

Evaluation of a Regional Compact Fluorescent Lamp Electricity Efficiency Pilot Program in New Zealand

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Abstract

The Electricity Commission of New Zealand (Commission), the electricity industry regulator, implemented a pilot residential compact fluorescent lamp (CFL) program to evaluate CFL effectiveness in improving electricity efficiency prior to a national rollout. The Commission's electricity efficiency activities are funded by a levy on electric energy sold. The Commission implemented the pilot in partnership with the local network company and the predominate generator/retailer in the area. CFL distribution was through a national grocery supermarket chain. Commission and partner funding, including a zero retail margin contributed by the supermarket, significantly reduced the cost of the product to consumers. Evaluation elements of the pilot program were designed to assess the outcomes of the pilot and to inform the final program design prior to a national rollout. The main objectives of the evaluation work were to assess actual electricity savings, peak demand reductions, marketing and delivery channels, consumer acceptance of the technology and changes in consumer behaviour.

The evaluation work included two telephone surveys and in-home data logging of CFL usage.

Introduction

The Commission is a Crown entity which oversees the governance and operation of New Zealand's electricity industry and markets in accordance with the Electricity Governance Regulations 2003 and the Electricity Governance Rules 2003 under the Electricity Act 1992. The Commission began operating in September 2003.

The Commission's functions and objectives, and the Government's expectations of the Commission, are set out in the Electricity Act 1992 and the Government Policy Statement on Electricity Governance issued in October 2004.

The Commission's principal objectives are to:

- ensure that electricity is produced and delivered to all classes of consumers in an efficient, fair, reliable, and environmentally sustainable manner; and
- promote and facilitate the efficient use and conservation of electricity.

The Commission is working to convert government electricity policy into practical programs that can be shown to enhance the generation, transmission and use of electricity in an efficient, fair, reliable and environmentally sustainable way.

Accordingly, the Commission, based on the outcomes of the CFL Christchurch pilot project undertaken in 2005, announced in March 2006 its commitment to invest \$3 million in 2006/07 towards programs that encourage the uptake of integral ballast, high performance CFLs (specification includes minimum of 8,000 hours and >0.9 power factor) as replacement for standard incandescent lamps used in households.

Christchurch CFL Pilot Project (2005)

In undertaking a CFL pilot project that would be the forerunner to an expanded market transformation program, the Commission wanted to better understand the barriers and the dynamics of engaging with the retail lighting market and more specifically with consumers.

Some of the questions that the Commission wanted answers to, were - what marketing channels would work and how would consumers react to such an initiative? What perceptions did consumers have of the technology, and when the CFLs were installed, what level of electricity savings and peak demand reduction would be achieved?

The Commission also recognizes that investment of the electricity levy in electricity efficiency programs must be backed by rigorous analysis, must be transparent in that the investment is that of public monies, and must be able to stand up to detailed assessment by key stakeholders such as those companies deemed to be levy payers. Levy payers are defined as those companies that purchase electricity through the electricity market and include electricity retailers (in New Zealand electricity retailers do not own network systems) and a small number of major industrial electricity users.

In summary, the Christchurch region pilot project, which was a first for the Commission, was undertaken by the Commission in partnership with Orion New Zealand (an electricity network company) and Meridian Energy (an electricity generator and retailer) and the project had the following characteristics:

Region covered	All households in the Christchurch and central Canterbury area between the Waimakariri and Rakaia rivers. (mix of city and rural areas, population around 300,000)
Timing	31 October 2005 to 4 December 2005 (34 days) (summer – daylight saving)
Project aim	<ul style="list-style-type: none"> • Replace up to 200,000 incandescent bulbs with CFLs in the target region and quantify peak load and overall electricity savings. • Educate consumers about the benefits of quality CFLs. • Educate consumers about the electricity saving benefits of CFLs
Communication aim	<ul style="list-style-type: none"> • Raise awareness of electricity efficiency using CFLs • Educate consumers about CFLs, how much light they give off and how much money they can save in the long term • Promote a price offer of 3 lamps for \$5 (note: NZD5.00 = USD3.64) with the option to buy additional lamps for \$3.95 each during the campaign period (normal retail \$5.95 per lamp) • Achieve a positive customer response to CFLs and use of them in the home
Mode of delivery:	<ul style="list-style-type: none"> • Vouchers offering 3 lamps for \$5, redeemable at any New World supermarket, Pak'n Save supermarket, or 4 Square store in the region during the campaign period.
Methodology	<ul style="list-style-type: none"> • Every Meridian Energy customer in the area was sent a letter explaining the benefits of participating in the project and included a redeemable voucher • Non-Meridian Energy customers living in the area could send in an addressed envelope and they were mailed a voucher. • The voucher was also placed in The Press (the region's main daily newspaper) three times during the campaign period.

