercury thermometers in local residences. Mercury occurs naturally in the environment, and the amount of mercury contained in a single household CF bulb is extremely small. While this makes CF bulbs safe to use in the home, over the course of five to seven years these bulbs will burn out and enter the waste stream. The concern is to avoid large accumulations of spent CF bulbs entering landfills and waste dumps. This is a valid environmental concern that needs to be addressed by encouraging responsible disposal.

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[48] SEATTLE POST-INTELLIGENCER, various newspaper articles and editorials (Seattle WA: 2001-2002).

At the same time, energy conservation efforts through the use of CF lighting contribute to reduced mercury emissions by displacing some coal-fired generation required to produce the energy wasted as heat by incandescent bulbs. The largest source of unnatural mercury contamination comes from the combustion of fossil fuels, mainly at electric plants.

Utility staff learned that the metropolitan hazardous water management program[49] and the state Department of Ecology have worked to increase public awareness of the public health issues around environmental mercury contamination, with a priority on educating *businesses* about the need and disposal requirements. In Minnesota, the first state to ban fluorescents from landfills in 1994, about 70% to 80% of these lamps are recycled.

Northwest power utilities in 2002 have discussed how to develop more convenient recovery and recycling programs aimed at the huge numbers of residential compact fluorescent bulbs that were distributed and purchased in recent years through initiatives such as the Conservation Kit and Retail Coupon Programs. For example, retailers could play a part by hosting return programs at their many and dispersed locations throughout the area. It is incumbent upon the community to put further recycling and disposal programs in place during the next few years, before the significant numbers of residential CF bulbs acquired during 2001-2002 reach the waste stream.

Assessment and Discussion

The Market Transformation Question

The overarching question is, at the end of 2001 had Seattle moved further along on the path to *market transformation*[50] in residential use of compact fluorescent lighting?

The U.S. Environmental Protection Agency finds that currently in the nation the average household has only 1.0-1.5 CF lights.[51] As our survey research confirmed, before receiving the Kit solicitation participants owned 1.03 CF bulbs on average, and nonparticipants owned 0.94. By autumn participants had installed 1.60 Kit bulbs.[52] Meanwhile participants went on to buy and install another 1.04 bulbs, while nonparticipants had purchased about 0.25. The result is a scenario where participants,

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[49] Seattle City Light and King County Web site links on CFL hazardous waste disposal: www.cityofseattle.net/light/conserve/cv5_lw2.htm ; www.cityofseattle.net/util/services/Hhwaste/ .

[50] *Market transformation* refers here to the change in product usage over time, in this case the change from incandescent to compact fluorescent bulbs. Rosenberg (1996) has defined market transformation as what occurs "when a DSM program induces a lasting change in the structure of an energy product or service market or the behavior of market actors that results in greater adoption and penetration of energy-efficient technologies."

[51] McClintock, Mike, "Switching to Fluorescents and Saving Energy One Bulb at a Time," WASHINGTON POST (Washington DC, 7 November 2002).

[52] Participants expected to install 0.28 more of the remained unused Kit bulbs in the half year after the survey.

who formerly averaged *one* CF bulb per home, now had an estimated *four* installed (Figure 2).

Most participants (85%) at the time of the survey felt there were still more locations in the home suitable for a CF bulb. Averaged across all participants, this group indicated the potential to install 4.6 more bulbs per household. Meanwhile most nonparticipants (72%) also felt they still had places where they could install a CF bulb, with the number of locations averaging 6.2 per household across the whole group. Summing these values, participants (8.27) and nonparticipants (7.39) were congruent in their perceptions of the combined total of lighting locations appropriate for a CF bulb. Where the product is the unit of measurement, it appears that by early 2002 participating Seattle residents had moved about halfway to their perceived *saturation capacity*[53].

.....Progress Made Toward Market Transformation

To judge progress toward market transformation, the perceived saturation capacity should be compared to an independent measure of the technical potential for lighting products. An independent metering study of residential lighting in the Pacific Northwest during 1993-1995 found that the typical single-family home has about 15 light fixtures (Tribwell & Lerman 1996). Extrapolating from this study by application locations, a typical multifamily unit might be expected to have about 11 light fixtures, and the residential sector overall would have about 14.

Since survey respondents perceived 8 fixtures per home where a CF bulb could be installed, from the metering study one may infer that they perceived CF lighting to be inappropriate for about 6 more fixtures. Reasons could include lights on dimmers, on daylight or motion sensors, in recessed cans, already linear fluorescent, or used for too few hours to seem a reasonable application. Indeed, 18% of nonparticipants cited these factors for not requesting the Conservation Kit in the first place.

As an index of market transformation among participants, they have installed about 44% of their perceived maximum saturation capacity, compared to 12% before the Kit Program began. This finding describes a market segment that was in the early stages of CF bulb usage before the program, and saw a dramatic increase in bulb usage in a relatively short time. Still, participants are less than halfway to perceived saturation capacity, and perhaps a bit over one-fourth of the way to penetrating the technical potential for residential lighting applications.

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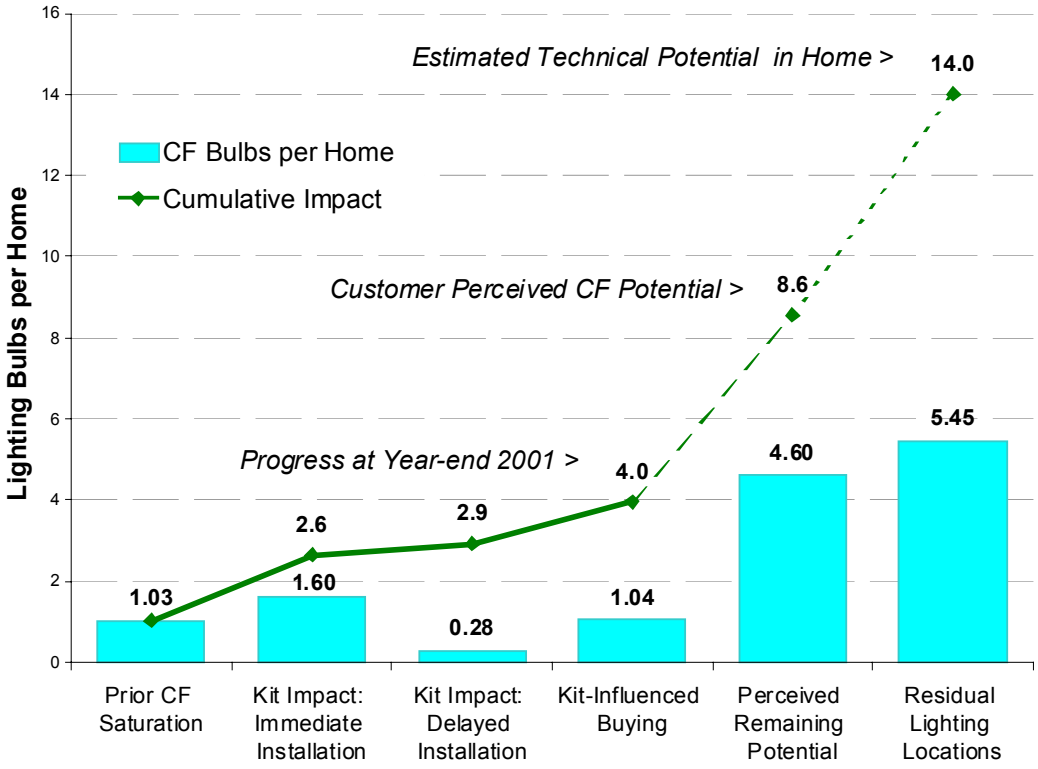
[53] *Saturation capacity* refers here to the total number of CF bulbs that could be used in a household, if one were used in all places that could be fitted with one, according to the perceptions of survey respondents.

Figure 2: Market Transformation Progress Among Kit Program Participants



It is too early still to tell if the response to Seattle's 2001 programs will have a lasting effect on market behaviors. The five-to-seven year measure life for CF bulbs should slow recidivism to incandescent bulb usage. The evaluation was designed to incorporate a second survey to follow up on longer-term market impacts. Unfortunately, however, this task was subsequently abandoned due to budget constraints.

Residents Shifted from Early Adoption to Early Majority

Program participants during 2001 moved from the stage of partial Early Adoption well into the Early Majority stage (see Rogers 1995).[54] Seattle City Light served as a 'change

[54] Rogers (1995) laid out four stages in an idealized model for diffusion of innovation. In his definition, *Early Adopters* (among the first 16% to accept an innovation) are an "integrated part of the social system, and are the system's opinion leaders, in that they are respected in determining the suitability of innovations." The next group in the diffusion process, the *Early Majority* (the next 34%), "are deliberate in their willingness to adopt new innovations, but interconnect through personal networks, so their decision process is longer than that of Early Adopters." The final two groups in the process are the *Late Majority* (also 34%), "decision makers who are skeptical and may adopt innovations out of economic necessity," and *Laggards* (the final 16%), who "use the past as a point of reference, and posses no opinion leadership."

agent' during 2001, communicating professional advice to customers on complex conservation issues, and concentrating the market demand upon manufacturers and suppliers, on behalf of residential customers. The Conservation Kit Program, combined with Retail Coupon promotions and auxiliary efforts, made great strides toward adding pressure and draw to the diffusion of CF bulbs into the retail market.

The CF bulb retail coupons were less effective than NEEA expected, however, and the torchiere coupon appears to have been completely ineffective at increasing sales. The Northwest Energy Efficiency Alliance states that retailers reported 22,171 coupon redemptions in 2001-2002. The customer response rates were about 6.7% for the bulb coupons and only 0.3% for the fixture coupons. The response rate expected by NEEA for each coupon was 10%.

Among Kit and Coupon nonparticipants, a tremendous opportunity remains for the utility to introduce more residential customers to the current CF lighting technology.

.....Keys to Success

The Conservation Kit Program successfully met the goals and objectives set for it in 2000 by the Community Conservation planning and management team. The keys to that success can be traced to several components. These include: informed assessment of the residential lighting market; identification of a crucial barrier to consumer adoption of CF bulbs; design and implementation of effective means to overcome this barrier; stringent product specifications; and careful selection and oversight of product vendors, the delivery contractor, and the product delivery mechanism (the U.S. Postal Service).

The Kit program enabled many customers to make a greater commitment to environmentally responsible home lighting. It softened the financial burden for taking the risk to try CF lighting again, or for the first time. It lowered the perceived risk by offering the utility's backing and manufacturer warranties. It chose a high quality subcompact bulb that fits into more locations than its predecessors did. The program screened vendor products for features that lead to perceptions of quality. And the program provided consumer telephone support through a hotline staffed by the fulfillment company, as well as through the utility's own Conservation Help line.

Selecting a reliable fulfillment company to deliver the Conservation Kits was essential for program success. The company had to be able to handle a high volume of customer requests in a short amount of time. They also had to operate an efficient tracking system. This was made possible by use of bar-coding technology for customer identification and postal codes. Seattle City Light had a good experience with the company selected. It is likely that, as did utility program staff, they learned a lot along the way, too.

Rogers, E., DIFFUSION OF INNOVATIONS, Fourth Edition, The Free Press (New York NY: 1995); quoted in Eilert, P. and G. Fernstrom, "An Industry Transformation Framework for Achieving Sustainability," Pacific Gas & Electric Company, PROCEEDINGS OF THE ACEEE 2000 SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS, American Council for an Energy Efficient Economy, Washington DC (Pacific Grove CA: August 2000), 6:85-106.

Missed Opportunities

As consumer demand developed in excess of planning projections, supplemental budgets were located and applied to expand the initial program allotment. In the end, the cost of implementing Option 3, chosen as the least cost solution, rose to the level projected for Option 2, a full blitz distribution program. Had these monies been available from the start, the Conservation Kit Program might have captured a large number of residents from the *Passive Nonparticipant* group (see Table 32 discussion). On the other hand, the Option 2 program would not have engaged customers to commit to trying products, as the two-stage solicitation approach required. A full-blitz distribution might also have engendered some backlash from *Active Nonparticipants*, and might have risked negative exposure in the press. Nonetheless, from the perspective of capturing the energy conservation resource, passing over the Option 2 approach was a missed opportunity for the Conservation Kit Program.

Another missed opportunity resulted from the failure of the program to repeat the solicitation offer, through follow-up mailings to nonresponding customers. The many unsolicited comments from *Passive Nonparticipants* indicate a great interest in trying compact fluorescent lighting among the third of all Seattle City Light customers in this group. Electricity savings from the Kit program were highly cost-effective compared to almost any other resource, even at today's lower market prices. Fortunately, the utility has a second chance to pursue this opportunity with former nonparticipants although, as time passes and customers change accounts, the database identifying them grows increasingly inaccurate. A second round of the program should make a serious attempt to target messages in non-English languages to customers missed by the initial program.

A third missed opportunity resulted from accelerating the program so quickly that the distribution database was not adequately screened and refined. This resulted in multiple solicitations send to property managers and rental owners, as well as some semi-commercial 'residential' accounts. It also meant that some renters and multifamily building dwellers were not afforded the opportunity to request and receive a Kit.

Evaluation Problems and a Caveat

In its course this evaluation of the Conservation Kit Program encountered three problems. First, the evaluation was designed to incorporate a second survey for follow up on longer-term market impacts; the second survey was abandoned due to budget constraints. Second, because of legal requirements related to customer confidentiality, the database resulted in multiple Kit and survey mailings to some property managers rather than to service addresses; this could have been avoided with better database grooming. Third, a survey questionnaire branching flaw caused poor response from the initial nonparticipant sample; revised logic in a new questionnaire sent to a second sample resulted in satisfactory responses.

Finally a caveat: neither the Conservation Kit Program nor the evaluation survey addressed customer language barriers. The unknown proportion of customers who do not have a fluent English-reading person in the household to screen mail may have biased non-response to the Kit solicitation letter and to the follow-on survey. Planners should have taken the time to have program messages translated into the major language groups usually addressed in utility materials.

Conclusion & Recommendations

During 2001 Seattle City Light mounted a Conservation Kit Program that acquired 3.7 aMW of annualized load reduction at a levelized cost to the utility of 17.7 mills, with an added spillover cost to participating customers of 28.7 mills. The program exceeded planning expectations for cost-effectiveness, and acquired the resource at one-fourth of the utility's 2001 cost to deliver energy. The Conservation Kit Program, in combination with supplemental distributions and the Retail Coupon Program, reduced the averaged system load at Seattle City Light by 3.9 aMW. This load reduction will persist for up to seven years, the average measure life for Kit CF bulbs.

Meanwhile the combined distribution and coupon programs were effective at meeting the six strategic objectives for ensuring equal opportunity, increasing customer awareness, fostering future demand, supporting the retail sector, leveraging resources through collaboration, and implementing an efficient delivery method. Not only did the Conservation Kit Program meet its stated planning objectives, but it also met the utility's overarching goal to advance market transformation for compact fluorescent lighting in the residential sector of Seattle City Light's service area.

Recommendations

.....Adopt Savings Estimates in Energy Conservation Accomplishments Report

Seattle City Light monitors conservation programs in an annual publication, the next issue of which will be entitled ENERGY CONSERVATION ACCOMPLISHMENTS: 1977-2002. The Conservation Kit and distribution effects are reported under the umbrella program entity for direct delivery of residential products and services, *Neighborhood Power Lighting, Appliances, and Warm Home*. The Retail Coupon effects are reported under the umbrella program entity for retail market interventions, *RetailWise Lighting and Appliances*.

From the findings of this impact evaluation, effects of the Conservation Kit and Retail Coupon Programs shall be stated in the ACCOMPLISHMENTS report as in Table 22. The overlap between effects of the Conservation Kit spillover into retail purchasing and the effects of the retail coupon distributions is unknown, due to cancellation of the second follow-on survey designed to measure in 2002 the combined program impacts. In the absence of such information, and based on the low customer response rates to the regional coupon offers, the coupon and spillover effects are treated as additive in this recommendation.[55] Coupons redeemed in 2002, as well as estimated spillover effects, shall be reported as occurring in 2002; all other annualized effects shall be stated as

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[55] This recommendation incorporating spillover effects is made in accord with the observation from an outside consultant that Seattle City Light should focus more on systematically including factors that increase net savings (free drivers and other spillover effects), as well as the traditionally reported factors that decrease net savings (free riders, persistence, take-back).

Khawaja, M. Sami, Ken Seiden, Connie Colter, and Harold Schick, *[SEATTLE CITY LIGHT]* CONSERVATION PROGRAM REVIEW: FINAL REPORT, Quantec LLC (Portland OR: January 2001).

occurring in 2001, in accord with the ACCOMPLISHMENTS report principal of tracking full annualized savings acquisition in the year of program participation. Conservation Kit products and supplemental distribution CF bulbs shall be deemed to have a seven-year measure life, while bulbs purchased retail (Kit spillover and with coupons) shall be deemed to have a six-year measure life, consistent with the LightWise program.

Table 22: Performance Reporting of Program Annualized Net First-Year Impacts in 2001 and 2002

Conservation Kit, Distribution & Retail Coupon Program Impacts: First Year Savings	Count	Annual MWh Impact	2002 aMW Impact	w/ 5.2% T&D Credit
Kit Bulb Immediate Installations	285,570	15,564	1.777	1.869
Kit Bulb Delayed Installations	49,758	2,712	0.310	0.326
Kit Free Riders	(-35,696)	(-1,945)	(-0.222)	(-0.234)
Kit Water Measures	—	2,675	0.305	0.321
Supplemental Bulb Distributions	38,705	2,818	0.322	0.338
2001 Neighborhood Power	**338,337**	**21,824**	**2.492**	**2.621**
Retail Bulb Coupons	11,143	735	0.084	0.088
2001 RetailWise	**11,143**	**735**	**0.084**	**0.088**
Kit Spillover Purchases	166,418	9,070	1.035	1.089
Retail Bulb & Lamp Coupons	11,028	728	0.083	0.087
2002 RetailWise	**177,446**	**9,798**	**1.118**	**1.177**
Combined Total Impacts	***526,926***	***32,357***	***3.694***	***3.886***

..... Stage Another Round Aimed Toward Both Participants and Nonparticipants

Autumn 2003 will provide another seasonal opportunity, as nights grow longer, to encourage consumers to purchase and use CF bulbs. Seattle City Light can inform residents (with illustrations) of the wide variety of styles now available in stores and of their specific applications in the home. To expand the use of these products, utility informational materials can emphasize products that address outstanding customer concerns. Attention should be drawn to the wide range of bulb shapes, sizes, and light outputs, as well as bulbs appropriate for recessed fixtures or use on dimmers, and permanent fixture alternatives. Care should be taken to include messages in the major language groups typically included in Seattle City Light literature, to reach customers missed by the original solicitation.

Utility customers identified in the Kit database as nonparticipants would benefit from another, targeted Kit offer. Many of them could be converted to *New Users*, while others could be moved into the Early Adoption and Early Majority stages. It may be possible to use alternative mailing lists to target more directly the renters and apartment dwellers missed by the 2001 Conservation Kit Program.

The utility should not expend effort on another coupon program. The regional coupons were not effective at promoting sales of CF torchieres, and were less effective than expected at promoting sales of CF bulbs (the actual redemption rate was about 6.7%, compared to the 10% planned).

.....Look into Snohomish PUD Model for Follow-On Retail Boosters

Seattle City Light faces the opportunity now to work with manufacturers and retailers in a new way, now that a large proportion of residents have become users and purchasers of CF bulbs. The precedent has been set through the Kit program mass purchasing experience. At a minimum, the utility should look into the low-cost model adopted by Snohomish PUD, to maintain the momentum in residential lighting market transformation (see footnote 14 on page 5 of this report).

