

Bulk Procurement vs. Market Channels: International Experience with the Promotion of Compact Fluorescent Lamps (CFLs)

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ABSTRACT

This paper reviews the lessons learned from implementation of compact fluorescent lamp (CFL) programs in Sri Lanka, India, and Vietnam. It describes the range of program approaches, the success of different incentive mechanisms, the sustainability of bulk procurement approaches, and lessons learned in the implementation of large-scale CFL programs. The lessons from recent CFL programs in Sri Lanka and Bangalore – which use a utility-bill-payback scheme, along with a supplier guarantee for the CFL – indicate that such programs can be effective at stimulating consumer purchase of CFLs. The experience in Vietnam demonstrates that bulk purchase programs, while attractive in theory, have several limitations. In particular, while bulk procurement can help the utility get a very good price, it actually works against development and strengthening of CFL market channels, since it involves only a single manufacturer, and thus makes it hard for others to compete in the market.

Background: CFLs are Increasingly a Globalized Commodity

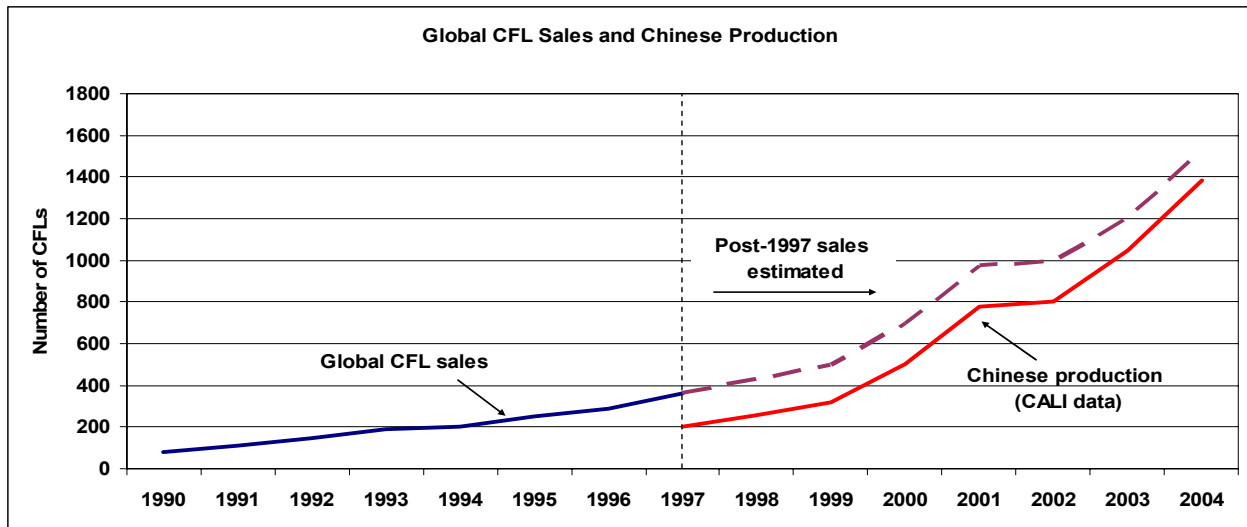
CFLs are rapidly becoming a globalized commodity. As Figure 1 shows, estimated global sales of CFLs increased more than seven-fold in the ten-year period from 1994 to 2004. Another thing that happened during this time period is that China emerged as the dominant CFL producer. While exact figures are not available, it is likely that Chinese manufacturers account for approximately 90% of total global CFL production today.¹

Overall, the global trend in CFL production can be summarized as rapidly increasing with a concentration of production in China. At the same time, on the distribution side, sales of CFLs have greatly expanded and much larger numbers of CFLs are available in many more countries. Initially, in the early and mid-1990s, there was little or no regulation of CFL quality. Once it became apparent that the flood of poor-quality CFLs represented a threat to the entire market, many national and local jurisdictions responded by establishing means for testing, verifying, or otherwise controlling CFL quality.²

¹ No global sales data are available after 1997. The data on Chinese production are fairly reliable, and – based on our observation of the closing down of CFL production in many countries, we assumed the following: (1) that Chinese production increased from 56% in 1997 to 90% of global CFL sales in 2004; (2) that the absolute level of non-Chinese production increased slightly from 1997-2000 and then decreased; and (3) that the absolute level of non-Chinese production was 13% lower in 2004 compared to 1997 (approx. 122 million vs. 140 million).

² Based on a review of the APEC Energy Standards Information System (APEC ESIS 2006), there are a total of at least 38 CFL programs or standards in place internationally: 13 minimum CFL standards are in place (9) or under consideration (4); 25 CFL labeling programs are in place (24) or under consideration (1); and one-third of existing programs are mandatory, while two-thirds are voluntary. Two key international efforts have been initiated to try to

Figure 1. Global CFL Sales and Production



Source: International Association for Energy Efficient Lighting for pre-1997 sales; China Association of Lighting Industries for post-1997 production

This situation has led to a mismatch of end-use policies with production: while production has become more routine, standardized, and lower-cost, there has been a proliferation of different standards for testing, labeling, and regulating CFLs.