	<ul style="list-style-type: none"> • Mid-weighted media activity included newspaper, radio, web and in-store collateral. • Public relations activity was also initiated to increase awareness of the project.
Number of bulbs sold	125,721 (daily average = 3,698 bulbs)
Household uptake	27% of Meridian Energy customers (42,000 homes)
Vouchers redeemed	<ul style="list-style-type: none"> • 33.4% • 71% from direct mail, 16% from newspaper vouchers, 13% SAE fulfilment.
Estimated savings over life of lamps sold	<ul style="list-style-type: none"> • 74.2GWh of energy • Average 1.4MW of peak demand • \$12m in reduced energy bills
Cost effectiveness	<ul style="list-style-type: none"> • Less than 1.5c/kWh compared to about 6-8c/kWh for new generation
Level of awareness achieved	<ul style="list-style-type: none"> • 80% of those surveyed were aware of the campaign and its objectives
Issues	<ul style="list-style-type: none"> • Predicted uptake ratios of screw vs. bayonet fitting bulbs was incorrect and screw bulbs ran out in week three. • Shipping delays meant the promotion started late and encountered competition for store space with Christmas promotions. • Supermarket participation varied with some of the larger stores having fewer displays promoting the lamps and it was apparent that some stores did not re-order stock during the campaign.

Pilot project evaluation

Post the completion of the pilot the project partners completed three evaluations including two telephone market research surveys. The first market research undertaken addressed campaign awareness, propensity of consumers to purchase and the effectiveness of distribution channels.

The second survey looked in more detail at purchase and installation decisions, consumer reaction to lamp performance, and the potential for additional CFL purchase in the future.

Measurement of electricity savings and peak demand reduction has also been completed providing the partners and particularly the Commission with key findings that answer questions relating to the effectiveness of the investment in achieving electricity savings and peak demand reduction.

All evaluations have been posted to the Commission's website to ensure that as the national CFL program expands interested third parties can learn from the results of the pilot program.

I would now like to highlight the key findings from the evaluation work.

Consumer Awareness and Purchase Decisions

- ◆ Methodology – 200 telephone interviews – 150 urban and 50 rural consumers – interview was with the person in the household responsible for making decisions about appliances in the home.

- ◆ The marketing campaign comprised a number of medium – direct mail, newspaper, in-store display and radio. From the survey we were able to establish that 80% of consumers were aware of the campaign and that 60% (unprompted) became aware through the direct mail and this number increased to 75% when respondents were prompted. Newspapers were the other significant contributor to awareness with 36% unprompted increasing to 64% when prompted.
- ◆ We also wanted to understand the impact of consumers being exposed to more than one medium and how that affects consumer decision making. What we found was that if consumers were exposed to more than three promotional sources that over 70% of them ended up making a purchase.
- ◆ A key component of the CFL program is providing consumers with information to overcome barriers to the uptake of CFLs. Therefore through the pilot we wanted to be able to assess the effectiveness of delivering fundamental messages to consumers that would enhance their understanding of the technology. In this respect there were two key messages one relating to the life of the lamp and the other relating to the savings that consumers can make from installing them. In addition we wanted to test recall around the actual campaign itself.
- ◆ The results concerning message recall were encouraging as can be seen from the table below. These questions were asked of all respondents who were aware of the campaign.