.....Evaluate Future Programs and Reassess Market Transformation Progress

While the 2001 Conservation Kit program itself was successful at leveraging resources through collaboration with other agencies, the evaluation effort was not successful in acquiring sufficient resources to carry through the original study design. The evaluation was intended to establish a baseline with the initial survey. Another survey was planned to follow in the second year, to track the combined effects of the Conservation Kit and Retail Coupon Programs upon CF-bulb market transformation in the residential sector. Due to budget constraints and cancellation of the second survey research phase, this study did not assess long-term retention, long-term satisfaction, Retail Coupon Program impacts in 2002, and ongoing market transformation.

Staging another CF-product distribution program, and following on with any retail boosters, offers the utility a second chance to reassess the ongoing transformation of the residential compact fluorescent lighting market. Survey research was effective at evaluating the 2001 Kit program. It should be supplemented in future with on-site surveys of efficient lighting opportunities in typical Seattle homes, and of retail stocking patterns for efficient and safe products that will solve consumer lighting problems.

.....Be Part of the Mercury Waste Management Solution

Seattle City Light should continue to participate in the regional dialogue about mercury waste management. Where the utility can productively take a hand toward a solution, perhaps through customer education and informational materials, information on responsible disposal should accompany any fluorescent lighting promotions.

The Survey Research

Research Innovations, Seattle, Washington, with Seattle City Light

Survey Executive Summary

Overview

In the Spring–Summer of 2001, Seattle City Light administered the Conservation Kit Program to distribute an energy and water efficiency kit to electric utility customers. Seattle City Light supplied Kit lighting efficiency products; Seattle Public Utilities collaborated to supply selected water efficiency items. Seattle City Light mailed solicitation letters to all of its 314,064 residential customers during late February through May of 2001. The letter offered to send free of charge a "Conservation Kit" containing two compact fluorescent light bulbs, an efficient-flow bathroom faucet aerator, and a water flow-rate bag to test the efficiency of household showerheads and faucets. Conservation Kits were distributed to all residents who responded to the solicitation letter. By the end of the project, 57% of Seattle City Light service area residents had responded to the offer and received a Kit.

Seattle City Light contracted with Research Innovations to study customer reactions to the products and the installation rates for each of the products distributed by the Conservation Kit Program. A total of 629 program **Participants**—customers who responded to the initial program solicitation mailing by requesting a Conservation Kit, and 581 program **Nonparticipants**—customers who did *not* respond to the program solicitation, completed mail-out questionnaires for this study. Although the Kit program is the focus of this report, the Retail Coupon distributions overlapped the data collection for this study. The information collected by this study provides the basis for estimating market trends in CF product use, and water and energy savings resulting from the program.

Major Survey Findings

.....New Users of CF Bulbs

Two-thirds (66%) of program Participants tried a compact fluorescent (CF) light bulb in their homes ***for the first time*** when they received the City's Kit.

Early Buyers, those who had tried CF bulbs before receiving the Kit offer, were found in the same proportion in both the surveyed groups: 34% of program Participants and 33% of Nonparticipants had tried the bulbs before.

> *Combining Participants and Nonparticipants into one group, the Conservation Kits were responsible for introducing approximately **38% of all** the households in Seattle City Light's service area to CF bulbs for the first time.*

Household CF Bulb Installation

For program Participants, the **Single-Bulb Installation Rate** was 92%. That is, nearly all Participants (92%) had installed at least one of the Kit bulbs at the time of the survey. In fact, 67% had installed both; thus the **Two-Bulb Installation Rate** is 67%.

> *For the service area, the Single-Bulb Installation Rate is 52%, consisting of the 14% of all customers who installed only one Kit bulb and the 38% who installed both of the Kit bulbs. This means that **52% of all** the households in the Seattle City Light service area have at least one Kit bulb installed.*

Adjusting for **Free-Ridership**, the Kit Program can be considered responsible for CF bulbs installed in approximately 71% of program Participant households. This is the **Adjusted Single-Bulb Installation Rate** for Participants.

> *Adjusting for Free-Ridership, the Kit Program can be considered responsible for CF bulbs installed in approximately **40% of all** households throughout the Seattle City Light service area (both Participants and Nonparticipants). This is the Adjusted Service Area Installation Rate for the service area.*

The largest proportion of Kit CF bulbs (31%) were installed in living rooms; this was twice the rate of installation in any other area of the house.

Half of the 33% of Participants who had **not** installed one or both Kit bulbs said they had not done so because they were simply waiting for an incandescent bulb to burn out. Most who had uninstalled Kit bulbs believed they were at least somewhat likely to install a Kit bulb in the next 6-8 months (23% of all Participants).

In 7% of participating households, residents perceived they have no more places to install additional CF bulbs. This is the **Saturation Rate**. In contrast, 85% of Participants still have places they feel they could install a CF bulb.

Market Transformation

The **Prior CF Bulb Installation** level was about one CF bulb per household. Participants averaged 1.03 CF bulbs installed per household before the Kit program. Nonparticipants averaged 0.94 CF bulbs per household at the time of the Kit offer.

Kit Bulbs Installed more than doubled the number of CF bulbs used by participating households. As a group Participants installed an average of 1.6 Kit bulbs per household.

The Kit program resulted in **Additional Purchases of CF Bulbs.** Nearly one-third (30%) of program Participants bought additional CF bulbs after receiving their Kits, resulting in an average of 1.04 additional purchased bulbs per household.

More than half of Participants who purchased more bulbs (16% of all Participants) said ***the Kit influenced their decision "a lot,"*** and an additional third (10% of all Participants) said the Kit had "a little" influence on additional purchases.

The combined impact of the Kit and additional purchases ***nearly quadrupled CF bulb usage***. At the time of the survey, Participants had increased the average number of CF bulbs installed to 3½ times the level before the Kit program (3.67 *after* vs. 1.03 *before*).

Participants said they could still install an average of 4.6 more bulbs per household, and Nonparticipants said they had about 6.2 more places where CF bulbs could be installed.

Thus, Participants reported a **Saturation Capacity** of about 8 CF bulbs, that is, the total number of CF bulbs they thought they could use if a CF bulb were used in all places that they believed could be fitted with a CF bulb. Nonparticipants reported a Saturation Capacity of about 7 CF bulbs.

Program Participants had reached a 12% **Market Transformation level** *before* the Kit program, and a 44% level *afterwards*, at the time of the survey. This means that Participants have installed about 44% (3.67 installed bulbs/8.27 Saturation Capacity) of their perceived maximum Saturation Capacity, or 44% of all the bulbs they report they could use.

.....Group Differences and Program Participation

Residents who participated in the Conservation Kit Program differed as a group from Nonparticipants in age, home ownership, fuel used to heat their homes, and income ($p<.05$). Participants were somewhat more likely than Nonparticipants to be 55 or older, were more likely to own their homes, use oil rather than electricity to heat their homes, and have lower incomes. These differences were very modest in magnitude.

About half of Nonparticipants said they ***did not notice*** the solicitation letter offering the Kit. We called this group the **Nonparticipant Passive Group**, as they did not receive the Kit offer, did not recognize it as an offer, or did not act upon the offer. A large proportion of these Nonparticipants asked in hand-written comments on their questionnaires if they could still receive the Kit.

Among the **Nonparticipant Choice Group**, those who gave a reason for not requesting the Kit, the most frequently checked reason was that lights are on dimmers or in recessed cans—features that make CF bulb usage inappropriate.

.....Barriers to CF Bulb Use

Program Participants indicated a ***high level of satisfaction*** with CF bulbs they received in the Kit, with 72% saying they were "very satisfied" with the bulbs they received in the Kit.

In other measures of satisfaction, most Participants said they planned to replace their Kit bulbs with another CF bulb when it burned out (in 3-5 years).

When asked what would be a fair price for a CF bulb, 64% of Participants and 58% of Nonparticipants said that $4 or $6 was a fair price. Participants, on average, gave a significantly higher dollar value for CF bulbs than did Nonparticipants ($4.81 vs. $4.12).

Nearly half (46%) of the Participants who already had CF bulbs installed in their homes, Early Buyers, reported that ***trying the Kit bulbs increased their satisfaction*** with compact fluorescent lighting.

Participants who were Early Buyers, those who already had tried CF bulbs, were more satisfied with the Kit bulbs than the bulbs they already had.

Among Nonparticipants who had tried CF bulbs, the Nonparticipant Choice Group (those who appeared to choose not to participate in the Kit program) were less satisfied with the CF bulbs they already had than the Nonparticipant Passive Group (48% vs. 69% "very satisfied").

Half of the program participants reported ***no problems*** using the CF bulbs from the Kit. The most frequently mentioned difficulties with the bulbs were brightness and size.

..... Use of the Aerator and Water Flow-rate Bag

Half of program Participants (52%) installed the **Faucet Aerator** that came in the Kit.

Most of those who had the aerator installed were ***very satisfied*** with it (70%), and nearly all said they will keep the aerator installed (97%).

The most frequently mentioned problem with the aerator was lack of fit on the faucet. Some also said they didn't like the spray pattern.

The **Water Flow-rate Bag** was the ***least frequently used*** of the items included in the Conservation Kit. Only 19% of the Participants used the water flow-rate bag to test the efficiency of their showerhead.

A small proportion (1.4%) of the entire Participant group changed to a more efficient showerhead after using the water flow-rate bag.

Consultant Recommendations

Based on the survey research, the survey research consultant recommended the following strategies for transforming the market for CF bulbs.

Because most residents have places to install more CF bulbs (***low saturation rate***), and program Participants and Nonparticipants appear more similar than they are different in their interest in CF products, Seattle City Light has opportunities to increase CF bulb use throughout the service area.

However, customers vary in their level of experience with CF bulbs; some have used CF bulbs for several years; many are in an early stage of CF bulb use due to the Kit program; and others, particularly Nonparticipants, have not yet used CF products. In addition, customer subgroups expressed specific concerns about using CF bulbs. These

group differences should guide future promotional messages and programs that seek further market transformation.

.....Market Transformation and Promotional Messages

The current early stage of market transformation in Seattle indicates that City Light has many opportunities for market transformation. The greater customer satisfaction with the Kit bulbs than previously installed CF bulbs suggests that ***introducing improved technologies is an important strategy*** for transforming a market. Other strategies include ***congratulations and encouragement***, and ***continuing customer education***.

.....Program Development

The success of the Conservation Kit Program indicates that distributing bulbs directly to utility customers is a viable way to affect the CF market quickly. Follow-up efforts can enhance its effectiveness, most importantly, ***a new offer to Nonparticipants and renters***, plus ***more retail discount coupons***.

.....Relationships with Industry Allies

Now that about one-third of Participants have begun to purchase more CF bulbs on their own, Seattle City Light could extend its impact on market transformation through ***collaborative efforts with retailers and manufacturers of CF products***. It will be important to future market transformation efforts for City Light to be aware of products available from manufacturers, and garner commitments by local retailers to carry ***a wide variety of new CF products***, with point-of-purchase displays and information sheets.

.....Future Research

Although the short-term effects of utility programs may be assessed in a single research study, market transformation can only be tracked with ***follow-up studies at planned intervals***, such as every two years for products that are relatively heavily promoted and quickly adopted. This will help Seattle City Light refocus educational and program strategies.

Survey Research Design

Overview

In the Spring–Summer of 2001, Seattle City Light administered a residential lighting efficiency program to conserve electric resources. City Light planned and operated the Conservation Kit Program to distribute an energy and water efficiency kit to electric utility customers. Seattle City Light[56] supplied Kit lighting efficiency products; Seattle Public Utilities[57] collaborated to supply selected water efficiency items.

In 1999 Seattle City Light had identified the distribution of compact fluorescent (CF) bulbs as a quick, cost-effective way to reduce energy use among residential customers. The value of this concept was confirmed in Fall 2000 by a multi-sector conservation potential assessment completed by Seattle City Light in cooperation with the Northwest Power Planning Council.

Due to the 2000–2001 West Coast energy crisis and rising wholesale energy prices, Seattle City Light launched the Conservation Kit Program as the first of a two-phase initiative to encourage the use of CF bulbs. The second phase, funded by the Bonneville Power Administration, encouraged the purchase of CF bulbs from retailers by sending customers a discount coupon in September–October, 2001, redeemable by December 31st. It was followed by a similar coupon mailed in January–February 2002 to encourage the purchase of CF fixtures.

CF bulb technology has been available for a number of years. However, the past experience of residents with CF lighting products was not always positive. Many early CF bulbs were too long or bulky to fit into most household fixtures. They were difficult to find in retail stores and fairly expensive. The light quality was seen as inferior to traditional incandescent technology. New CF products developed during the last five years have largely solved these problems. To get residential customers to purchase and use CF products and overcome prior negative impressions of the technology, Seattle City Light decided to reintroduce the bulbs to customers. This was a market transformation effort; that is, the program was designed to increase the residential use of CF bulbs and stimulate the market for CF products.

Seattle City Light contracted with Research Innovations[58] to study customer reactions to the products and the installation rates for each of the products distributed by the Conservation Kit Program. Although the Kit program is the focus of this report, the

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[56] Seattle City Light, Customer Services Branch, Energy Management Services Division, Community Conservation Section.

[57] Seattle Public Utilities, Resource Management Branch, Community Services Division, Resource Conservation Section.

[58] Research Innovations (Seattle WA) subcontractors include Decision Data, Inc. (Kirkland WA) and Brost Data, Inc. (Seattle WA).

Retail Coupon distributions overlapped the data collection for this study. Thus, many of the findings are best viewed as an assessment of Seattle's progress toward market transformation as of the beginning of 2002. The information collected by this study provides the basis for estimating market trends in CF product use, and water and energy savings resulting from the program. A key purpose of the program was market transformation, that is, to increase the residential use of CF bulbs and stimulate the market for CF products.

Kit Distribution

Seattle City Light mailed solicitation letters to all of its 314,064 residential customers during late February through May of 2001. The letter offered to send free of charge a "Conservation Kit" containing two compact fluorescent light bulbs, an efficient-flow bathroom faucet aerator, and a water flow-rate bag to test the efficiency of household showerheads and faucets.[59] Conservation Kits were distributed to all residents who responded to the solicitation letter.

Seattle City Light hired a fulfillment company[60] to mail out the solicitation letters, receive the return requests, track those requests, and assemble and mail out the Conservation Kits.

By the end of the project, 57% of Seattle City Light service area residents had responded to the offer and received a Kit.

Study Objectives

The specific objectives of this survey research study were to assess installation rates for Kit CF bulbs, satisfaction with the Kit bulbs, barriers to requesting and using Kit bulbs, prior use of and satisfaction with CF bulbs, perceptions of a reasonable price for CF bulbs, reasons for not requesting the Kit, and demographic differences between Participants and Nonparticipants. The study also assessed installation of the faucet aerator and water flow-rate bag included in the Kit, as well as satisfaction and problems experienced with the aerator. The Conservation Kit Program evaluation was designed to incorporate a second survey. The second survey would follow up on the market transformation impacts of subsequent program distributions of retail discount coupons for CF bulbs (purchased September–December 2001) and CF fixtures (purchased January–April 2002), as well as longer-term impacts of the original Conservation Kit Program. The long-term survey has been abandoned due to budget constraints.

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[59] The Energy Star® rated compact fluorescent bulbs included one 15-Watt bulb equivalent to a 60-Watt incandescent, and one 23-Watt bulb equivalent to a 100-Watt incandescent. They were supplied by Sunpark Electronics Corporation and Technical Consumer Products, Inc. Niagara Conservation Corporation supplied the 1.0 gallon-per-minute (gpm) faucet aerator.

[60] Solicitation, assembly, packaging, mailing, and tracking of Conservation Kits was performed by K/P Corporation, Inc. (Seattle WA), a marketing fulfillment house.

Survey Methodology

Survey Procedure

The short-term Conservation Kit survey was conducted from September 2001 through January 2002. In September 2001, the Seattle City Light evaluator mailed an 8½ x 8½-inch survey booklet with cover letter and postage-paid return envelope to 1,718 program **Participants**—customers who responded to the initial program solicitation mailing by requesting a Conservation Kit, and to 1,412 program **Nonparticipants**—customers who did *not* respond to the program solicitation. Research Innovations, in consultation with the City Light evaluator, developed separate questionnaire booklets appropriate to each group. Two weeks after the survey mailings, a follow-up postcard was mailed to Participants to remind them to complete the questionnaire and to thank those who had already done so. Customers continued to return survey booklets throughout the next two months.

Due to difficulties with the Nonparticipant survey response (see below), a second sample of 1,350 Nonparticipants was sent a revised questionnaire in November 2001, and those who did not respond after the first mailing and follow-up postcard received two further mailings of the questionnaire booklet during December 2001–January 2002. Copies of the survey materials and follow-up post-card appear in the Appendix.

Sampling Procedure

The Seattle City Light evaluator selected proportional stratified 1% random samples from groups of residential customers documented in a computer database supplied by the Kit distributor. The original contact file contained customer service addresses and mailing addresses for customers with active single-family and multifamily accounts. It was drawn by City Light from the conservation customer information system (CTS) and delivered to the fulfillment house in comma-delimited format. Due to legal requirements related to customer confidentiality, the database fields contained a specifically-identified mailing address, should the customer have provided one for utility contacts; and if not, contained the service address. The fulfillment house maintained the database in FoxPro™, adding flags and dates for postal station, tracking of requests for Kits, their distribution, responses to customer telephone calls or complaints, and Kits re-mailed due to bad addresses, breakage or burnt-out bulbs.[61] The database was returned to City Light program management for program documentation. The evaluator converted the file to Access™ before manipulating the data in SPSS™ and drawing the 1% survey samples.

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[61] The U.S. Postal Service recognized Seattle City Light at their National Postal Forum (Denver, Colorado, October 14-17, 2001), with an Idea Forum award for "innovative use of the Postal Service." This award was presented to representatives of the Community Conservation Section for the "parcel select" mass-mailing of Conservation Kits in 2000.

Response Rates

A total of 629 program Participants (37% of the sample) returned completed questionnaires by a cutoff deadline set for data processing, and were included in all data analyses. This is called the **Completion Rate**. Another 72 Participants (4%) returned their questionnaires in a less complete state (for example, having skipped a page), or were disqualified because they did not fall into the correct sample group (for example, requested but did not receive a Kit). The total **Response Rate** (complete plus incomplete questionnaires returned) is 41%. The apparent Response Rate of 41% returning a questionnaire is likely an under-estimate of the actual Response Rate, as multiple mailings went to property managers on the mailing list (having multiple properties and multifamily building units with a single utility-contact mailing address), some of whom responded only once to the questionnaire.

Among Nonparticipants in the second sample (sent in November), 473 completed the revised survey for a 40% Completion Rate. As shown in Table 23, another 48 responded with incomplete questionnaires (4%), giving a 45% Response Rate. An additional 108 Nonparticipants responded with complete questionnaires to the first version of the survey (sent in September); these responses were combined with the final sample for a total of 581 Nonparticipant respondents.

Undeliverable mailings to each group were subtracted from the sample sizes when calculating response rates; the counts were 10 for Participants, 102 for the first Nonparticipant sample, and 180 for the second Nonparticipant sample.

Table 23: Survey Samples and Completion Rates

Samples	Participant	Nonparticipant I	Nonparticipant II
Sample size	1,718	1,412	1,350
Undeliverable	10	102	180
Deliverable sample	1,708	1,310	1,170
Completed questionnaires	629	108	473
Completion rate	37%	8%	40%
Screened out	43	152	0
Incomplete	31	9	48
Total response rate	**41%**	**21%**	**45%**

A sample of 600 provides a 4% level of precision for the entire sample on proportions near 50% with a 95% confidence interval. For example, if 41% of the respondents heat their homes with natural gas, in 95% of samples drawn from the population the actual proportion of service-area residents who heat their homes with natural gas equals 41%±4%, or somewhere between 37% and 45%. Thus we are confident that 41% is a reliable estimate of gas space heating.