Recent CFL Programs in South Asia: Sri Lanka and India

Given the array of different international specifications and standards, and the lack of a single internationally recognized set of specifications for CFL quality, it is quite difficult for countries implementing CFL programs, who are often left to craft their own programs based on their own knowledge, or recommendations from international consultants. The rest of this paper describes the evolution of some CFL program approaches with which the authors have been involved, initially in South Asia, and more recently in Vietnam.

Sri Lanka's CFL Programs

Sri Lanka introduced its first CFL program in 1994, during a period of power shortages as a result of a drought that affected the country's hydropower resources. The objective was to increase the efficiency in the use of electricity, resulting in lower electricity bills for the customers; in the short term, to mitigate the energy deficits of the Ceylon Electricity Board (CEB); and in the longer term, to defer CEB investment in new capacity. The program was

bring a bit of order to this tower of regulatory Babel for CFLs: the International CFL Harmonization Initiative, (www.apec-esis.org/cfl), which is working toward a single, improved international test protocol for CFLs, and a universal set of three to four performance steps that could be applied needed by each country; and the Efficient Lighting Initiative (www.efficientlighting.net), a certification and labeling program, with an emphasis on developing countries, which provides a "reach" specification for energy-efficient lighting products.

offered to customers classified as Domestic and Religious Purpose customers under CEB's and Lanka Electric Company's (LECO's) tariff structure.

The initial pilot project covered 600 households, of varying electricity consumption levels. It was implemented by a leading university, with funding from the Energy Conservation Fund (ECF) established under the Ministry of Power. Lamps were installed at no cost to the customer, and performance was monitored over a period of one year. Based on the success of the pilot project, a larger program of 100,000 CFLs with electronic ballasts was launched in June 1995, and ran through August 1996. The main feature of this program was a subsidy provided by CEB to cover the cost of import taxes and other duties, advertising through brochures, seminars and electronic media, and an 18-month manufacturers' warranty on the lamps. The program also included an interest-free loan scheme for CEB and LECO employees to purchase CFLs.

In 1997 and 1998, the CFL loan scheme was extended geographically to cover 10 of the 12 provinces in the CEB distribution network, and all participating suppliers were required to provide a two-year warranty on the lamps. An evaluation of the CFL program was conducted in 2000 under the World Bank-funded Energy Services Delivery (ESD) Project, and recommendations were made for program refinement. The refinements were made in 2001 and the program is still continuing under the same management structure at CEB.

Results of program evaluation. The cumulative benefits to the CEB system in 1998 and 1999 (up to September) were evaluated based on the total participation (loan scheme and direct sales) and the program costs including cost of incentives (interest free loan). The program accounted for 990,000 CFLs during the period January 1997 to September 1999, of which 19% were sold through the loan scheme and the rest through direct purchases from participating suppliers. The results of the impact evaluation are summarized in Table 1.

Table 1. Results of Impact Evaluation of Sri Lanka's CFL Program

<i>System Impacts</i>	<i>Program Target</i>	<i>1998</i>	<i>Program Target</i>	<i>1999 (up to 30/9)</i>
Energy Saving (GWh/yr)	37.5	46.4	56.3	64.10
Demand saving (MW)	25.0	33.9	37.5	46.73
<i>Cost Effectiveness</i>				
Reduced Supply Costs (Rs.M)		182.66		252.18
Customer Bill Savings (Rs M)		153.18		211.48
Net Benefit (Rs M)		29.48		40.69
Program Costs (Rs M)		1.75		2.00
Incentives (Rs M)		9.65		12.36
Total Costs (Rs M)		11.40		14.36
Net Benefit / Cost Ratio		2.59		2.83

Note: The B/C ratios were calculated using the total resource cost tests. The avoided cost of supply was assumed to be the bulk supply tariff (energy and demand) due to unavailability of other data.

The CFL Program in Bangalore

Introduction. The International Institute for Energy Conservation (IIEC) has been working with the Bangalore Electricity Supply Company Ltd (BESCOM) in implementing a series of DSM demonstration projects in the State of Karnataka under the ECO II Project, which is funded by the U.S. Agency for International Development (USAID). The aim of the demonstration projects is to develop a sustainable model for market driven DSM programs that would benefit the utility, customers and society as a whole. Below, we summarize one of the DSM programs, the BESCOM Efficient Lighting Program (BELP).

Program rationale and key elements. Load research showed that lighting is a major contributor to the BESCOM system peak load, especially in the evenings, and that the lighting load comes predominantly from the residential and small commercial sectors. The BESCOM lighting program includes the design, implementation, monitoring, verification and reporting of a demonstration project using a model that incorporates private sector participation.

The program was initially implemented during a demonstration phase of six months, and it has since been extended. It is available to all of BESCOM's domestic customers. The technologies promoted under the program include compact fluorescent lamps (CFLs) and 36W (T8) fluorescent tubes.