Message	Recall
Each lamp lasts 9 years on average	67%
Save \$300 in electricity costs over the life of the lamp	61%
Redeeming the voucher entitles you to purchase 3 CFLs for \$5.00	91%
Vouchers can only be redeemed at selected supermarkets	82%

- ◆ The importance of message recall to consumer engagement in the promotion is verified when it is revealed from the research that 61% of consumers who recalled four messages ended up purchasing lamps whereas only 39% of consumers recalling two messages purchased lamps.
- ◆ Some concern exists regarding the effectiveness of inserting a voucher with a direct mail promotion. The concern is that inserts get thrown away. Pleasingly our survey showed that 75% of consumers recall receiving the voucher in the post. This was considered a good outcome.
- ◆ Results showed that 37% of those who had received the voucher ended up purchasing the lamps. There was also 24% who did not purchase but have been using CFLs and there was also a larger group of 39% who did not purchase and they have not previously used this technology. It is going to be important for the long term success of the program to better understand why this latter group have not used CFLs in the past and to test key messages to ensure that information about the technology is communicated in such a way as to encourage uptake amongst consumers who have previously been reluctant to purchase.

- ◆ Respondents were asked why they purchased the CFLs and those that did not purchase were asked why they did not. The following table shows the results of these unprompted questions.

Unprompted questions for buying CFLs	Response
Save money on power bill	45%
Length of time that lamps last	22%
Cost of lamps	16%
Want to be environmentally responsible	16%
Unprompted questions for NOT buying CFLs	
Already use CFLs	17%
Just didn't get around to it	15%
Didn't get voucher in the mail	12%
Not suitable for my house	10%

- ◆ When we considered the profile of respondents we found that those most likely to purchase CFLs were older than 40, lived in an urban environment and had no children in the household.

Installation of Lamps and Product Satisfaction

Once consumers have purchased the CFLs it is important for the success of the program that the lamps are not only installed immediately but are installed in those areas of the home where the lights are used most frequently. It is also important for the Commission and future partners to understand the barriers that continue to discourage consumer purchase of the technology and to find solutions to address these consumer concerns many of which are the result of misinformation.

To help inform the program on these matters the pilot project partners agreed to undertake further market research to obtain consumer feedback on questions relating to installation and performance.

The results of this second market research survey are summarized below:

- ◆ Methodology – 201 interviews were completed of consumers who purchased CFLs during the pilot campaign, with respondents randomly selected from all those who redeemed a voucher as part of the purchase transaction.
- ◆ The survey was conducted six months after the promotion.
- ◆ Remembering that the promotion offered consumers three CFLs for \$5.00, the average number of lamps purchased per household during the promotion was 4.6 and after the promotion 1.3.

- ◆ At the time of the survey, of all the lamps purchased 71% of them had been installed and 89% of those installed had replaced incandescent bulbs.
- ◆ Where consumers installed the lamps is shown in the table below:

Living room	68%
Kitchen	58%
Bedrooms	47%
Dining room	46%
Hallway	41%
Bathroom/toilet	30%

- ◆ Some consumers had not installed all the lamps they had purchased and when asked why not the primary reason was that consumers were waiting for the old bulb to burn out. However just under 90% of those who had not installed all the lamps they have purchased said that they will eventually.
- ◆ One of the key concerns when developing the program was consumers' reaction to lamp performance and in that regard the survey result shows that 16% of consumers said that the lamp performed much better than expected, 18% a little better than expected and 56% said that performance is what they expected. Therefore 90% of respondents were considered to be happy with the performance of their CFLs.
- ◆ Encouraging from the program perspective is that 82% of consumers were either very likely or extremely likely to buy CFLs again.

Electricity Savings and Peak Demand Reductions

Given the Commission's strategy of investing in electricity efficiency programs that cost less than the long run marginal cost of new generation, an important element of the pilot program was the measurement of electricity savings and peak demand reductions. The "Measurement Project" as it was referred to, required the monitoring of CFL usage in a randomly selected sample of 100 households to estimate the network load reduction and electricity savings arising from the pilot program.