Nonparticipant Survey Versions

Nearly all the Participants who responded to the survey confirmed that they had requested and received a Kit; the few who said they did not receive a Kit were instructed to return the questionnaire unanswered. However, the first Nonparticipant sample drawn was problematic. Although the survey designers assumed that Nonparticipants had made a conscious choice not to request a Kit, many Nonparticipants said that they did not recall receiving the offer, or did request the Kit but did not receive it. Because the first version of the Nonparticipant survey instructed customers to return the questionnaire unanswered if they had not received the Kit offer or if they had in fact requested the Kit, the Nonparticipant Completion Rate was low and necessitated a second version of the survey to be sent to another sample of Nonparticipants.

A total of only 269 in the first Nonparticipant sample returned the questionnaire, yielding a 21% response rate; a much smaller subgroup of 108, or 8%, completed the questionnaire. A full 39% of the Nonparticipants who responded to the initial survey indicated they did not recall receiving the offer, an additional 15% said they did request the Kit but did not receive it, and 3% said they in fact did receive the Kit.

The screening decision to exclude those who didn't notice or receive the Kit was made because the survey designers believed that those who had made a conscious decision to decline the Kit offer constituted the vast majority of the Nonparticipant database. Those who declined to participate also were expected to provide the most information about barriers to using CF products.

The unexpectedly large number of individuals who fell into the screened-out categories and returned incomplete surveys can be attributed to a combination of factors: database error concerning who did and did not receive a Kit offer (perhaps because mailing of Kits continued beyond the cut-off date, when survey samples were drawn); multiple Kit offers sent to property management companies rather than individual residential-use customers; poor customer recall of the Kit offer; and Kit deliveries that were mistakenly received by nearby residents (or otherwise "lost in the mail").

Two further difficulties affected the overall efficiency of the survey administration as well as Seattle City Light's ability to reach its customers to offer them the Conservation Kit. First, City Light is required by law to contact customers using the designated mailing address rather than the service address. This probably led to some confusion among customers about the intended location eligible for program services. Second, the database was not sufficiently cleaned before program administration to eliminate multiple service addresses linked to a common mailing address. This meant that multiple mailings of both the offer and the questionnaire booklet went to property owners and managers, whereas the property tenants did not receive the offer. A small proportion of these parties receive mail outside the City Light service area (which is basically zip codes 98101-98199), either in Washington State or other locations across the country. A further result of the database difficulties was that not all customers in City Light's service area received the offer for the Kit because, although the service address lies within City Light boundaries, the mailing address lies outside those boundaries.

All complete questionnaires from both the first and the second Nonparticipant surveys were included in the sample of Nonparticipants. This sample underestimates those who

did not recall the offer, because most of those who actually completed the first version of the Nonparticipant survey remembered the offer.

Data Analysis and Reporting Conventions

Differences among respondent groups were analyzed in SPSS™ using chi-square statistics for frequency data.[62] Results are reported for items showing differences significant at the probability levels of $p<.000$ to $p<.05$. Nearly all the group differences discussed in the report are statistically significant at the 95% confidence level. That is, these findings could have occurred by chance in only one in twenty samples drawn from the studied populations. A few findings are significant at the 90% confidence level and were interpreted for their implications for the program if they were consistent with other patterns in the data. Any reported findings at a 90% confidence level are described in the text as "trends." Open-ended responses were analyzed using Microsoft Excel™.

Graphs of tabled data are used in the text to highlight important findings. The *Topline Reports* for each respondent group, included in the Appendix, provide tabled response percentages for the entire survey. The *Topline Reports* were prepared as soon as the initial frequency data were available for each respondent sample. Some slight inconsistencies may exist between this report and the *Toplines*, as the data sets were refined for more complex analyses. In those cases, figures in this survey report document are the most accurate.

The abbreviation **CFL** commonly refers to "compact fluorescent lighting" or "compact fluorescent light bulb." In this report this type of lighting will be referred to as "CF bulbs."

The questionnaire booklets left space for open-ended comments, beyond the choices listed on the questionnaire, about the following topics: problems with the CF bulbs, what customers did with uninstalled CF bulbs, where the faucet aerator was installed (if not the bathroom or kitchen), factors affecting use of the aerator, and reasons for not requesting the Kit. General additional comments were solicited at the end of each booklet. These comments were used only to elucidate the quantitative analyses and to identify problem areas. They are listed verbatim in a technical report that accompanies this document.

Characteristics of Program Participants and Nonparticipants

Respondent groups had demographic profiles that were consistent with Seattle City Light's *2000 Residential Customer Characteristics Survey (RCCS)* data, collected on a regular basis throughout City Light's service area.[63] The *RCCS* data are considered representative of utility customers as a whole. Demographic differences between Participant and Nonparticipant groups are examined on page 86.

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[62] Decision Data, Inc. conducted the quantitative data analyses for Research Innovations.

[63] Geist, Arlene M., 2000 RESIDENTIAL CUSTOMER CHARACTERISTICS SURVEY, Financial Planning Unit, Finance Division, Seattle City Light (Seattle WA: December 2001).

Survey Findings

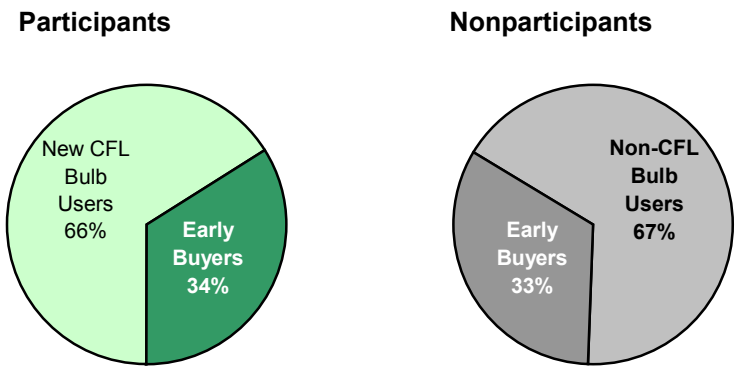
Introducing CF Bulbs to Seattle Households

..... New Users of CF Bulbs

> *How many residential customers were introduced to CF lighting for the first time through the Conservation Kit?*

The Conservation Kit Program introduced a large proportion of utility customers to CF bulbs. *Two-thirds (66%) of program Participants tried a compact fluorescent (CF) light bulb in their homes* ***for the first time*** *when they received the City's Kit.* As Figure 3 shows, the Conservation Kit offered these **New Users** their first opportunity to try the bulbs.

Figure 3: First-Time CF Bulb Users

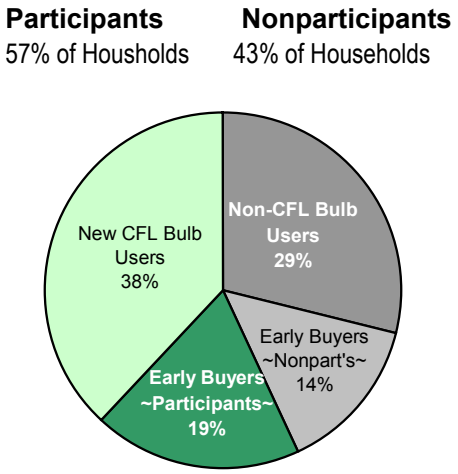


Those who had tried CF bulbs before receiving the Kit offer are called **Early Buyers**. Approximately a third of all respondents were Early Buyers. As shown in Figure 3, Early Buyers were found in the same proportion in both the surveyed groups: 34% of program Participants and 33% of Nonparticipants had tried the bulbs before.

Figure 4 combines the information from Figure 3 into a single pie chart to show the proportions of Participants and Nonparticipants in the entire service area. Across all households in the service area, 57% were program Participants and 43% were Nonparticipants.

Figure 4 also shows the proportion of all households in Seattle City Light's service area that were introduced to CF bulbs by the Kit program. *The Conservation Kits were responsible for introducing approximately 38% of all the households in Seattle City Light's service area to CF bulbs for the first time.*

Figure 4: First-Time CF Bulb Users among All Households in Service Area



As illustrated in Figure 2, one-third (33%) of all Seattle City Light customers were Early Buyers, another 38% became New Users due to the program, and 29% remained non-users of CF lighting at the time of this survey.

.....Early Buyers of CF Bulbs

How do CF bulb New Users and Early Buyers differ?

New Users—those Kit recipients who were trying CF bulbs for the first time—were more likely than Early Buyers to fall into the demographic groups listed in the first column of Table 24. That is, they were more likely than Early Buyers to have one or more of these characteristics. New Users were more likely to be renters, apartment dwellers, female respondents, have fewer members of their households, and have lower household incomes, less than $60,000. For size of household, the relationship appears linear; that is, the smaller the household, the more likely the respondent was a New User (had not used CF bulbs before the Kit program).

Table 24: Characteristics of New CF Bulb Users Compared to Early Buyers

New CF Bulb Users More Likely Characterized by:	**Early Buyers** More Likely Characterized by:
Rent home	Own home
Apartments	Single family homes
Smaller households	Larger households
Lower income	Higher income
Female	Male

Early Buyers (those who purchased CF bulbs before the Kit Program), in contrast, were more often homeowners, residents of single-family homes, male respondents, those who have larger households, and those with household incomes of $60,000 or more.

Consistent with the findings for program participants, Early Buyers who did *not* participate in the Kit Program were more likely to be homeowners, residents of single-family homes, have larger households, and higher household incomes.

Implications of Bulb Introduction

The large proportion of residents who said they used a CF bulb for the first time when they received the City's Kit indicates that the Conservation Kit Program has been a vital force in transforming the Seattle market for CF bulbs. This program has helped Seattle City Light take a giant first step toward achieving its market transformation objective.

The demographic profile of new CF bulb users makes sense in that those who live in one-person households and have lower incomes would be less likely to have spent money to try (relatively expensive) CF bulbs. Apartment dwellers overlap with renters, and are also more likely to have lower incomes than homeowners. They may be reluctant to spend extra money on household lighting that would remain with the apartment after they move. Of interest is that women were more likely to be new CF bulb users than men were. Lower income customers are less likely on their own to use unfamiliar, higher-cost products (this group includes many women). However, the program was successful at encouraging people with these demographic features to use the CF bulbs.

This program offered a relatively expensive item free of charge. The demographic findings suggest that such a direct distribution program is a particularly effective method of introducing a product to a market segment who would be reluctant to purchase CF bulbs on their own but stand to benefit most by the resulting energy savings.

Household CF Bulb Installation

Installation Rate

> *What was the Installation Rate for Conservation Kit bulbs?*

For program Participants, the **Single-Bulb Installation Rate** *was 92%. That is, nearly all Participants (92%) had installed at least one of the Kit bulbs at the time of the survey. In fact, 67% had installed both; thus the* **Two-Bulb Installation Rate** *is 67%.* These proportions are illustrated in Figure 5, which shows that 9 out of 10 Participants installed a CF bulb, and 2 out of 3 installed both bulbs. In terms of number of bulbs, 997 more CF bulbs were installed in the homes of this group of 629 residents after distribution of the Kits than before, on average, 1.6 Kit bulbs per household across the entire participant group. This is the **Participant Installation Ratio**.

Figure 5: Proportion of Participants Installing One or Two Kit Bulbs

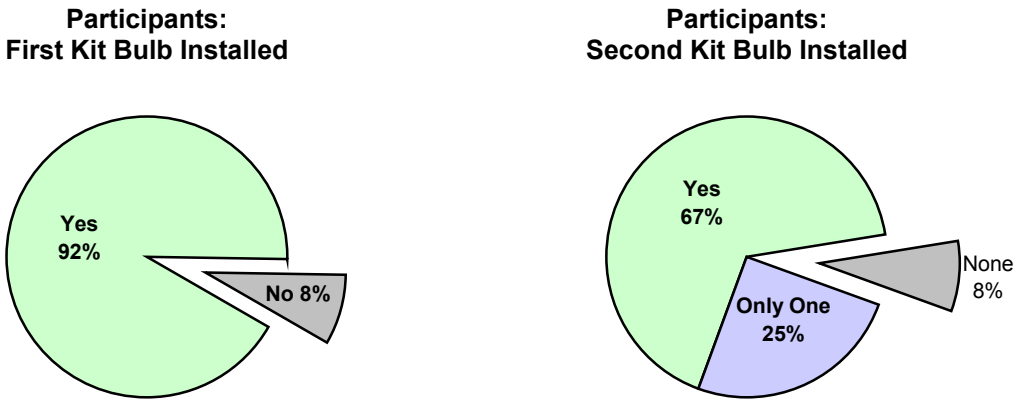
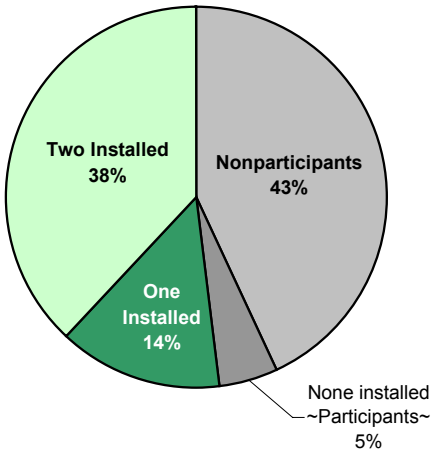


Figure 6 shows the installation rates calculated across the entire Seattle City Light service area, which includes both Participants and Nonparticipants. *For the service area, the* **Single-Bulb Installation Rate** *is 52%, consisting of the 14% who installed only one bulb and the 38% who installed both of the Kit bulbs. This means that 52% of the households in the City Light service area have at least one Kit bulb installed.* (The service-area installation rates, illustrated in the following figure, are calculated by multiplying each Participant installation rate by the 57% of the population who were Participants).

Figure 6: Seattle City Light Households Installing One or Two Bulbs



The **Service Area Installation Ratio** is 0.9 for the Seattle City Light service area (Table 25). This figure indicates the number of Kit bulbs installed by Participants relative to the entire number of households in the service area. Even though 44% of households did not participate in the program, the total number of Kit bulbs installed by the time of this survey was equivalent to 9 bulbs for every 10 households in the service area (1.6 bulbs per Participant x 0.57 proportion of Participants in the population).

Table 25: Bulb Installation Statistics

Participant Measures:	
Single-Bulb Installation Rate (proportion of Participant households with at least one Kit bulb installed)	92%
Two-bulb Installation Rate (proportion of Participant households with two Kit bulbs installed)	67%
Participant Installation Ratio (average number of bulbs installed per Participant household)	1.6
Total number of Kit bulbs installed	997
City Light Service Area Calculations:	
Single-bulb Installation Rate (proportion of all service area households with at least one Kit bulb installed)	52%
Service Area Installation Ratio (average number of bulbs installed per service area household)	0.9

Program Free-Riders

> *What proportion of installations are due to the Conservation Kit Program? What proportion were Free Riders?*

When estimating the impact of a conservation program on behavior, we attempt to control for **Free-Rider Effects**, that is, the behavior that would have occurred in the absence of the program. In this case, Free-Rider figures estimate the proportion of respondents who would have purchased a CF bulb between the Kit distribution period and the time of the survey, if the Conservation Kit Program had not taken place. Then the Single-Bulb Installation Rate of 92%, reported above, can be adjusted to give a more conservative estimate of program effects.

The short-term survey measured self-reported Free-Ridership by asking respondents how likely it was that they would have purchased a CF bulb during that period. A full 21% of Participants said that they were very likely to have purchased a bulb on their own. Although program participants might overstate their socially desirable behavior, 21% seems a reasonable proportion. The Early Buyers, 34% of Participants, had installed a CF bulb in their homes already. Due to retail sales promotions over the last 1-2 years, we might expect anywhere from a quarter to a half of these customers to purchase another CF bulb in a 6-8 month period, or perhaps 9-17% of Participants. Some small proportion

of those who had not previously purchased a CF bulb might also purchase a CF bulb, contributing to the 21% figure.

By subtracting this Free-Ridership figure (92%-21%), we calculate an **Adjusted Single-Bulb Installation Rate** of 71% attributable to the program, removing Free-Rider Effects. That is, *the Kit Program can be considered responsible for CF bulbs installed in approximately 71% of program Participant households* (Table 26).

Applying the Adjusted Installation Rate to the entire service area, we can calculate the proportion of all residents who installed a CF bulb due solely to the Conservation Kit Program. The **Adjusted Service Area Installation Rate** for the Seattle City Light service area, across both Participants and Nonparticipants, is 40% (71% adjusted installation x the 57% proportion of the population who were Participants).

Table 26: Bulb Installation Statistics Adjusted for Free-Rider Effects

Participant Measures	
Adjusted Single-Bulb Installation Rate (proportion of Participants with at least one Kit bulb installed attributable to program effect only)	71%
Adjusted Participant Installation Ratio (average bulb installation per Participant household due to program effect only)	1.4
Adjusted total number of Kit bulbs installed due to program effect only	868
City Light Service Area Calculations	
Adjusted Single-Bulb Installation Rate (proportion of all service area households with at least one Kit bulb installed attributable to program effect)	40%
Adjusted Service Area Installation Ratio (average number of bulbs installed per service area household attributable to program effect only)	0.8

.....Kit Bulb Locations

Where did Participants install their Conservation Kit bulbs?

The following table shows in which areas of the home Participants installed their CF bulbs. The table indicates that *the largest proportion of bulbs were installed in living rooms.* About one-third to one-half the number installed in living rooms were used in each of the following locations: kitchens, porches, bedrooms, and family rooms or home offices. The second and fourth columns of Table 27 compare the locations of Kit bulbs with previously installed bulbs acquired before receipt of the Conservation Kit. The proportions are fairly similar, with a few exceptions: more Kit bulbs went into living rooms than before, and slightly more went into porches, whereas slightly more previously installed bulbs went into bathrooms.

Table 27: Location of Installed CF Bulbs

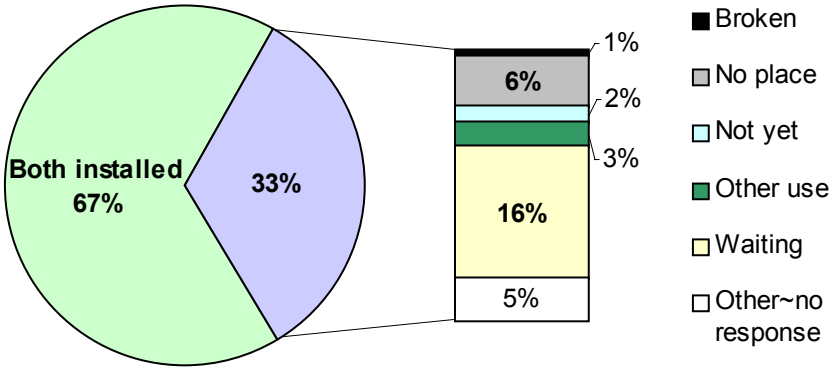
Area of Home	Kit Bulbs Installed		Previous Bulbs	
	Count	Percent	Count	Percent
Living room	292	31%	123	20%
Kitchen	125	13	89	14
Porch	120	13	53	9
Bedrooms	114	12	94	15
Family room or home office	92	10	53	9
Hall, entry or stairway	63	7	45	7
Bathrooms	61	6	61	10
Basement, shop, garage or laundry	53	6	57	9
Yard or driveway	18	2	28	5
Storage room, pantry or closet	13	1	17	3
Total	**951**	**100%**	**620**	**100%**

Fate of Uninstalled Bulbs

What did Participants do with their uninstalled Conservation Kit bulbs?

The 33% of Participants who had not installed one or both bulbs explained what they did with their uninstalled bulbs. As shown in Figure 7, half of non-installers (16% of Participants) said they were simply waiting for an incandescent bulb to burn out, and another one in ten non-installers (3% of Participants) used them in another way, either installing them somewhere else or giving them to a friend.

Figure 7: Bulbs Not Installed by Participants



Of more concern are the 6% of Participants who said they could not find a place for one of the Kit bulbs. Another 2% of Participants said they hadn't gotten around to installing them yet, and 1% said a bulb broke or burned out.

Many of the broken or burnt out bulbs were replaced by the Conservation Kit Program upon customer request. The delivery database shows that 182 Kits arrived with a broken bulb and required replacement. Another 37 customers requested replacement of bulbs that burned out early. The 219 replaced Kits represent 0.1% of the total assembled and mailed to participating customers. The survey suggests that only one out of ten customers who experienced a bulb failure or breakage reported it to Seattle City Light.

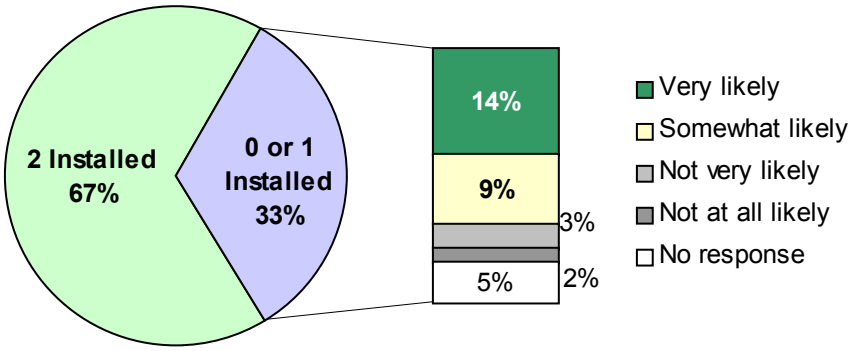
.....Expectations for Uninstalled Bulbs

Did Participants expect to install both Conservation Kit bulbs?

Among the 33% of Participants who had not installed both Kit bulbs, about half said they were very likely to install a Kit bulb in the next 6-8 months, and more than three-quarters said they were at least somewhat likely to do so. As illustrated in Figure 8, between 14% and 23% more of the Participants expected to install a Kit bulb within the year.

Most of those who still had a bulb to install believed they were at least somewhat likely to install a Kit bulb in the next 6-8 months, presumably when an incandescent had burned out. They represent 23% of all Participants.

Figure 8: Likelihood of Installing a Kit Bulb in 6-8 Months



.....Saturation Rate

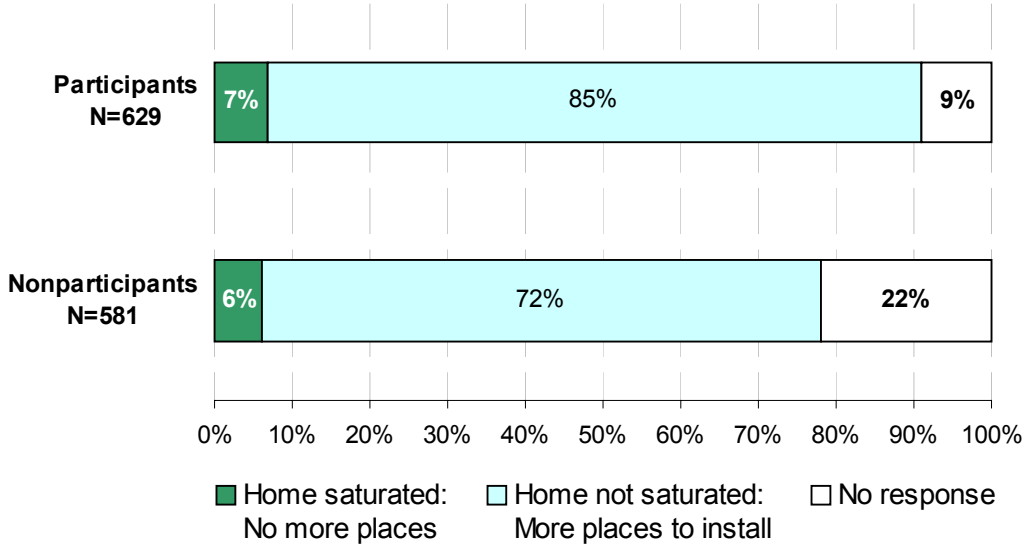
What was the Saturation Rate among program Participants?

Saturation rate refers to the proportion of participating households where residents perceive they have no more places to install additional CF bulbs. *The Saturation Rate of perceived CF lighting locations at the time of the survey was 7%.* Another 9% of Participants did not answer the question, so it is unclear whether they did or did not have more places to install CF bulbs. This means that 85% of Participants still have places they feel they could install a CF bulb.

The 533 Participants who believed they could use more CF bulbs said they had places to install between 1 and 31 bulbs, averaging 5.4 more bulbs per household. A more conservative statistic, applicable to all Participants, can be calculated by taking the total number of perceived additional bulb locations and dividing the sum by the entire 629 Participant sample. This statistic indicates that program Participants as a group provide a potential to increase the number of bulbs installed by an average of 4.6 CF bulbs per household. (For more on this topic, see page 80.)

Among Nonparticipants, 6% said they had no additional places to install CF bulbs. Another 22% did not answer this question, so it is unclear whether they did or did not have more places to install CF bulbs. The remaining 72% of Nonparticipants still have places they feel they could install a CF bulb.

Figure 9: Perception of More Places to Install CF Bulbs



Implications of Bulb Installations

Measures of Program Success

The CF bulbs distributed by the Utility enjoyed a remarkable 52% Household Installation Rate (92% of 57% of residents), similar to the 54% installation rate for showerheads in Seattle City Light's Home Water Savers Program[64], through which efficient flow showerheads were distributed directly to every household in the City Light service area.

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[64] Brattesani, Karen A. and Debra L.O. Tachibana, SEATTLE CITY LIGHT SURVEY RESEARCH FOR THE HOME WATER SAVERS PROGRAM, PHASE II, Research Innovations and Evaluation Unit, Energy Management Services Division, Seattle City Light (Seattle WA: March 1994).

That 1992-1994 program also took place in a period of regional drought, during which local news media carried frequent articles about the need for resource conservation. To be fair, it is easier to install a light bulb than a showerhead. Still, the high bulb installation rates depended on both a high level of initial interest in the bulbs (57% response to the solicitation) and a very high follow-through to install them (92%).

A major difference between these two programs is that the Home Water Saver Kits went unsolicited to all homes, whereas the current Conservation Kit went only to the 57% of homes requesting a Kit. If all interested Nonparticipants had also seen the notice and requested a Conservation Kit (see page 88), the single-bulb installation rate for the service area would have been even higher.

The method of Conservation Kit distribution may be in part responsible for the high level of Kit CF bulb use. Behavioral studies have found that a higher proportion of individuals follow through on an intent to act in a certain way if they do something in advance, such as signing a "contract," that heightens their commitment to act. By having to send in a reply card, customers may have made some level of commitment to using the products they received.

The Free-Rider adjustment gives a conservative estimate of the installations that can be attributed to the Conservation Kit Program alone. Because the calculation is based on self-reports of probable behavior rather than the actual behavior of a control sample, the figure is a best estimate. If the measure is biased in any direction, the self-report measure may over-estimate CF bulb purchases in the absence of the program, as bulb purchase was a socially desirable behavior in the context of this study. Thus, the estimated program impact, adjusted for Free-Rider Effects, is a conservative estimate of program impact. Compared to the 35%-43% showerhead installation rate from the Home Water Savers program (adjusted for Free-Ridership), the 71% adjusted Participant installation rate and the 40% adjusted service-area rate for CF bulbs are commendable.

Additional CF lighting promotions, such as discount coupons distributed with utility bills, and community outreach bulb distributions, occurred at the same time as the Conservation Kit Program or overlapped the program. These efforts can not be statistically controlled. Thus, program effects are properly attributed to a combination of these efforts.

.....How Residents Used Kit Bulbs

Consistent with instructions to install one of the CF bulbs on a porch, slightly more Kit bulbs were installed on porches than previously installed bulbs. However, the largest proportion of Kit bulbs were installed in living rooms; this may have been one place where people are aware that a light is on at least 3 hours per day (as the Kit insert recommended). A Tacoma Public Utilities study[65] of the number of hours lights are used

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[65] Tribwell, Lyle S. and David I. Lerman, Tacoma Public Utilities, "Baseline Residential Lighting Energy Use Study," PROCEEDINGS OF THE 1996 SUMMER STUDY ON ENERGY EFFICIENCY IN BUILDINGS, American Council for an Energy Efficient Economy, Washington DC (Pacific Grove CA: August 1996), 3:153-160.

in different parts of the home found the following average hours of usage: porch 4.7, yard or driveway 3.4, kitchen 3.9, living room 3.1, bathrooms 1.7, bedrooms 1.2-1.3. **Follow-up educational materials might target the high-usage areas by continuing to encourage residents to install CF bulbs in those specific locations first.**

Customers should also be reminded that CF bulbs come with a limited one-year warranty that guarantees replacement if the bulb burns out within the first year of use. The Kit materials gave a telephone number to call if the Kit arrived damaged, and the bulb boxes instructed customers to return bulbs that burned out before one year to the bulb company or the place of purchase. However, customers may not have known they could contact the utility for a replacement. The one-year warranty applies to bulbs purchased in retail outlets, as well, and Seattle City Light should continue to remind customers using discount coupons or making purchases on their own that they can get a free replacement if any CF bulb burns out within the first year.

..... Measures of Work to be Done

In addition to the 67% of Participants who have installed both Kit bulbs, a large proportion of residents said they planned to use their uninstalled bulbs (14%-23%). **This means that nearly 90% of Participants might realize the energy and cost savings of both Kit bulbs in the long-term.**

That 16% of Participants were waiting for an incandescent bulb to burn out in order to install a Kit bulb indicates that respondents were not willing to "waste" their current bulbs for the prospect of electricity cost savings. Seattle City Light may have to be patient rather than appear wasteful by encouraging disposal of functioning incandescents.

Meanwhile, the survey data point to additional opportunities for Seattle City Light to encourage CF bulb use. **In particular, the low Saturation Rate (few respondents said they had no more additional places to install a CF bulb) indicates the market is still in an early stage of transformation.** Rather, 85% of Participants and 72% of Nonparticipants said they had more places in their households to install CF bulbs. Consequently, Seattle City Light can further encourage residents to change out their incandescents for CF bulbs, whether by product distribution programs, coupon discounts, or educational outreach. **At this early stage of market transformation, further educational or promotional materials would be most effective if broadly distributed to service area residents, rather than targeted to a small group.**

The saturation rate is a household-level indicator of market transformation, that is, a statistic where the unit of measurement is households. In the next section, we examine indicators of market transformation based on the number of bulbs installed.

Market Transformation

The survey data can be used to create a picture of the changes in CF bulb use over time, or market transformation where the product is the unit of measurement. The data most relevant to understanding market transformation for CF bulb use are:

- Prior CF Bulb Installation: Number of CF bulbs installed before residents received the Kit offer in Spring 2001
- Kit Bulbs Installed: Number of Conservation Kit bulbs installed (Participants only)
- Additional Purchases: Number of additional bulbs purchased and installed between Spring 2001 and the time of the survey
- More Places to Install CF bulbs: Number of additional places residents believe they could install a CF bulb.

Statistics for each of the above variables were calculated separately for Participants and Nonparticipants, and were based on the number of respondents who answered each survey question. As a result, many pieces of data come from a slightly different subset of the respondent samples. For example, the 184 Participants who installed bulbs prior to the Kit offer may overlap, but are a different group than, the 166 who purchased bulbs after receiving the Kit. Each of these subgroups is different from the 578 Participants who installed Kit bulbs and the 533 who said they had more places to install CF bulbs.

To examine installation statistics for Participant and Nonparticipant samples as a whole, we divided the total number of bulbs (sums in Table 28) by the total sample size of Participants or Nonparticipants in each subgroup. In this way the average installation statistics for each respondent group were recalculated to render the data applicable to the entire Participant group (629 respondents) or Nonparticipant group (581 respondents). What resulted were comparable statistical averages that could be added together to indicate the cumulative installation of CF bulbs for each group. These statistics are shown in Table 29 and illustrated in Figure 10.

Table 28: Average Number of CF Bulbs Installed: Respondents Only

Samples	Installed Before Program	Kit Bulbs Installed	Purchased After Spring 2001	More Places to Install
Participants				
N of cases	184	578	166	533
Sum of bulbs	648	997	657	2,897
Average bulbs	3.5	1.7	4.0	5.4
Nonparticipants				
N of cases	170	n/a	47	421
Sum of bulbs	549	0	649	3,601
Average bulbs	3.2	0.0	3.1*	8.6

* Data underestimate actual average for this group.

Table 29: Market Transformation: Average Number of CF Bulbs Installed Across Entire Participant or Nonparticipant Sample

	N of Cases	Installed Before Program	Kit Bulbs Installed	Bought After Spring 2001	More Places to Install
Participants	629	1.03	1.60	1.04	4.60
Nonparticipants	581	0.94	0.00	0.25*	6.20

* Data underestimate actual average for this group.

..... Prior CF Bulb Installation

The Participants who had installed CF bulbs before receiving the Kit offer in Spring 2001 had an average of 3.5 bulbs installed (based on 184 respondents), and the Nonparticipants who had installed CF bulbs before Spring 2001 had an average of 3.2 bulbs installed (based on 170 respondents). These averages, shown in column one of Table 28, were not significantly different from each other.

Calculated across each sample, Participants averaged 1.03 CF bulbs installed per household before the Kit program. Nonparticipants averaged 0.94 CF bulbs per household at the time of the Kit offer. These averages are in column one of Table 29.

.....Kit Bulbs Installed

Statistics on Conservation Kit bulbs installed pertain only to program Participants. The 578 Participants (92% of Participants) who installed at least one Kit bulb installed a total of 997 bulbs, or an average of 1.7 bulbs per household. If the 997 total installed bulbs are averaged over the entire 629 Participants, we find that *as a group Participants installed an average of 1.6 Kit bulbs per household.* These statistics are shown in column two of Table 28and Table 29.

If we compare installation levels before and after Kit distribution (Table 29), we find that *after Kit bulbs were installed, the average number of CF bulbs installed in Participant homes increased to 2½ times the previous installation level (2.63 vs.1.03).*

.....Additional CF Bulb Purchases

Nearly one-third (30%) of program Participants bought additional CF bulbs after receiving their Kits. Participants who had purchased more had installed an average of 4.0 additional bulbs (based on 166 respondents). Calculated for the entire Participant sample, *Participants installed an average of 1.04 additional purchased bulbs per household. That is, subsequent purchases alone doubled the number of CF bulbs Participants used as a group before receiving the Kit offer.*

About 8% of Nonparticipants reported purchasing CF bulbs between the time of the Kit offer and the time of the survey. These Nonparticipants had installed an average of 3.1 additional bulbs during that time period. Calculated for the entire Nonparticipant sample, Nonparticipants installed an average of 0.25 additional purchased bulbs per household.

Because so few Nonparticipants reported additional purchases, Nonparticipants as a group appear to have installed dramatically fewer purchased CF bulbs than Participants did. However, these data were collected differently for Nonparticipants, and should not be compared to that for Participants. Due to the survey design, only Nonparticipants who had installed CF bulbs before receiving the Kit offer were asked if they had purchased more between the time of the Kit offer and the time of the survey. Consequently, the means exclude those Nonparticipants who had purchased CF bulbs for the first time during this time period, and statistical tests comparing Participants with Nonparticipants would be inappropriate. (Further assessment of Nonparticipants' CF bulb installations was planned for a follow-up study.)

..... Total CF Bulbs Installed

Figure 10 summarizes the average installation figures measured for Participants and Nonparticipants, as well as the capacity for further use of CF bulbs. (Recall that for Nonparticipants, only the measures of previously installed bulbs and additional places to install bulbs are comparable to those for Participants.)

The average total number of CF bulbs Participants had installed at the time of the survey was 3.67 per household, compared to 1.03 at the time of the Kit offer. Put another way, *at the time of the survey, Participants increased the average number of CF bulbs installed to 3½ times the level before the Kit program (3.67 vs. 1.03).*

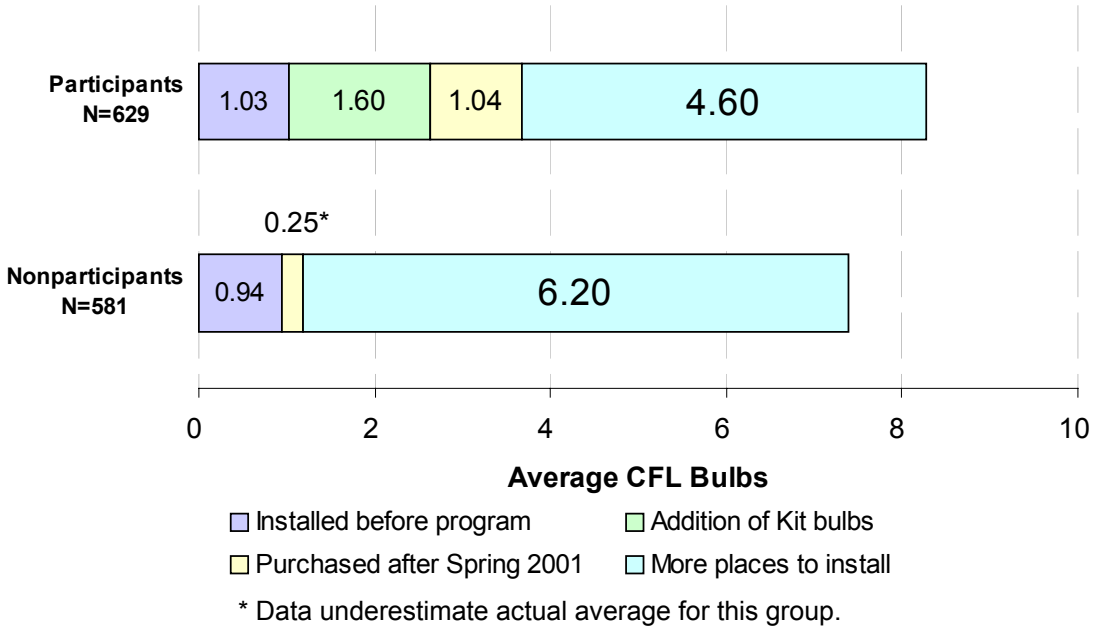
..... More Places to Install CF Bulbs

The average number of household locations where respondents said they could install another CF bulb is illustrated by the right-most bar segments in Figure 10. Participants said they could install an average of 4.6 more bulbs per household, and Nonparticipants said they could install an average of 6.2 more bulbs.

The number of places respondents said they could install more CF bulbs seemed to reflect the impact of the Kit program. Whereas Participants had installed *more bulbs* than Nonparticipants had, Nonparticipants indicated they had *more places* in their homes to install additional bulbs than did Participants. This difference was statistically significant ($p<.001$).

On closer examination, the averages indicate a precise congruence between the bulbs needed and those supplied by the Kit program. The average number of places Nonparticipants said they could install bulbs (6.20) equals the average number of places Participants said they could install bulbs (4.60) plus the average number of Kit bulbs Participants installed (1.60). *That is, Nonparticipants said they could install an average of 1.6 more bulbs per household than Participants could. This group difference of 1.6 bulbs is exactly equal to the average number of Kit bulbs per household that Participants actually installed in their homes.* The absolute number of potential locations may differ between groups by the amount of bulbs Participants purchased after the Kit distribution (1.04 vs. .25), but due to differences in data collection for Participants and Nonparticipants, the extent of this difference is unclear. (See the discussion on additional CF bulb purchases, page 79.)