The results of this measurement project are summarized below:

- ◆ 125,721 15W and 20W CFLs were sold in the campaign.
- ◆ To determine the electrical and financial savings from the use of the CFLs, 97 homes were monitored over a six week winter period from 3 July to 13 August 2006. The lamps installed in these homes were monitored via temperature sensitive loggers that were attached to each lamp in the home that had been purchased and installed as part of the pilot program. The logger recorded when the CFL was switched on or off, to an accuracy of one minute, over the six week winter period.

- ◆ The results from these 97 homes (355 lamps were monitored) were then extrapolated to estimate the savings that resulted from all 125,721 lamps sold during the pilot program. The extrapolated results are estimated to have a measurement margin of error of $\pm 13\%$.
- ◆ The sale of 125,721 CFLs is estimated to have:
 - reduced network load by an average of 1.4MW during those periods when the local central Canterbury electricity network experiences peak network load;
 - realized annual electricity savings per household of 166kWh or \$26.51 at 16 cents per kWh based on the 97 homes monitored each installing on average 3.66 CFLs.
 - resulted in annual electricity savings of 5.7GWh;
 - resulted in annual consumer power bill savings of \$910,000
 - resulted in 74.2GWh of electricity being saved over the life of the lamps (each lamp has an estimated life of 10,000 hours);
 - lifetime power bill savings worth \$11.9 million to consumers based on an electricity tariff of 16 cents per kWh;
 - average wattage of incandescent bulbs replaced was 84.1W
 - average wattage of CFLs installed was 18.3W
 - average wattage saving was 65.8W
 - average daily hours of CFL operation during the measurement period was 2.8 hours/day; and
 - reduced carbon dioxide emissions by 46,400 tonnes over the life of the lamps (based on the assumption that in New Zealand every GWh of electricity saved reduces carbon dioxide emissions by 625 tonnes).

All reports relating to this pilot program can be found at –
www.electricitycommission.govt.nz/opdev/elec-efficiency/lightprog

Conclusions

The *Electricity Act 1992* was amended in October 2004 to give the Electricity Commission additional powers to promote and facilitate the efficient use of electricity in New Zealand.

Therefore a priority for the Commission is the investment in the development and management of an electricity efficiency program through a range of interventions, including incentives and consumer education that will realize sustained electricity efficiency and conservation gains.

The electricity efficiency programs developed must return electricity savings and peak demand reduction, and any investment in such programs must be cost effective when measured against the long run marginal cost of building new generation.

The CFL pilot program reported in this paper has shown that promoting and incentivizing the installation of CFLs will result in electricity savings and peak demand reduction at a cost effective rate of less than 1.5 cents/kWh. This compares favorably with the current long run marginal cost of new generation of about 7 cents/kWh.

The evaluation of the Christchurch pilot program has shown that there are worthwhile electricity savings for the consumer who installs CFLs and that the country as a whole would benefit significantly from the rollout of a national CFL program.

The research also clearly indicated that consumers are much more likely to purchase CFLs once they understand the benefits that the technology offers over the standard incandescent bulb.

Subsequent market research undertaken earlier this year as a baseline survey has returned some very important findings that demonstrate the success of the Commission's national program that is now in full implementation phase and is targeting both residential and commercial consumers.

In particular the baseline survey shows that there is a high level of awareness and usage of CFLs and that 67% of the people interviewed in the survey of 500 New Zealanders currently use at least one CFL in their home.

The value of evaluating and monitoring the development and implementation of the Commission's CFL program has been and continues to be one of the program's critical success factors.

Based on the success of this pilot, the program has been implemented on a national basis with approximately 2 million CFLs being subsidized in 2006/07 and the incentive strategy coupled with consumer information campaigns is set to continue into 2007/08.

References

Christchurch Ecobulb Promotion Post-Evaluation, January 2006, Colmar Brunton.

Christchurch Ecobulb Promotion – Post Purchase Evaluation, May 2006, Colmar Brunton.

Christchurch and central Canterbury Efficient Lighting Pilot Program Measurement Project Report, 1 May 2007, Energy Mad Limited.

CFL: Baseline Research, May 2007, Colmar Brunton.