Figure 10: Market Transformation: Installed Bulbs and Potential for Additional Installed Bulbs



.....Saturation Capacity

Saturation Capacity refers to the total number of CF bulbs that could be used in a household if a CF bulb were used in all places that could be fitted with a CF bulb. This survey did not provide an objective auditor's assessment of potential locations for CF bulb use. However, in the perception of respondents, based on their current knowledge of CF technology and their preferences for use in the home, the average Saturation Capacity for Participants is 8.27. This is the sum of the average bulb installations (1.03+1.60+1.04) plus the average additional places respondents said bulbs could be installed (4.60). *That is, the average Participant currently reports a Saturation Capacity to use about 8 CF bulbs per household.*[66]

The average Nonparticipant appears to perceive slightly fewer locations (7.39 vs. 8.27) for CF bulb use, but due to the way Nonparticipants were asked about purchases, the difference is indeterminate and may be negligible.

An independent metering study of lighting[67] conducted in the Pacific Northwest during 1993-1995 found that the typical single family home has about 15 light fixtures. Tacoma Public Utilities counted the following lights used in different parts of the home: living

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[66] Saturation Capacity can be calculated only for Participants, because the survey provided incomplete data on subsequent CF bulb purchases by Nonparticipants.

[67] Tribwell and Lerman (1996).

room 2.5, kitchen 2.9, bathroom 2.8, master bedroom 2.0, other bedrooms 2.6, porch 0.8, and yard or driveway 1.2. Extrapolating from this study, one would expect a multifamily unit with one bedroom (but no porch or yard/driveway) to have about 11 light fixtures. Since the Conservation Kit Program was administered to a population that is about 36% multifamily, a weighted average of lighting fixtures might be around 14 per residence in the Seattle City Light service area. From this we may infer that survey respondents perceive 8 fixtures per home where a CF bulb could be installed, and about 6 fixtures per typical home where CF lighting would not be appropriate or desirable—including lights on dimmers, in recessed cans, already containing linear fluorescent lighting, or exterior applications like floodlights and security lights on daylight or motion sensors.

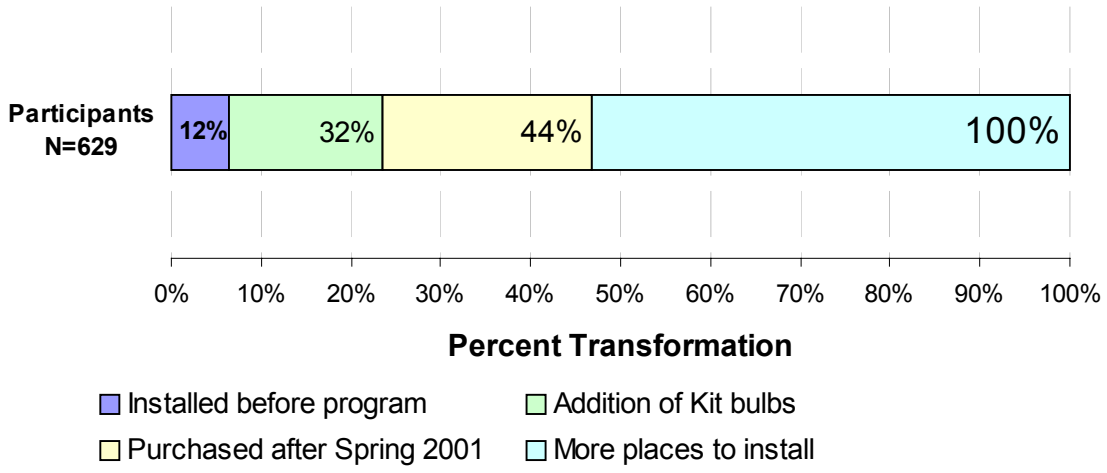
A Measure of Market Transformation

Market Transformation *is the change in product usage over time, in this case the change from incandescents to CF bulbs.* An index of market transformation at any point in time can be viewed as a percentage of Saturation Capacity, calculated by dividing the level of product usage at a given point in time by the average Saturation Capacity (see discussion of saturation capacity, above).

Shown in Figure 11*, Participants had reached a 12% Market Transformation level before the Kit program, and a 44% MT level at the time of the survey.* This means that Participants have installed about 44% (3.87/8.27) of their perceived maximum Saturation Capacity, or 44% of all the bulbs they report they can use. Participant market transformation percentages are illustrated in Figure 11. Notice that the Market Transformation statistics refer to the proportion of installed bulbs, rather than to a proportion of households.

Again, because we have incomplete data on subsequent bulb purchases for Nonparticipants, it would be misleading to calculate a market transformation figure for this group. However, given that they did not receive the Kit bulbs, and given the greater potential Nonparticipants reported for additional installed bulbs (6.20 compared to 4.2 for Participants), we can assume that Nonparticipants are at an earlier stage of market transformation than Participants are.

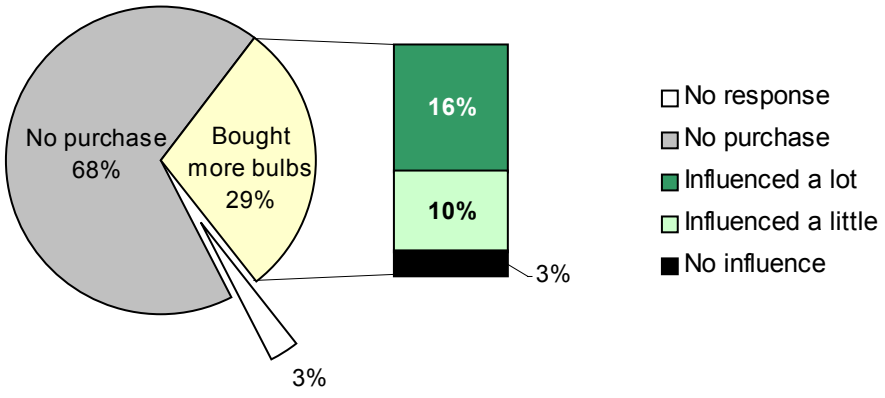
Figure 11: Market Transformation: Cumulative Proportion of Installed Bulbs Compared to Total Installation Potential



.....Program Impact on Subsequent CF Bulb Purchases

More than three-quarters of Participants who purchased additional bulbs said the Kit program at least partly influenced their purchase decision. *More than half of those who purchased more bulbs (16% of Participants) said the Kit influenced their decision "a lot," and an additional third (10% of Participants) said the Kit had "a little" influence.*

Figure 12: Kit Influence on Subsequent Bulb Purchases



The Kit program also influenced CF bulb purchases planned for the future; Participants were more likely to say they would purchase CF bulbs than Nonparticipants were ($p<.001$). As shown in Table 30, more than one-third of program participants, compared to one-quarter of Nonparticipants, said they were very likely to purchase one or more CF bulbs in the next 6-8 months. In contrast, only 6% of Participants compared to 18% of Nonparticipants said they were not at all likely to buy a CF bulb.

Table 30: Likelihood of Purchasing More CF Bulbs in 6-8 Months

	Participants	Nonparticipants
Very likely	37%	25%
Somewhat likely	39	35
Not very unlikely	18	22
Not at all unlikely	6	18
N of cases	611	549

Implications for Lighting Market Transformation

Additional utility promotions of CF bulbs, such as the distribution of discount coupons to purchase CF bulbs, and bulb distribution through community outreach programs, overlapped the Kit program or the survey period, and continue to influence CF bulb purchases. Given the continued promotion of CF bulbs and fixtures, further installation increases should be measurable by the end of 2002.

..... Current Stage of Market Transformation

The market transformation figures for program Participants (Figure 9) describe a market segment that was in the early stages of CF bulb use before the program, and saw a dramatic increase in bulb use in a relatively short time. Program Participants had installed 12% of their saturation capacity for CF bulbs before the Kit program. By the time of the survey, 8-10 months after the Kit deliveries began, this group had installed 44% of their saturation capacity, the increase being due to Kit bulb installation and subsequent bulb purchases. These findings restate the effectiveness of the CF programs to encourage the use of CF bulb technology.

Still, market transformation for this group is less than halfway to saturation capacity. Recalling the low household saturation of 7% (page 73), nearly all Participants have more places they feel they can install CF bulbs. **Taken together, these findings suggest little need to target subgroups of Participants for further promotions; broad, community-wide efforts are still appropriate to encourage CF bulb use.**

.....Impact of Utility Programs on Market Transformation

The Conservation Kit Program, which was Seattle City Light's main 2001 effort to promote CF lighting, combined with auxiliary coupon promotions, made great strides toward furthering Market Transformation changes in CF bulb use.

The Kit bulbs increased the average number of CF bulbs installed by Participants to 2½ times the previous level. Subsequent purchases added as many bulbs to Participant households as they already had installed before the Kit program. **These increases represent not only a significant change in the CF bulb market over the course of the Kit program, but also a change in the buying habits of Participants, as they have begun to purchase CF bulbs on their own.**

Participants say that the Kit program also had a favorable impact on their subsequent bulb purchases. More than half of the Participants who bought more bulbs said the program influenced their purchase "a lot," and more than three-quarters said the program influenced them at least "a little" to buy more bulbs. Individuals generally are reluctant to admit their behavior was influenced by outside forces such as advertising, for example. **That Participants linked their behavior to the Kit program is another indication of the effectiveness of the program and its method of giving residents a sample product to test and use.** Once they could try the products in their homes, Participants were more willing to buy more. The slight overlap of the Kit program with a discount coupon mailing from Seattle City Light may have augmented the subsequent purchases. The full impact of the coupon distribution and other promotions can only be assessed in a follow-up tracking study.

A further indication of the program's impact is that Participants were more sure than Nonparticipants were that they would purchase more bulbs in the future. Seattle City Light has an opportunity to help turn these purchase plans into action.

.....Targeting Participants and Nonparticipants

The Market Transformation figures indicate surprising similarities between Participants and Nonparticipants. The Participant and Nonparticipant samples were similar to each other in their use of CF bulbs prior to the Kit program and in their need for additional bulbs. Recall that the number of CF bulbs Nonparticipants said they could use exceeded the Participants' average by the number of Kit CF bulbs Participants installed.

We might have expected Nonparticipants to have had less prior experience with CF bulbs, and to express less need for more bulbs. This pattern would be more consistent with their lack of program participation in the first place. Instead, many Nonparticipants seem open to using CF bulbs. (See the following section on group differences.) Their similarities to Participants in these respects suggest that **many Nonparticipants are likely to be receptive to future broad-based educational or promotional materials on compact fluorescent lighting.**

Future Research

Due to differences in survey design for Participants and Nonparticipants, it is unknown how many CF bulbs Nonparticipants installed on their own during the time between the Kit offer and the survey. A subsequent Seattle City Light study (planned but not funded) intended to assess Nonparticipant purchases further. This information would be important to assess Nonparticipants in any future market transformation study. In addition, the Conservation Kit Program affected Participant CF bulb use, resulting in different phases of market transformation for Participants and Nonparticipants. These differences call for separate analyses of CF bulb use for program Participants and Nonparticipants to assess their stages of market transformation in future studies.

Group Differences and Program Participation

Demographic Differences

How do program Participants and Nonparticipants differ?

Residents who participated in the Conservation Kit Program differed as a group from Nonparticipants in age, home ownership, fuel used to heat their homes, and income ($p<.05$). As highlighted in Table 31, participants were somewhat more likely than Nonparticipants to be 55 or older, whereas Nonparticipants were more likely to be under 55. The most prominent age differences appeared within two age groups: senior citizens, 75 or older, were twice as likely to be Participants as Nonparticipants, whereas those 25-34 years of age were more likely to be Nonparticipants. Participants also were more likely to own their homes, use oil rather than electricity to heat their homes, and have lower incomes. Specifically, participants were more likely to earn between $20,000 and $40,000, whereas Nonparticipants were more likely to earn $80,000 or more.

These differences, particularly the home ownership and income differences, are consistent with expectations, but did not dramatically distinguish demographically between those who showed their interest in CF bulbs by requesting the Kit and those who did not.

Table 31: Demographic Characteristics of Program Participants vs. Nonparticipants

Percentage	PART	NON-P	Percentage	PART	NON-P
Age of respondent	**N=616**	**N=571**	**Education of respondent**	**N=609**	**N=570**
18-24	2%	3%	Some high school or less	3%	4%
25-34	***16***	***24***	High school graduate	13	10
35-44	18	19	Some college	21	22
45-54	22	26	Grad 2-yr bsns/tech school	7	11
55-64	15	14	Grad 4-year college	34	32
65-74	9	7	Post-graduate degree	22	22
75 or older	***19***	***8***			
Gender of respondent	**N=613**	**N=568**	**Own or rent home**	**N=613**	**N=568**
Female	54%	58%	***Rent***	***72%***	62%
Male	46	42	***Own or buying***	28	***38***
People living in home	**N=618**	**N=559**	**Type of building**	**N=613**	**N=570**
One	35%	32%	Separate single-family home	68%	61%
Two	38	37	Apartment / townhouse		
Three	13	13	– with 4 or fewer units	7	8
Four	10	11	– with 5 units or more	24	31
Five	3	4			
Six or more	2	3			
Home heat fuel	**N=618**	**N=566**	**Water heat fuel**	**N=615**	**N=555**
Electricity	39%	***47%***	Electricity	69%	66%
Natural gas	41	39	Natural gas	31	33
Oil	***19***	13	Oil	0	0
Heat pump	1	1	Heat pump	1	1
			Household Income	**N=569**	**N=526**
			(combined, before taxes)		
			Less than $20,000	14%	14%
			$20,000–$40,000	***29***	23
Note:			$40,000–$60,000	22	20
Bold Italic indicates			$60,000–$80,000	16	15
a significant difference	(p<.05)		***$80,000–$100,000***	9	***12***
			More than $100,000	11	***16***

..... Reasons for Nonresponse

Why did Nonparticipants fail to respond to the Conservation Kit offer?

About half of Nonparticipants said they did not notice the solicitation letter offering the Kit. We called this group the **Nonparticipant Passive Group**, as they did not receive the Kit offer, did not recognize it as an offer, or did not act upon the offer. (Note that some in the Nonparticipant database said that they did request the Kit and a few said that they received it.)

Of interest, a large proportion of the Nonparticipant Passive Group asked in hand-written comments on their questionnaires if they could still receive the Kit. They appeared genuinely interested in trying the CF bulbs. In all, the great majority of Nonparticipants (77%) did not participate at least in part due to some stumbling block related to the program solicitation, their own response, or delivery of the product (Table 32).

By contrast, those in the other half who mentioned a reason for not participating beyond missing the notice are called the **Nonparticipant Choice Group**, because they chose not to use CF bulbs at the time of the offer.

The most frequently checked reason for choosing not to participate is that lights are on dimmers or in recessed cans. This response indicates that the Nonparticipants know enough about CF bulbs to recognize that they should not be installed in fixtures that are recessed or on standard dimmers. These respondents, along with those who said they had all the CF bulbs they could use, may have legitimate reasons for not requesting more bulbs.

Of greater concern are those who held negative opinions about CF bulbs. The 23% of Nonparticipants who wrote in a negative comment viewed the program as a hassle, expected to dislike the bulbs, or had a bad experience with previous fluorescent products.

The 16% who wrote in some other response mentioned features of compact fluorescents, including not liking the quality or brightness of light, or size of bulbs, and a myriad of reasons indicating some hesitancy to try them. Some of the Nonparticipants who made a decision not to respond to the offer made a variety of negative comments about CF bulbs. Some of the strongest comments against CF bulbs came from the second sample of Nonparticipants in response to the multiple mailings of the questionnaire.

Table 32: Reasons for Failing to Respond to Kit Offer

Reason Cited (N of cases = 566, multiple choices allowed)	Percentage
Problems with Program Solicitation, Response or Delivery:	***77%***
I did not notice the solicitation letter	49
I forgot to send in the card/I lost the card	24
I did request the Kit but did not receive it	7
I requested and received the Kit	3
I did not know the Kit was free	13
Realistic Limitations on CF Bulb Use:	***18%***
My lights are in recessed cans or on dimmers	16
I already have all the compact fluorescent bulbs installed that I could use	3
Resistance or Negative Opinions about CF Lighting:	***23%***
It seemed like a hassle	10
I don't want to use compact fluorescent bulbs	8
From what I hear about CF bulbs, I don't think I'd like them	4
Had bad experience with a compact fluorescent bulb	4
I'm concerned about how to dispose of them	3
Other	***16%***

Because so many Nonparticipants said they did not recall the Kit offer, additional analyses compared the Passive group with the Choice group. The Choice Group was significantly different from the Passive group only in number of household members. The Choice Group respondents were more likely to have 4 living in their home, whereas those in the Passive group were more likely to have 5 or more. No other demographic variables differentiated these two Nonparticipant subgroups.

Implications of Group Differences

The demographic differences between program Participants and Nonparticipants are consistent with expectations for who would be most interested in free CF bulbs. Although those with lower incomes might be less inclined to buy a relatively expensive CF bulb, it is easy to see how they might be more likely to take the opportunity to receive them free of charge. Those who own their own homes also own their lighting fixtures, directly pay their utility bills, and expect to live in the home longer than the life of a standard incandescent bulb, so are more interested in CF bulbs. However, the highest income customers also were least interested in the free CF bulbs. Because they could afford their own CF bulbs, free bulbs did not particularly motivate them. They might also have more lighting that is inappropriate for CF bulbs (dimmers or more modern recessed lights) than others.

Age level differences are harder to explain, but the relationship of age to income and to homeownership probably plays a role here. Both outlier groups, those 25-34 and 75+, are likely to have relatively lower incomes and would be expected to accept the offer of free bulbs. However, the younger respondents are likely to be renters so are more likely to be Nonparticipants, whereas older respondents are likely to own their homes so are more likely to be Participants.

The difference in household size between Nonparticipant subgroups is difficult to interpret. It appears that those with 5 or more in the household didn't have time for a utility program, whereas those with 4 in the household found it quite important to their family budget to take part.

The unsolicited requests for the Kit from Nonparticipants who did not recall the offer suggest a tremendous opportunity to introduce more utility customers to CF bulbs. Whether they did not receive the offer, did not notice it, or did not consider it important at the time cannot be determined by the survey data. It is possible that busy residents needed additional offers or reminders to kindle enough interest to send for the Kit. Taken as a rule of thumb in advertising, an audience needs multiple exposures to an ad before buying a new product. The survey itself may have been the crucial influential promotion that prompted requests for the Kit.

Regardless of the explanation for failing to request the Kit, many Nonparticipants have now heard enough about CF bulbs to raise their awareness, and are willing to try them. The Nonparticipants who made a conscious decision not to participate, in contrast, are the least likely converts to CF lighting. In particular, those who said their lights were on dimmers or in recessed fixtures, approximately 16% of Nonparticipants, might be excluded from the group of potential CF bulb customers until CF bulb technology addresses those applications.

Barriers to CF Bulb Use

Satisfaction with Kit Bulbs

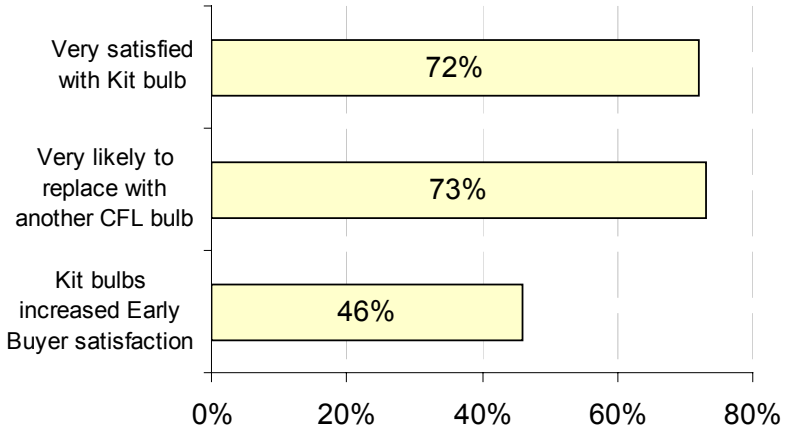
Were respondents satisfied with the Conservation Kit CF Bulbs?

Program Participants indicated a high level of satisfaction with CF bulbs they received in the Kit. As illustrated in Figure 13, 72% said they were very satisfied with the bulbs they received in the Kit. An overwhelming 95% said they were at least somewhat satisfied.

In other measures of satisfaction, most Participants said they planned to replace their Kit bulbs with another CF bulb when it burned out (in 3-5 years). Nearly three-quarters (73%) of those who installed a Kit bulb said they were very likely to replace their Kit bulbs with another CF bulb, and half (52%) reported no problems using the bulbs (see page 93 for more on this topic).

Further, nearly half (46%) of the 183 Participants who already had CF bulbs installed in their homes reported that trying the Kit bulbs increased their satisfaction with compact fluorescent lighting. None reported a decrease in satisfaction due to the Kit bulbs.

Figure 13: Measures of Satisfaction with Conservation Kit Bulbs



Another measure of satisfaction with CF bulbs, shown in Table 33, is the value respondents gave CF bulbs. *When asked what would be a fair price for a CF bulb, 64% of Participants and 58% of Nonparticipants said that $4 or $6 was a fair price.* Currently, this is the price range for CF bulbs at discount warehouses and in advertised sales at variety stores. *Participants, however, gave a significantly higher average dollar value for CF bulbs than did Nonparticipants (p<.001).* Nearly a third of Nonparticipants preferred a $2 price.

Table 33: Fair Price for a CF Bulb

Dollar Amount	Participants	Nonparticipants
$0	1%	4%
$2	20	30
$4	38	35
$6	26	23
$8	11	5
$10	5	4
$12	<1	<1
Average value	$4.81	$4.12
N of cases	472	560

..... Early Buyer Satisfaction

> *How do the Conservation Kit bulbs compare with CF bulbs previously installed by Early Buyers?*

Participants who were Early Buyers, those who already had tried CF bulbs, were more satisfied with the Kit bulbs than the bulbs they already had (p<.001). Columns 2 and 3 of Table 34 show that 82% of Participants were very satisfied with the Kit bulbs, whereas 65% were very satisfied with previously installed bulbs.

Table 34: Satisfaction with Compact Fluorescent Light Bulbs

	Participants			**Nonparticipants**		
				Previously Installed Bulbs		
	1 Kit Bulbs (All Participants)	**2 Kit Bulbs** (Early Buyers)	**3 Previously Installed Bulbs** (Early Buyers)	**4 All Non-participants**	**5 Passive Subgroup**	**6 Choice Subgroup**
Very satisfied	72%	82%	65%	56%	69%	48%
Somewhat satisfied	23	17	29	34	25	40
Somewhat dissatisfied	3	1	5	7	5	6
Very dissatisfied	2	1	1	4	2	6
N of cases	591	178	178	155	67	82

..... Satisfaction with Prior CF Bulbs

> *Were Participants and Nonparticipants satisfied with the CF Bulbs they already had in the home?*

Participants and Nonparticipants in general did not significantly differ in their satisfaction with previously purchased CF bulbs. However, because Participants were expected to report more satisfaction with their purchased CF bulbs than Nonparticipants were, and the percentages were in the predicted direction, the Nonparticipant subgroups were further examined.

Satisfaction levels for the Passive Subgroup and the Choice Subgroup of Nonparticipants (see page 88) are shown in the right-most two columns of Table 34.

Comparisons revealed that Nonparticipants in the Choice Group were less satisfied with the CF bulbs they already had than were those in the Nonparticipant Passive Group (48% vs. 69% very satisfied). That is, those who appeared to choose not to participate in the Kit program had been less satisfied with CF bulbs they used in the past (p<.01).

.....Problems with Kit Bulbs

What problems did respondents have with the Conservation Kit CF Bulbs?

Half of the program participants reported no problems using the CF bulbs from the Kit. The most frequently mentioned difficulties with the bulbs were brightness and size. The first column of Table 35 shows the difficulties Participants had with the Kit bulbs. Most often, Participants found the light from the bulbs was not bright enough in the location where installed. Almost as bothersome was the size of the bulbs; in particular, they did not fit fixtures because they were too long.

Table 35: Problems with Compact Fluorescent Bulbs

Problem	Participant Kit Bulbs	Nonparticipant Previously Installed Bulbs
No problem with the bulb or bulbs	52%	37%
The light wasn't bright enough	22	33
Bulb was too long for my fixture	13	22
Bulb did not fit in the first place I put it	5	17
Bulb was slow to come to full brightness	4	22
Bulb base was too wide for my fixture	3	11
The bulb burned out much sooner than I expected	3	11
I didn't like the color of the light	2	20
Other problem	2	9
I didn't like how the bulb looked	1	11
N of cases	572	270

The second column of Table 35 lists the problems Nonparticipants said they had with previously installed CF bulbs. (Participants were not asked about problems with previously installed bulbs.)

Nonparticipants were more likely to mention each of the problems on the survey list than were participants, as shown in the table. Complaints about the amount of time it took for bulbs they acquired in past years to reach full brightness and the generally higher instance of problems with bulbs used previously are characteristic of complaints about the

previous generation of CF bulbs. The complaints are consistent with those mentioned in earlier studies of CF bulbs.[68]

Implications of Barriers to Bulb Use

Satisfaction with CF bulbs and problems experienced are viewed here as potential facilitators or barriers, respectively, of CF bulb use.

..... Satisfaction with CF Bulbs

The greater satisfaction with the Kit bulbs than previously installed bulbs suggests that program Participants noticed the design and technological improvements characteristic of the newer bulbs. The findings also suggest that customers will be more likely to use CF bulbs if the first bulbs they try have the latest technology.

Although Participants were not significantly more satisfied with their previously purchased bulbs than Nonparticipants, Participants gave a higher dollar value to CF bulbs than did Nonparticipants. The different value ratings likely reflect the Participants' experience with the newer bulbs, providing further evidence that experience with the newer technology may convince a greater portion of the market to use CF bulbs.

Although the Nonparticipant subgroups were not significantly different demographically (see previous section), the Nonparticipant Choice group had been less satisfied than the Passive group in the past with CF bulbs. This finding presents a challenge to future market transformation efforts, which will need to overcome the various reasons for dissatisfaction with CF bulbs in order to convince these residents to try CF bulbs again. It will be important, for example, to make residents aware of the recent product improvements. **As technologies improve, they may need to be reintroduced to the market in order to stimulate market transformation.**

..... Problems with CF Bulbs

The most problematic features of the CF bulbs—brightness and size—are consistent with customer concerns reported for the early Seattle City Light pilot program.[69] **These features of CF bulbs are still barriers to their use.** Although size of the bulbs has decreased over the past decade, CF bulbs of comparable light output to incandescents are still larger than their incandescent counterparts. Further size reductions or the introduction of more fixtures to accommodate the bulbs may be necessary to facilitate their use among those who would like to use them. In addition, customers may need an opportunity to try brighter CF bulbs in the locations where they found 15W or 23W to be inadequate.

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[68] Brattesani, Karen A. and Anne M. Ducey, SEATTLE CITY LIGHT COMPACT FLUORESCENT LIGHTING PRODUCTS RESEARCH REPORT, Research Innovations for Community Conservation Section, Energy Management Services Division, Seattle City Light (Seattle WA: September 1994).

[69] Brattesani and Ducey (1994).

Other concerns reported in 1994 were rarely mentioned among current program Participants. Improved technology of CF bulbs has greatly reduced the problem of being slow to reach full brightness, for example. Further, program Participants were not particularly bothered by the color quality of the light. Decreased problems with newer CF bulbs again highlight the importance of reintroducing customers to conservation technologies whenever they have achieved significant quality improvements. Part of the Conservation Kit Program's success was its emphasis on reintroducing the improved products to utility customers.

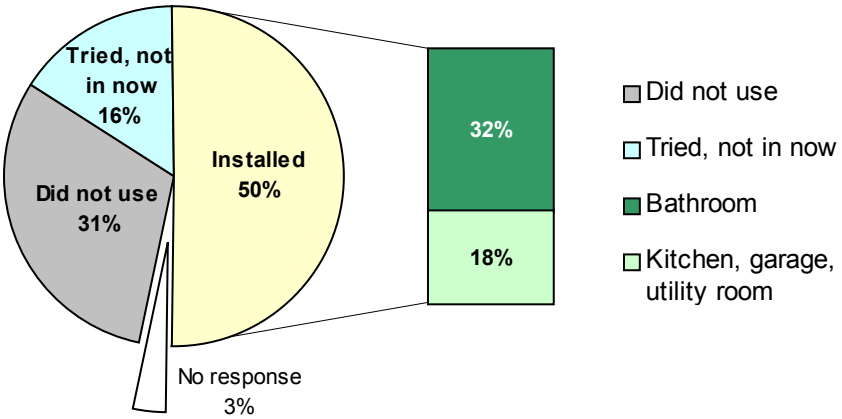
In spite of technological improvements in today's bulbs, the group differences in satisfaction ratings and reports of problems with previously installed CF bulbs indicate that some residents may have avoided requesting the Kit due to problems they had with the earlier technologies. Unfortunately, those bulbs in use may have been among the first generation of CF bulbs, which were most problematic. The challenge will be to convince Early Buyers of CF bulbs, especially in the Nonparticipant population, that newer bulbs have diminished or eliminated the earlier problems.

Use of the Aerator and Water Flow-rate Bag

.....Faucet Aerator Installation

Half of program Participants (50%) installed the faucet aerator that came in the Kit. However, one-third (31%) had not tried to install the aerator, and another 16% said they tried to install it but did not have it installed at the time of the survey. As a proportion of all service area households, the Kit aerator installation rate was 29% (Table 36).

Figure 14: Faucet Aerator Usage



About two-thirds of the aerators were installed in a bathroom, as suggested by the informational material in the Kit, and another third were installed in a kitchen, garage or utility room.

Table 36: Aerator Installation Statistics

Participant Measures:	
Aerator Installation Rate (proportion of Participant households with Kit aerator installed)	50%
Total number of Kit aerators installed	315
City Light Service Area Calculations:	
Aerator Installation Rate (proportion of all service area households with Kit aerator installed)	29%

Satisfaction with the Aerator

Most of those who had the aerator installed were very satisfied with it (70%), and nearly all said they will keep the aerator installed (97%). Further, 79% of this group said they would have installed a second aerator if it had been provided.

Problems with the Aerator

All respondents were asked about factors affecting their use of the aerator. As shown in Table 37, about half (the same proportion who installed the aerator) reported no problems. The most frequently mentioned problem was lack of fit on the faucet. Some also said they didn't like the spray pattern. In open-ended comments, 5% said they already had an efficient aerator installed. In some cases, the aerator made the water flow too slowly, and in others the aerator caused too much splashing (perhaps due to high household water pressure).

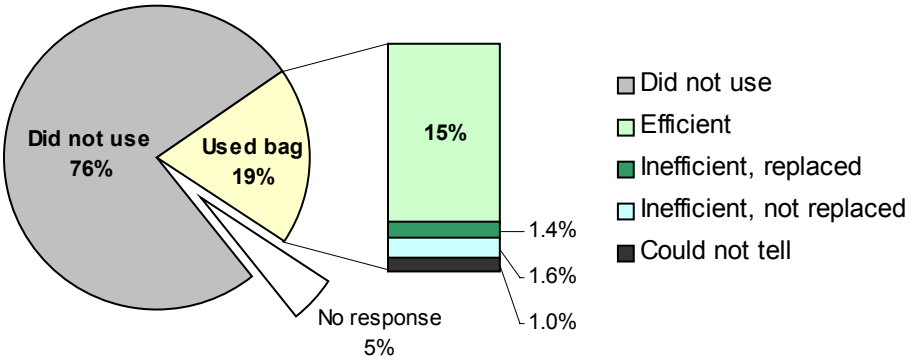
Table 37: Problems with the Aerator

Problem (N of cases = 527)	**Percent of Cases**
No problem with the aerator	48%
The aerator did not fit on the faucet	18
I didn't like the spray pattern	13
Haven't gotten around to installing it / forgot	10
I didn't want to change my aerator	10
I had one already (written in)	5
Flow too slow/low pressure (written in)	2
I didn't think it would work or fit	1
It didn't seem important	1
Other	5

.....Use of the Water Flow-rate Bag

The water flow-rate bag was the least frequently used of the items included in the Conservation Kit. Only 19% of the Participants used the water flow-rate bag to test the efficiency of their showerhead. Among those who did use the bag, 79% found that their showerhead was efficient at conserving water. Only 17% of flow-rate bag users learned that their showerhead was inefficient and half of these (47%) changed their showerhead in response to the test results. Shown in Figure 15, *this means that just 1.4% of the entire Participant group used the water flow-rate bag and changed to a more efficient showerhead.* Still, based on a total of 178,481 distributed Kits, 1.4% is equivalent to approximately 2,500 Participants who replaced an inefficient showerhead with an efficient one.

Figure 15: Water Flow-rate Bag Usage



In open-ended comments, several respondents explained that they already had an efficient showerhead and felt no need to test the water flow. Others said they did not receive the flow-rate bag in the Conservation Kit.

Implications for Water Efficiency Measures

.....Faucet Aeration

The faucet aerators enjoyed a 50% installation rate among Participants. This is comparable to the 47% rate of bathroom faucet aerator installations measured for the Home Water Savers Program in 1992-1994. In both cases residents received the faucet aerator as part of a conservation kit that emphasized the use of another energy-conserving product. Although we assume the Conservation Kit Program Participants were most motivated to receive the Kit for the free CF bulbs, the aerators were a smart addition to

the Kit. We can anticipate the aerators will continue to be used as the Home Water Savers study found a good one-year Retention Rate (94%) for program aerators.[70]

Problems with the spray pattern suggest that residents might be instructed to test their household water pressure to make sure it is not too high to use this type of efficient flow product. **The high interest in a second aerator among those who installed the Kit aerator suggests a further opportunity to save energy by offering aerators for additional household locations.**

..... Showerhead Water Flows

The water flow-rate bag, in contrast, was used by only 19% of Participants. Although it resulted in the replacement of about 2,500 existing showerheads for more efficient ones, much higher utilization would have been optimal. This item may not have been well targeted to those who could use it. Many Participants may have felt no need to test their showerheads, first, because 64% of residents (in single family and 2-4 unit housing) installed a free efficient-flow showerhead that Seattle City Light distributed through its Home Water Savers Program (1992-1994), and second, because efficient showerheads have been available in stores for more than a decade.

The water flow-rate bag might have been used by more Participants if the Conservation Kit or bag instructions, or the method of distribution, had more specifically targeted those who did not receive or install the free efficient-flow showerhead Seattle City Light distributed, those who have more than one showerhead, those who live in older homes, and those who have not replaced a showerhead in the last ten years.

Further, although the water flow-rate bag had instructions for use printed on the bag itself, it was the only item in the Kit that did not come with a separate instruction card containing a product description, instructions for its use, and a list of its benefits. Compared to the other products in the Kit, the water flow-rate bag may have been perceived as the least important product to use.

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[70] Brattesani and Tachibana (1994).

Consultant Recommendations

Based on the survey research, the survey research consultant recommended the following strategies for transforming the market for CF bulbs.

Because most residents have places to install more CF bulbs (low saturation rate), and program Participants and Nonparticipants appear more similar than they are different in their interest in CF products, Seattle City Light has opportunities to increase CF bulb use throughout the service area. However, customers vary in their level of experience with CF bulbs; some have used CF bulbs for several years, many are in an early stage of CF bulb use due to the Kit program, and others, particularly Nonparticipants, have not yet used CF products. In addition, customer subgroups expressed specific concerns about using CF bulbs. These group differences should guide future promotional messages, and program development that seeks further market transformation.

Market Transformation and Promotional Messages

The current early stage of market transformation in Seattle indicates that City Light has many opportunities for market transformation. The greater customer satisfaction with the Kit bulbs than previously installed CF bulbs suggests that introducing improved technologies is an important strategy for transforming a market.

- Congratulate Seattle City Light customers on their program participation and their collective impact on community energy-savings, and remind them of the benefits of using CF products. This will also serve as an encouragement to install another CF bulb.

- Educational materials could suggest where customers should install their remaining or newly purchased CF bulbs based on the greatest average usage. Ask customers to install a low-wattage bulb in the porch or yard fixture, a higher-wattage bulb in a kitchen or living room.

- To maximize the use of both Kit bulbs, prompt customers to use their second CF bulb to replace a burnt out incandescent.

- Avoid suggesting that customers use their CF bulbs to replace a functioning incandescent, as that might appear wasteful to the large subgroup that preferred to wait for their incandescents to burn out.

- Seasonal opportunities to encourage purchase and use of CF bulbs will occur in the fall and winter, as indoor lighting is used for longer hours. Those who are waiting to use their CF bulb until an incandescent bulb burns out can be reminded to replace them with a CF bulb.

- To expand customer use of CF products, inform customers of the styles of CF bulbs that the utility did not distribute, and their specific applications in the home.

- In educational materials, emphasize the improvements customers should notice in CF bulbs compared to their counterparts from years ago. This

kind of information can ready customers to accept further technological advances, as they become available.

- Notify customers about new products and product improvements as they become available, especially those that address customer concerns, such as decreased size of bulbs, increased light output, products appropriate for recessed fixtures or use with dimmers, and light fixtures.

- Consider including in a bill insert some follow-up instructions on the use of the water flow-rate bag and how to get one, for those who did not receive the Kit.

Program Development

The success of the Conservation Kit Program indicates that distributing bulbs directly to utility customers is a viable way to affect the CF market quickly. Follow-up efforts can enhance its effectiveness.

- Because many Nonparticipants indicated they were eager to receive a Kit, Seattle City Light could have a dramatic impact on CF use, particularly first-time use, by making another Kit offer to previous program Nonparticipants. If offered again:

- Provide more than one eye-catching opportunity to request the Kit. Many Nonparticipants believed they had not received the Kit offer.

- Enhance commitment to using the products in the Kit, similar to this program, by requiring customers to first return a reply card.

- Consider introducing new energy-saving CF products in a similar way, whenever economically feasible.

- Given the large proportion of Seattle residents who tried CF bulbs for the first time as a result of the Kit distribution program, it is important to provide support for future purchases. The retail rebate coupons mailed in bills were a good follow-up, and could be repeated.

- Seattle City Light could target customers who rent their homes; they tended to be new bulb installers. If legally permissible, a mailing list of apartment residents, purchased from an outside vendor could reach those who were missed when mailings were sent to property managers.

- To maintain positive public relations, if possible, exclude from future mailings all those survey respondents who expressed primarily negative opinions of CF products, requested no further mailing about this subject, or made a conscious decision (rather than a passive choice) not to send for the Kit.

- Consider repeating the offer of a faucet aerator, or including one as part of another program. The aerators enjoyed a respectable installation rate, and many Participants indicated they could use a second one.

- Include instructions for the use of each product distributed to customers as part of any future conservation Kit. Be sure to include separate instructions for the water flow-rate bag if it is included in another mail-out program.

Relationships with Industry Allies

Now that about one-third of Participants have begun to purchase more CF bulbs on their own, Seattle City Light could extend its impact on market transformation through collaborative efforts with retailers and manufacturers of CF products. It will be important to future market transformation efforts for City Light to be aware of products available from manufacturers and commitments by local retailers to carry a wide variety of new CF products.

- To stay informed of ongoing product improvements that could increase customer satisfaction with the products, maintain relationships with CF product manufacturers. Be prepared to notify customers about product improvements or develop conservation programs around them.

- Encourage retailers to make a commitment to carry large selections of CF products as well as new CF products.

- Point of purchase displays could restate utility messages about the advantages of using CF bulbs.

- Information sheets could be displayed with the retail products telling about the different types of CF products they carry and how to use them for specific applications.

- Regularly notify retailers of future utility promotions that could affect retail demand for CF products.

Future Research

Although the short-term effects of utility programs may be assessed in a single research study, market transformation can only be tracked with follow-up studies at planned intervals, such as every two years for products that are relatively heavily promoted and quickly adopted.

- With a program of market transformation research that assesses when the market approaches a higher level of CF product use (e.g., increased percentage of installed bulbs and saturation), Seattle City Light will be in a better position after each assessment to refocus its educational and programmatic strategies. Based on what the data show, City Light can decide whether and how to proceed with further programs to stimulate product use and at what level of market saturation no further efforts are necessary.

- Because this program had differential effects on program Participants and Nonparticipants, future market transformation tracking studies

should ask about customers' participation in the Kit program, and data on CF product use should be analyzed separately for each group. Nonparticipants are likely to lag behind Participants in their usage, and tracking separate findings for each group might indicate different strategies for increasing product usage.

Appendix A

Vendor Contract Requirements

General Vendor Requirements

Ability to Deliver Product

Successful bidders will be expected to deliver the number of lamps ordered within thirty days of the order being placed. All price quotes are expected to be valid for two years, with indication of price increase for the second year.

Product Warranty

A one-year vendor warranty must be provided to the Seattle City Light customers who receive the lamps, in addition to Seattle City Light as the purchaser. Customers must be able to contact the manufacturer to secure replacement lamps for those that are defective or fail within the warranty timeframe.

Power Factor

Lamps must have a power factor of 0.9 or greater, generally termed "high power factor." Power factor plays a significant role in the energy efficiency of these devices. Many of the lamps current available in the retail distribution channel are what is termed "mid or normal power factor." These devices usually have a power factor of 0.5, which burdens the distribution system with additional capital costs that high power factor lamps reduce to a minimum. In order to maintain cost effectiveness and efficiency for the program that these purchases support, the lamps should be restricted to a high power factor.

Bulb Features & Specifications

Feature	Requirement	
Physical Characteristics	Self ballasted; fully enclosed ballast that meets ANSI C82.11, except as otherwise specified Medium (Edison screw) base CFL fluorescent tube glass and other housing materials shall be UV resistant and heat stable The CFL fluorescent tube glass and its connection to the CFL housing and base shall be sufficiently sturdy and resistant to twisting forces to remain intact without any loosening of connections after installations and removals.	
Maximum Overall Length & Width	MOL	MOW
15 – 16W	5.25 IN (133 mm)	2.5 IN (64 mm)
18 – 20W	5.5 IN (140 mm)	2.5 IN (64 mm)
23 – 28W	6.0 IN (152 mm)	2.625 IN (67 mm)
Power Factor (PF)	0.9, minimum (High PF CFL)	
Total Harmonic Distortion (THD)	33%, maximum	
Color Rendering Index (CRI)	82, minimum	
Corrected Color Temperature	Between 2700K and 3000K	
Operating Voltage	120 volts at 60Hz	
Efficacy	60 lumens per watt, minimum	
Noise	Sound rated A	
Rated Life	6,000 hours, minimum	
Minimum Starting Temperature	Not higher than -20°F	
Light output at low temperature	50% of full light output at 0°F, minimum	
Lamp Lumen Depreciation	20% over rated life, maximum	
Illumination Delay	1 second, maximum	
Transient Protection	ANSI C82.11	
Electromagnetic Interference/ Radio Frequency Interference	Within FCC limits for high frequency electronics in Class A (Commercial) and Class B (Residential) applications	
Fire Safety	Rated for use in enclosed fixtures	
Safety Standard	ANS/UL Standard 935 Class-P; the lamp may not contain PCBs	
Warranty and Other After-Sale Service	One-year warranty required; attach warranty features and conditions	
Labeling	In English with manufacturer, model number, wattage rating, lumens, safety rating, warranty, Energy Star® Label	
Packaging	Cardboard packaging only, no plastic; prefer recycled content materials	

Bulb Testing & Certification

Feature	Requirement
Rated Initial Lumen Output	IES Procedure LM-66 using calibrated instruments traceable to NIST standards
Power Factor (PF) and Total Harmonic Distortion (THD)	IES Procedure LM-66 and ANSI C78.375 using calibrated instruments traceable to NIST standards
Color Rendering Index (CRI)	IES procedure LM-58 using instruments calibrated to NIST standards
Correlated Color Temperature	IES procedure LM-58 using instruments calibrated to NIST standards
Efficacy	Lumen Output divided by rated wattage. Lumens from IES Procedure LM-66 using calibrated instruments traceable to NIST standards
Noise	Certify compliance, but no required test
Rated Life	Certify compliance, but no required test
Minimum Starting Temperature	Certify compliance, but no required test
Light output at minimum starting temperature	IES Procedure LM-66 using calibrated instruments traceable to NIST standards
Illumination Delay	Observed during tests for IES Procedure LM-66 using calibrated instruments traceable to NIST standards
Transient Protection	ANSI C78.375
Electromagnetic Interference	Federal Communications Commission Test Procedure Code of Federal Regulations Section 47.18.
Rated for use in Enclosed Fixtures	ANSI/UL standards for this application; meets National Electric Code 410-73(e)

Acceptance Tests

The Offeror shall certify that the sub-CFLs sold under this solicitation have met the ANSI/UL Standard 935 for Class-P lamps. Lamps must be tested, listed, and labeled by an organization accredited by the National Voluntary Laboratory Accreditation (NVLAP) or the American Association for Laboratory Accreditation (A2LA) as having the capability for testing, listing, and labeling sub-CFLs. These organizations include Underwriters Laboratories (UL), Intertek Testing Services Performance Division (formerly ETL Testing Laboratories), Factory Mutual, and others. Listing and labeling are as defined in the National Electrical Code®. In addition, the Offeror shall certify that the sub-CFLs sold meet the minimum performance criteria based on the above test procedures.

Vendor and Contracting Costs

Budget & Expenditures

Program Funding	Budget	Expenditures	by Period
Grand Totals	**$3,165,080**	**$3,200,622**	**$3,200,622**
General Fund Ordinance (March)	**1,845,080**	**2,040,631**	
Initial Purchase Order	**407,250**		
Distribution Contractor		379,432	
February			36,480
March			204,629
April			138,324
Emergency Purchase Orders	**1,437,830**		
Bulb Vendor 1		901,516	
February			62,174
March			839,342
Bulb Vendor 2		759,683	
February			168,547
March			295,218
April			295,918
Ordinance 120322 Supplement (April)	**525,000**	**486,800**	
Change Orders	**525,000**		
Bulb Vendor 1		310,868	
May			310,868
Bulb Vendor 2		175,932	
May			175,932
Divisional Supplements (May)	**795,000**	**673,191**	
Change Order	**420,000**		
Distribution Contractor		239,262	
May-June			209,418
July-August			26,014
October-December			3,830
B-Contract Purchasing	**375,000**		
Bulb Vendor 3		65,933	65,933
June			
Bulb Vendor 2		367,996	
May-June			25,381
July			257,099
August			85,517

Appendix B

Customer Information about CF Bulbs

On the Utility Web Site

.....Source: http://www.cityofseattle.net/light/conserve/resident/cv5_lw2.htm

Lighting represents about 5-10% of a home's electricity use. Recent years have seen considerable improvement in energy efficient lighting technologies, especially with compact fluorescent (CF) light bulbs and fixtures that use them. Where CF bulbs used to be available only in home improvement stores, you can now find a wide variety of styles and wattages in hardware, department, grocery, and drug stores. Prices have dropped dramatically, too. Most CF bulbs are now under $10 with some as low as $5, and CF bulbs are found in a wider variety of fixtures. Although there are many types of energy efficient lighting, this web site deals mainly with CF technology.

Compact fluorescent bulbs (CF bulbs) are an energy efficient alternative to regular incandescent or tungsten light bulbs in your home. Although not every socket that uses a regular bulb is right for a CF bulb, this web site will tell you everything you need to know to make the best choices.

Benefits of CF Bulbs

Convenient—With normal on and off switching, CF bulbs enjoy a long life, with one bulb able to outlast 6-10 incandescent bulbs. You spend less time on the ladder and less money replacing burned-out bulbs.

Appealing—CF bulbs now have rapid or instant start, no flicker and are available with a comforting, soft-white quality of light.

Economic and Efficient—Most incandescent (including halogen) bulbs waste 90% of their energy on heat. Not so with the CF bulb, which uses 75% less energy to produce the same amount of light. You can save substantially on electricity costs by using a lower wattage CF bulb and still enjoy the same or even more light. See the ***Compared to Incandescent Bulbs*** chart. CF bulbs cost more up-front (about $5-10) but, over the life of the bulb, the savings really add up.

Versatile—You can buy CF bulbs to fit almost any fixtures. The bulbs with circular shapes work well in table lamps that couldn't use CF bulbs before. You can also buy CF bulbs for vanities and flood lights and there are 3-way CF bulbs that are dimmable.

Comparing Incandescent and CF Bulbs

Because fluorescent sources emit light differently than incandescent sources, you may perceive a CF bulb with the same lumen out put as dimmer than a regular bulb. (See Question #10 below for further explanation.) Therefore, Seattle City Light follows Energy Star® guidelines when replacing regular bulbs with CF bulbs.

Incandescent Bulb Wattage	Standard Lumen Output	Comparable CF Bulb Wattage*	Average Lumen Output	Yearly Energy Savings*
25	210	5	210	$1.75
40	505	9-11	500	$2.60
60	865	13-15	825	$3.94
75	1190	18-20	1100	$5.01
100	1710	23-27	1500	$6.57
150	2850	30-39	1900	$10.07
200	3910	42	3200	$13.84
300	5100	55	4800	$21.46

* Using the winter SCL residential rate of $.08/kWh and an average bulb burn time of 3 hours per day. Does *not* include additional savings of not having to buy 9 replacement incandescents over the life of the CF bulb.

..... To make sure you are getting enough light, when replacing a:

- 40-watt, buy a 14-watt CF
- 60-watt, buy a 20-watt CF
- 75-watt, buy a 25-watt CF
- 100-watt, buy a 32-watt CF
- 150 watt, buy a 50-watt CF

Disposal of CF Bulbs

CF bulbs contain about 4 milligrams of mercury sealed in the glass tubing of the bulb. Mercury vapor converts electricity into light. No mercury is released when the bulb is in use. Unbroken, burned-out CF bulbs emit no mercury. But broken bulbs or tubes can harm human health and the environment. (For more information on mercury, visit the Web site, www.buildinggreen.com, and type “mercury” in the search field.)

Therefore, compact fluorescent (CF) bulbs or fluorescent tubes may not be thrown away with your regular garbage. They must be disposed of at a free Household Hazardous Waste (HHW) site (according to Seattle Municipal Code 21.36.026).

For location and hours of the Seattle HHW or the King County Wastemobile sites nearest you, call the Households Hazards Line at 206.296.4692 (Monday–Friday, 9 a.m.–4:30 p.m., except holidays), or visit the Web site, www.cityofseattle.net/util/services, and

click on "Hazardous Waste" under "Other Services". Please note that the North HHW site is by appointment only through the Household Hazards Line.

Frequently Asked Questions about CF Bulbs

.....Q 1: Doesn't it take more power to turn a CF bulb on, than to leave it on all the time?

It is a common myth to believe that switching on fluorescent bulbs use more power than operating them for short periods of time. The initial start-up, or surge of electricity, is very small and only lasts for a millisecond. In fact, a City Light demand meter could not detect this start-up load as a measurable spike. You'll use much more energy by keeping the light on when not in use. However, frequent switching of CF bulbs does shorten life, but only if turned on and off more than 20-30 times a day. That is why we do not recommend they be used with motion sensors. The bottom line: turn off a CF bulb whenever you no longer need the light.

.....Q 2: I've heard CF bulbs have dangerous levels of mercury in them. What happens if I break one? Can I throw it in my garbage?

CF bulbs have about 4 milligrams of mercury in them to assist with starting. A troy ounce of mercury equals 31 grams, so 4 milligrams is about a one-thousandth of that amount. That amount of mercury is about the volume that would fill the size of the period at the end of this sentence. That amount of mercury is not dangerous in the home, but only becomes problematic when large amounts of CF bulbs are disposed in waste dumps.

If you accidentally break a CF bulb, the broken glass is more problematic than the mercury, as what mercury is left will be released into the air in a gaseous state.

Regarding disposal, Seattle Municipal Code 21.36.026 prohibits the disposal of mercury in household trash. For proper disposal, take your burned-out CF bulbs to your local Household Hazardous Waste site. For HHW locations and hours of operation, go to the Web site, www.cityofseattle.net/util/services .

.....Q 3: Do CF bulbs work with dimmers, photocells, timers and motion sensors?

Dimmers—Unless specifically noted on the packaging, CF bulbs do not work in any type of fixture that uses a dimmer, either on the wall or as part of the fixture. CF bulbs need precise voltage amounts to work properly, and a dimmer mechanism (even if not dimmed) will cause a CF bulb to fail within hours.

Photocells—If the photocell acts only as a switch turning the light 'on' or 'off', there should be no problem using a CF bulb. But if the photocell acts as a dimmer, gradually turning the light on in the evening or off in the morning, then the CF bulb will fail. (See DIMMERS, above.)

Timers—If the timer is a manual clock type, acting as a simple mechanical 'on-off' switch, a CF bulb will work just fine. But if the timer is electronic, there is a 50 50% chance that the electronics of the timer will scramble the electronics of the CF bulb and

cause it not to start. The best way to determine compatibility is to call the 1-800 number on the timer's package and ask the manufacturer.

Motion Sensors—CF bulbs work fine on motion sensors but we don't recommend that application, because of the excessive 'on-off' cycles. Excessive 'on-off' cycles (more than 20 per day) shorten bulb life by up to 15%.

..... Q 4: Do CF bulbs work on touch lamps?

No, because touch lamps work with an electronic 'on-off' device that scrambles the electronics of a CF bulb and causes it not to start.

..... Q 5: Are CF bulbs harmful to my health?

There are common myths that fluorescent lights cause headaches, rob the body of Vitamin B, and can cause seizures. Many of these myths began when fluorescent lights first came into being in the 1940s. At that time, the phosphors (white coating on the inside of the glass tubes) were very primitive and gave off an unnatural and unpleasant bluish-green color, causing people to look jaundiced or sick. The old-style tubes also produced excessive glare that prompted some people to squint and get headaches. And the ballasts were magnetic, which caused the lights to flicker at 60 Hz (cycles per second). This just-barely perceptible flickering was annoying to some, and was blamed for headaches and seizures, although this effect was never proven. Today's fluorescent tubes and bulbs are vastly improved. State-of-the-art rare earth phosphors show true colors and natural skin tones. And flicker is totally eliminated with new electronic ballasts that operate as high as 20,000 Hz.

..... Q 6: Can I use a photocell that installs in the socket beneath my CF bulb?

No. These types of photocells alter the voltage of the CF bulb and will cause the bulb to fail prematurely or not start at all.

..... Q 7: The base of my CF bulb is too fat to fit in my fixture. What do you recommend?

Buy a socket extender at any hardware or home improvement store. This raises the base of the bulb above the narrowest part nearest the socket.

..... Q 8: My CF bulb is tall for my harp, the part that holds the lamp shade on. What do you recommend?

Buy a pair of harp extenders at any hardware or home improvement store. This makes more room under the harp for the CF bulb. There are CF bulb styles that are more compact (like the curlicue sub-compact, which may fit better).

..... Q 9: How come it says not to use a CF bulb in an enclosed fixture?

Even though CF bulbs give off much less heat than their incandescent equivalents, the heat that builds up from a CF bulb in an enclosed fixture can cause the ballast to fail

prematurely. Heat is the worst enemy of ballasts. It is not a safety hazard, but can reduce ballast life 10-50%, depending on how long the CF bulb is on at any one time. It is less of a problem in outdoor fixtures.

.....Q. 10: I bought a 15-watt CF bulb to replace my 60-watt regular bulb. It seems dimmer. Why?

There are several reasons.

1. Light from an incandescent is called a 'point source'. All the light comes from a single filament, resulting in a large glare when you stare at it. But with a CF bulb the light is distributed evenly from all around the tubes, so when it meets your eye it seems less bright.

2. The light from a CF bulb does not travel as far. That's why we don't recommend putting CF bulbs in recessed fixtures. They don't have the 'punch' that incandescent sources have.

3. When under a lamp shade, less light travels down to your task; for instance, when you are reading or knitting. More lumens go up from the shade. That's why we recommend using a circular CF bulb for use under a lamp shade when you need task lighting.

4. After about half of the CF bulb's life, light output can decrease by as much as 25%. But if you buy an Energy Star® labeled CF bulb, due to more stringent requirements it will lose no more than 10% of its total light output 40% through the rated life.

5. Most CF bulbs take 30-90 seconds to come up to full brightness.

.....Q. 11: When my Sun Park CF bulb burned out, it smelled funny and smoked. Are these bulbs a fire hazard?

Seattle City Light distributed over 200,000 *Sun Park* CF bulbs in 2001, as part of the Conservation Kits. Since then, there have been about five complaints of premature failure accompanied by a foul-spelling smoke. A *Sun Park* representative gave us the following explanation.

When the glass tubes are roughly handled (when screwed into a socket by holding the glass tubes, for instance), the vacuum inside the tubes is lost. Oxygen can then come into contact with the tungsten filament at the base of the glass tube (the filament assists with bulb start) causing the filament to overheat. This overheating causes: 1) premature bulb failure, and 2) the epoxy glue that holds the glass tubes to the base to melt, smoke, and turn black.

We were assured that the plastic base is not burning or melting, as it's a high temperature lexon material that is UL-approved as a material appropriate for high heat (although it will darken when exposed to high heat.) What actually is melting and smoking is the epoxy glue. *Sun Park* said there is a cut-off switch inside the ballast (required for UL approval) which prevents the electronics in the ballast from burning when exposed to excess heat.

Sun Park has distributed over 1,000,000 bulbs throughout the Northwest and has fewer than 20 complaints of premature failure and smoking, but no fires. *Sun Park* stated that rough handling during production or the shipping can also loosen the seal and cause premature failure and epoxy smoking. *Sun Park* will gladly replace for free any bulb that fails prematurely. They can be reached at 1.310.320.7880 or mvelasco@sunpkco.com.

..... Q 12: These bulbs sound a major hassle. Why should I bother using them?

Well, there are several conditions under which CF bulbs will not work, but there are even more places where they will work. And once you find the right places to put them, you can forgot about them for 5 years which is how long they'll last if on an average of 3 hours per day. Not only that, you'll have the same amount of light for 75% less cost!

Lighting Controls and CF Bulbs

Lighting control selection is critical to achieving the rated life for your CF bulbs, and to avoiding potential fire hazards. If you use anything besides a standard switch to control a fluorescent light, the following information will help you select a compatible lighting control.

Using a dimmer with a CF bulb can cause a fire! Never use a non-dimmable fluorescent in a circuit with a dimmer, even at full brightness. There are several CF bulbs currently available which are compatible with household incandescent dimmers, so read the package carefully.

Motion sensors are not generally used with CF bulbs because the frequent on/off switching will shorten the lamp life, and because in cold weather outdoor CF bulbs will not provide full light levels until they warm up. Inexpensive magnetic-ballast PL-tube CF bulbs can be used for these on/off outdoor applications but they may need an enclosed fixture to provide enough light in sub-freezing weather. (The lumen output of CF bulbs is quite temperature dependent.)

CF bulbs and photocontrols are an excellent combination if the proper photocontrol is used. You have to use a photocontrol that is rated for use with CF bulbs or inductive loads. A cheap photocontrol is basically a light-controlled dimmer and can cause the same fire hazard as a household dimmer connected to a CF bulb.

Lastly, mechanical timers are fine with any CF bulb, but many electronic timers will get into a harmonics war with electronically ballasted CF bulbs, and either the timer or the lamp will die in battle. If you use an electronic timer, use a magnetically ballasted CF bulb.

It is unfortunate that so many caveats apply to the use of controls with CF bulbs, but failure to observe them can create fire hazards or at least an expensive learning process. Despite these few limitations on control selection, CF bulbs are long lasting, high quality, economical light sources for a home.

Tips for Installing and Using CF Bulbs

CF bulbs are best used in hard-to-reach areas (stairwells, high ceilings) ***and*** where the bulb is on for at least 3 hours per day, such as porch lights that stay on all night.

CF bulbs use the same screw base as regular incandescent bulbs.

CF bulbs work on manual clock timers but may not work on all electronic clock timers or photoelectric timers.

CF bulbs take about 1-3 minutes to come up to full brightness.

When using them outdoors, be sure CF bulbs are protected from rain and snow.

Use circular or '2-D' type CF bulbs in table lamps for best light distribution.

Unless specified on the package, do not use CF bulbs with dimmer switches, even if the switch is all the way on. CF bulbs need a very clean AC (alternating current) power flow, and dimmers alter that flow causing early failure and possible fire hazard.

Using CF bulbs on motion sensors is *not* recommended, as extremely frequent on-off cycles (more than 25 per day) will shorten life.

Do turn off CF bulbs whenever leaving a room. No extra energy is needed to turn it on again. Only very frequent on-off cycles (more than 25 per day) shorten life.

See the Lighting Design Lab (on-line) for more information about using CF bulbs in the home.

Where and How to Buy CF Bulbs

CF Bulbs are available at:

Ace Hardware	Lowe's Home Improvement Centers
Bartell Drug	Madison Market
Chubby & Tubby	McLendon's Hardware
City People's Mercantile	Morgans Electrical & Plumbing
Fred Meyer	PCC Natural Markets
Hardwick's	Seattle Lighting
Home Depot	True Value Hardware
Limback Lumber	Walgreens
Logan Lumber	World Lighting
Long's Drug	and most grocery stores.

Until you are satisfied with the fit and light output, save all packaging and receipts if a CF bulb needs to be returned.

Look for packages with the Energy Star® label. This is your assurance of a high quality product.

All light bulbs are now labeled with their light output, or lumens. Buy a CF bulb with similar lumen output to the incandescent you are replacing. Remember—wattage is a measure of power, not light output. See the ***Comparing Incandescent and CF Bulbs*** chart .

Where to Install Your CF Bulbs

Though a CF bulb may not be an appropriate replacement for an old-fashioned incandescent in every instance, for the majority of places, it is. Although different household rooms have different lighting requirements, here are some locations to think about, room by room, that apply to a majority of homes or apartments.

..... Bathroom

Having a CF bulb can be a pleasant replacement for those night-time trips to the bathroom, since the light can take a minute or two to warm up. For other purposes, the light produces more than enough illumination in a short time and the light quality is good enough to shave or apply make-up. Good applications include either the ceiling fixture or the wall fixture around the mirror.

..... Home Office

Several types of desk lights that are on adjustable arms are very compatible with CF bulbs. Since the home office is a place where one often spends a lot of time, CF bulbs are especially suited here.

Living/Dining Room Fixtures that have harps to support the shade and are not controlled by a dimmer switch are excellent applications for CF bulbs. The best kinds of CF bulbs for these fixtures are circular-shaped. They distribute light both up and down better than regular CF bulbs. Especially useful are the 3-way CF bulbs. Floor lamps with mogul-base sockets can be adapted to fit CF bulbs by using a socket adapter that changes the mogul base to an Edison base. Halogen torchiere floor lamps cannot be adapted to fit CF bulbs. Dimmable and 3 way torchieres made just for CF bulbs are available at most home improvement stores. CF bulbs are not recommended in recessed cans as the light tends to get swallowed up inside the can (unless they are 'Y-shaped' like a floodlight).

..... Kitchen

As long as lights are not recessed into ceiling cans, CF bulbs can provide abundant light for the kitchen. Especially good applications include a hanging pendant or ceiling fixture.

..... Bedroom

Many bedside table lamps are small and the shade clips directly to the bulb. Unless the CF bulb has an outer covering that is bulb-shaped, this application does not suit regular

CF bulbs. Best applications for the bedroom include a ceiling fixture or lamp with a shade attached to a harp.

.....Basement/Shop/Laundry Room

CF bulbs are especially good in bare-bulb ceiling fixtures. Look for places where the light is on at least 2-3 hours per day for the best savings. A fixture over a stairway is an excellent place for CF bulbs if only for the convenience and safety of a long-life bulb.

.....Hall/Entry

Most hall and entryways have ceiling or wall fixtures. Especially if these lights are left on for safety or security reasons, these are good applications for CF bulbs provided they fit.

.....Outdoors

Porch lights are especially good applications for CF bulbs because many people keep these lights on all night for safety. Porch lights are usually in hard-to-reach areas, making them difficult to replace. If on all night every night, a CF bulb will last at least 2-3 years.

.....A Note About Enclosed Ceiling Fixtures

If you have a ceiling fixture that is totally enclosed, excessive heat buildup can reduce the life of a CF bulb. The best solution is to purchase a ceiling fixture that is made just for CF bulbs. These are found in most home improvement or hardware stores and are packaged with the correct CF product included.

Appendix C

Program and Survey Instruments

Conservation Kit Solicitation Letter

City of Seattle
Paul Schell, Mayor

Seattle City Light
Gary Zarker, Superintendent

CONSERVE 10% at home at work

February 23, 2001

**********ECRWSH**C-052

th Avenue
Seattle, WA 981 -

FREE
Conservation Kit Offer!

Dear :

Kit Offer Number: MAIN- MI 7Q F

Seattle and the entire West Coast are in an unprecedented energy crisis. Despite this, Seattle City Light's number one priority remains delivering reliable electricity to you at an affordable price. If we all reduce electricity use by just 10%, we'll save more than half a million dollars per day in the cost of power purchased to meet Seattle's needs. That means fewer and smaller electricity rate increases. It also means that more money stays in your pocket every month.

To get you started on reaching the 10% savings goal, **we have reserved a FREE conservation kit for you!** It contains 2 FREE compact fluorescent light bulbs and a FREE bathroom faucet aerator. Just return the slip below, and we'll send it to you. If everyone installs both compact fluorescent bulbs, we'll save more than $25 million on Seattle's 2001 purchased power bill. For more ways to save, see the tips on the back of this letter.

Seattle City Light also offers a **FREE *Home Resource Profile*** for *single family* households that provides customized recommendations for reducing your home's utility bills. Check out www.cityofseattle.net/conserve/homeprofile. Fill out the web survey and receive a detailed report *in seconds* on your household's resource use. Or call 1-888-693-2169 to request a paper version of the survey.

Please call our Conservation Help Line at **(206) 684-3800** or go to www.cityofseattle.net/light/conserve if you have any questions. For information on programs to help you pay your bill, call **(206) 684-3000**. We're here to help. Thank you.

Sincerely,

Mayor Paul Schell

tear along dotted line and mail this today!

Yes, please send me my
FREE Conservation Kit!

th Avenue
Seattle, WA 981 -

Kit Offer Number: MAIN- MI 7Q F

Return this slip in the enclosed postage-paid envelope. If address or name correction is needed, please mark any changes above. The kit will arrive via US mail. Please allow up to 4 weeks for delivery. One kit per household please. Offer expires May 31, 2001.

Printed on recycled paper.

Conservation Kit includes:
- 2 FREE compact fluorescent light bulbs
- FREE bathroom faucet aerator

After sending for your free conservation kit, check out these other easy-to-follow tips to help reduce your City Light bill. For information on bill payment assistance programs, call (206) 684-3000.

at home

- Set your thermostat to 68° during the day, 55° at night and when no one is home.
- Close fireplace dampers when not in use.
- Turn off and drain your hot tub until the energy crisis is over.
- If you have a water-guzzling showerhead, replace it with a new one.
- Reduce shower time by 2 minutes.
- Wash clothes in cold water.
- Wash only full loads in your dishwasher and clothes washer.
- Set your dishwasher to air dry.
- Turn off your computer, stereo, TV, etc. when not in use.
- Replace incandescent lights with compact fluorescent bulbs.
- Turn off lights when you leave the room.
- Set your water heater to 120°.
- Reduce faucet flow by using faucet aerators.
- Fix any toilet or faucet leaks, especially hot water faucets.
- Weatherstrip around doors, windows and anywhere you feel a draft.
- Close off and don't heat unoccupied rooms.

at work

- Turn off your computer, monitor and other office equipment when you leave for the day.
- Unplug those appliances that draw power even when they are not in use. This will prevent energy use from appliance clocks, sensors and computerized displays.
- Set thermostat to 68° during the day, 55° at night and during non-business hours.
- Dress appropriately for your office temperature. Avoid using portable heaters.
- Turn off overhead lights where appropriate.
- Use company newsletters, bulletin boards and web sites to promote energy conservation in your office.

CONSERVE 10% at home at work

www.cityofseattle.net/light/conserve

The Conservation Kit (two versions) and Enclosure Cards

City of Seattle

Paul Schell, Mayor

Seattle City Light

Gary Zarker, Superintendent

CONSERVE 10% at home at work

Dear Seattle City Light Customer:

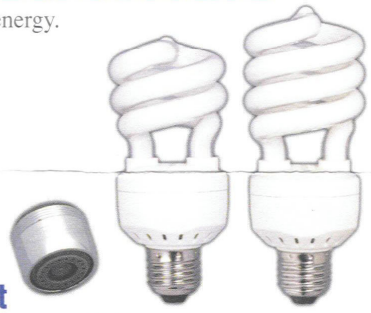
Here is the **FREE Conservation Kit** you requested.

In this kit you will find two compact fluorescent bulbs, a bathroom faucet aerator and a water flow-rate bag. Open this flyer for information about installing and using your compact fluorescent bulbs. Below you'll find other tips on how to save energy. Inside your kit you'll find instructions for using the aerator and flow-rate bag.

If this kit arrived damaged, please call **1-800-419-5095**. If you have any questions about the items in this kit, please call our **Conservation Help Line** at **(206) 684-3800** or go to www.cityofseattle.net/light/conserve/resident. Thank you for your commitment to conserving energy.

Paul Schell

Mayor Paul Schell



After installing your compact fluorescent bulbs and bathroom faucet aerator, check out these other tips to help you reach your 10% savings goal.

- Set your thermostat to 68° during the day, 55° at night and when no one is home.
- Close fireplace dampers when not in use.
- Turn off and drain your hot tub until the energy crisis is over.
- If you have a water-guzzling showerhead, replace it with a new one.
- Reduce shower time by 2 minutes.
- Wash clothes in cold water.
- Wash only full loads in your dishwasher and clothes washer.
- Set your dishwasher to air dry.
- Turn off your computer, stereo, TV, etc. when not in use.
- Replace incandescent lights with compact fluorescent bulbs where appropriate.
- Turn off lights when you leave the room.
- Set your water heater to 120°.
- Reduce faucet flow by using faucet aerators.
- Fix any toilet or faucet leaks, especially hot water faucets.
- Weatherstrip around doors, windows and anywhere you feel a draft.
- Close off and don't heat unoccupied rooms.
- Unplug those appliances that draw power even when they are not in use, such as battery chargers, and appliances with clocks and computerized displays.

For information on bill payment assistance programs, call (206) 684-3000.

COMPACT FLUORESCENT BULB
Fact Sheet

Congratulations on your choice to reduce energy use! By installing these 2 free energy-saving compact fluorescent (CF) bulbs, you'll reduce your bills and help the entire region reduce its need to buy expensive power.

How long do CF bulbs last?

- 6-10 years if on 3 hours per day.
- 3-5 years if on 6 hours per day.

How does the wattage compare to regular bulbs?

- A 15-watt CF bulb = a 40 - 60-watt incandescent bulb.
- A 23-watt CF bulb = a 75 - 100-watt incandescent bulb.

Where is the best place to put these CF bulbs?

- We suggest putting the 15-watt bulb in your porch light for all night security (shield it from rain) and the 23-watt bulb in a fixture in your home that is on at least 3 hours per day.
- These bulbs are not recommended for use with motion sensors. Too many on-off cycles (more than 30/day) can shorten the life of the bulb.
- These bulbs will work in fixtures with 3-ways sockets, but use the 2nd click for longest life.
- Use only in fixtures not controlled by dimmers. Dimmers, even if all the way on, alter the quality of the power to the ballast and can drastically reduce the life of the bulb.
- These bulbs are not recommended for use in recessed cans due to poor light distribution.

How are these bulbs different?

- CF bulbs take 30-90 seconds to come up to full brightness. This "soft-start" is not a defect, but actually prolongs the life of the bulb.
- CF bulbs may seem dimmer because the light comes out evenly from all around the tubes instead of from a single small element like in regular bulbs. (That is why they don't work well in recessed cans.)

How much money will I save on my electric bill?

You may not see a big difference on your bi-monthly electric bill. But your savings over a year will be about $12 for both bulbs. If all SCL residential customers replaced 2 regular bulbs with these 2 CF bulbs, Seattle would reduce its 2001 purchased power bill by $25 million.

Where can I buy more?

Lowe's Home Improvement, Home Depot, Fred Meyer, Morgan's Electrical, Costco, City People's Mercantile and Ikea. Call stores first for availability and prices. You can also order CF bulbs online at **www.lightsite.net** and **www.pnl.gov/cfl**.

How do I dispose of CF bulbs?

CF bulbs are safe to use, but contain trace amounts of mercury that can be released if the bulb is broken when thrown away. Please bring burned-out bulbs to Seattle's Household Hazardous waste sites for free disposal. Call **(206) 296-4692** for locations and hours of operation.

What if I need more information or have questions?

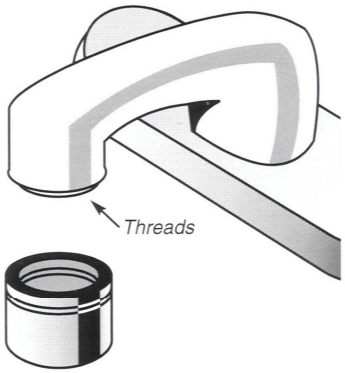
Call the Conservation Help Line at **(206) 684-3800** Monday - Friday, 8:15 a.m. to 4:45 p.m. or go to our website at **www.cityofseattle.net/light/conserve/resident**.

Printed on recycled paper.

Bathroom Faucet Aerator (Nozzle)

Your new aerator is easy to install, and will conserve both water and energy.
(Faucet aerators save energy by reducing hot water use.)

installation instructions



1. **Unscrew the old bathroom faucet aerator (nozzle)** with your hand or by lightly gripping with pliers.
2. **Remove packing tape from the new aerator.**
3. **Check your faucet threads.**
   - *Outside threaded faucets.* Remove the top rubber washer from the new aerator. Keep the smaller rubber washer (below it) in place.
   - *Inside threaded faucets.* Use the aerator as received. (Keep both rubber washers in the aerator.)
4. **Screw on the new aerator and tighten by hand.**

note:

- Caution: keep the aerator away from young children and pets. It contains small parts that can be swallowed accidentally.
- If you are a renter, please seek approval from your building owner before installing.
- The City of Seattle is not responsible for any damage arising from the installation of the aerator.

About Your Aerator:

- The flow rate of the aerator is one gallon per minute (gpm). Standard aerators use from 1.5 to 3.0 gpm.
- Depending upon how much water you use, your new aerator will save up to 400 gallons of water and 35 kilowatthours of energy each year.
- Efficient aerators for kitchen and bathroom faucets are available for purchase at hardware stores and home centers.
- As with all faucet nozzles, when clogging occurs remove the aerator and rinse out the inside screen.
- If you have any questions about the aerator or if you would like information on water conservation, call 206-684-SAVE (206-684-7283) to leave a message.

Troubleshooting:

- If your new aerator sprays out the side, unscrew it and screw it on again. If it still sprays out the side, you may need to tighten it about a half turn with pliers (wrap a cloth around the aerator to avoid scratching it), or add thread tape.
- In case the rubber washers fall out of the aerator, the narrow rubber washer goes on top of the screen, and the wide rubber washer goes on the very top.
- If you are not sure whether your faucet has inside or outside threads, try installing the aerator as received. If it doesn't fit, remove only the large washer and try to install it.
- The aerator may not fit all faucets. Some older faucets do not have threads for aerators.

conservation tip:

Fix leaks. Leaks account for an average of 8% of all home indoor water use, often costing you both water and energy. Call 206-684-SAVE to leave a message to request more information about how to detect and repair water leaks, or visit our website at: **www.savingwater.org**

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TTY/TDD: 206-233-7241. This information can be made available on request to accommodate people with disabilities and those who need language assistance.

The Retail Coupons

— $6 Front/Back (above) — • — $15 Front / Back (below) —

Rules for CF Bulb Disposal

Seattle City Light

Seattle Public Utilities

Compact Fluorescent (CF) Bulb Disposal

Rules for Residential Customers

Disposal Rules

Thank you for using energy-saving fluorescent bulbs. Burned-out bulbs should be disposed of properly. Please don't put used fluorescent lamps in the garbage. Because all fluorescent lamps contain a small amount of mercury, they should be disposed of at a free Household Hazardous Waste (HHW) site (Seattle Municipal Code 21.36.026).

For location and hours of the Seattle HHW site or the King County Wastemobile sites nearest you, call the **Household Hazards Line** (M – F, 9 am – 4:30 pm, except holidays) at **(206) 296-4692** or visit www.cityofseattle.net/util/services and click on "Hazardous Waste" under "Other Services". Please note: The North HHW site is by appointment only through the **Household Hazards Line**.

Benefits of Compact Fluorescent Bulbs

CF bulbs use 75% less energy than regular light bulbs or halogen lights. They last up to 7 years – 10 times longer than most regular light bulbs. By using CF bulbs, consumers save money on their electric bill and help the environment by using less energy.

Since early 2001, more than 6.5 million CF bulbs have been sold in the Northwest. As these bulbs burn out, they must be recycled so they do not end up in landfills – another way to protect our environment.

Why Treat CF Bulbs or Tubes as Hazardous Waste?

CF bulbs contain about 4 milligrams of mercury sealed in the glass tubing of the bulb. Mercury vapor converts electricity into light. No mercury is released when the bulb is in use. Unbroken, burned-out CF bulbs emit no mercury. But broken bulbs or tubes can harm human health and the environment. (For more information on mercury, visit **www.buildinggreen.com** and type in "mercury" in the search field.)

Are Broken Bulbs Dangerous?

A small amount of mercury is released if a fluorescent tube or bulb breaks. Breathing in mercury on a repeated basis is hazardous, but the small amount of mercury released from one bulb should pose no significant health risk. Try not to break bulbs. Instead, bring intact bulbs to a free Household Hazardous Waste site. For questions, call the **Household Hazards Line** (M – F, 9 am – 4:30 pm, except holidays) at **(206) 296-4692**.

MORE INFORMATION

For more information about CF bulbs, call the Conservation Help Line at **(206) 684-3800** or visit **www.cityofseattle.net/light/conserve/resident**.

www.cityofseattle.net/light/conserve **www.cityofseattle.net/util**

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Participant Survey

Nonparticipant Survey II