The selection of lighting suppliers was through a tender process, and based on product quality, price, warranty, and retail network. Multiple suppliers were selected for certification under the program. Customers have two choices for the purchase of CFLs of approved brands: direct outright purchase, or payment in installments through BESCOM's billing system. Only CFLs are eligible for the installment scheme.

Eligible customers (with no arrearages on electricity bills) acquire the CFLs from approved retailers and complete a sales voucher confirming purchase. For customers electing to purchase lamps on an installment basis, the distributors send invoices at regular intervals to BESCOM's program administrators. Upon verification, BESCOM includes the cost of the lamp(s) in the customer's bills and allows for repayment in installments over the specified period of nine months. BESCOM reimburses the suppliers in monthly installments following collections from customers. Program marketing is managed by BESCOM.

Program target and duration. Cost/benefit analysis has shown that the replacement of incandescent lamps with CFLs is cost effective in areas where the average usage is around 4 hours per day. In the residential sector, the target areas include porticos, living rooms, verandas, kitchen, lobbies and security lighting.

Market research³ has also shown that the 40W fluorescents account for nearly 80% of the fluorescent tubing sold, even though the unit cost is marginally higher than a 36W fluorescent tube. It is possible that market transformation from 40W to 36W could be achieved primarily through customer education and without the need for payment by installments through the electricity bills.

The duration of the pilot program was 6 months (mid December 2004 to June 2005). Following the evaluation (see results below), BESCOM has continued with the program in

³ Surveys of the Bangalore lighting market carried out by the International Institute for Energy Conservation (IIEC) as part of the USAID-funded ECO-II project in India..

Bangalore, and the BESCOM Board has approved an extension of the program to five other cities.

Program Design Features

Direct sales guidelines. The suppliers offer a “special price” for those customers who prefer to purchase lamps (CFLs and 36W FTL) outright. Under the lighting program, BESCOM will only endorse the products of the selected suppliers. The lamps purchased directly have the same warranty as those purchased under the installment scheme, and they carry a unique hologram seal for identification with the program and warranty obligations.

Given the prevalence of fraud in many developing countries, this hologram concept represents a unique and innovative development that makes it extremely difficult to fake the product. Each hologram has a serial number. If one attempts to remove the hologram, the image disintegrates indicating that it has clearly been tampered with.)

The participating suppliers are required to provide sales figures of all direct sales under the program to BESCOM on a monthly basis. The provision of direct sales figures are voluntary and hence, there are no penalties. However, suppliers willingly provide these because of their association with CEB.

Installment scheme - procedure for issue of lamps. Following the program launch, customers interested in the program were given the program details and relevant information (retail outlets, brands and prices of the CFLs). This information is provided at the BESCOM district offices where the customers come to pay their electricity bills. The customer is required to choose one approved retail outlet for the “purchase” of the lamps.

The customer will produce the last electricity bill and receipt of payment from BESCOM as proof of eligibility. The customer is then free to choose a single brand of CFLs and can purchase up to 5 lamps. There is no provision to allow the selection of multiple brands due to practical problems in invoicing. The customer and the authorized agent (retailer) complete an Agreement for the purchase of lamps.

At the time of purchase, the customer is required to provide proof of identity (driver’s license or copy of passport or ration card or election card), which should correspond to the name on the electricity bill. In order to provide lamps to tenants, an authorization is required from the landlord.

The price of lamps under the installment scheme is expected to be higher than that for direct purchase due to corresponding finance costs. This scheme allows the customer to pay in nine (9) equal monthly installments.

Procedures for Invoicing and Payment. The purchase agreements are forwarded to the sole distributor of each brand and are reconciled on a monthly basis. Invoices are then submitted to BESCOM, together with the original purchase agreements.

Following verification, BESCOM incorporates the payment in the customer’s electricity bill, and monthly collections from each BESCOM district office are forwarded to BESCOM’s Central Accounting Division, which then forwards the installments to each supplier against the monthly invoices. The repayment period of the customer is nine (9) months. The supplier

reimbursements start no later than sixty (60) days from the sale and the supplier reimbursement period is completed within nine months.

Procedures for lamp replacement under warranty. Under the Agreement with BESCO, the supplier has an obligation to honor the warranty given on the CFLs purchased under this program, both for direct purchases and purchases under the installment scheme. The retailer is obliged to replace any defective lamp within 24 hours upon presentation of the original receipt as proof of purchase.

The obligation of the supplier is to replace failed lamps up to the limit of the warranty period from the date of the original purchase. For example, if a supplier offers a warranty of one year, and a lamp fails after 9 months of purchase, then the replacement lamp will have a continuing warranty of only 3 months.

The supplier is required to provide a bank guarantee to BESCO, valued at Rs 500,000 (US\$ 11,400), as security against the warranty obligations.

Selection of suppliers. The selection of suppliers was made through formal Request for Proposals (RFP) and clearly defined selection criteria, as outlined below:

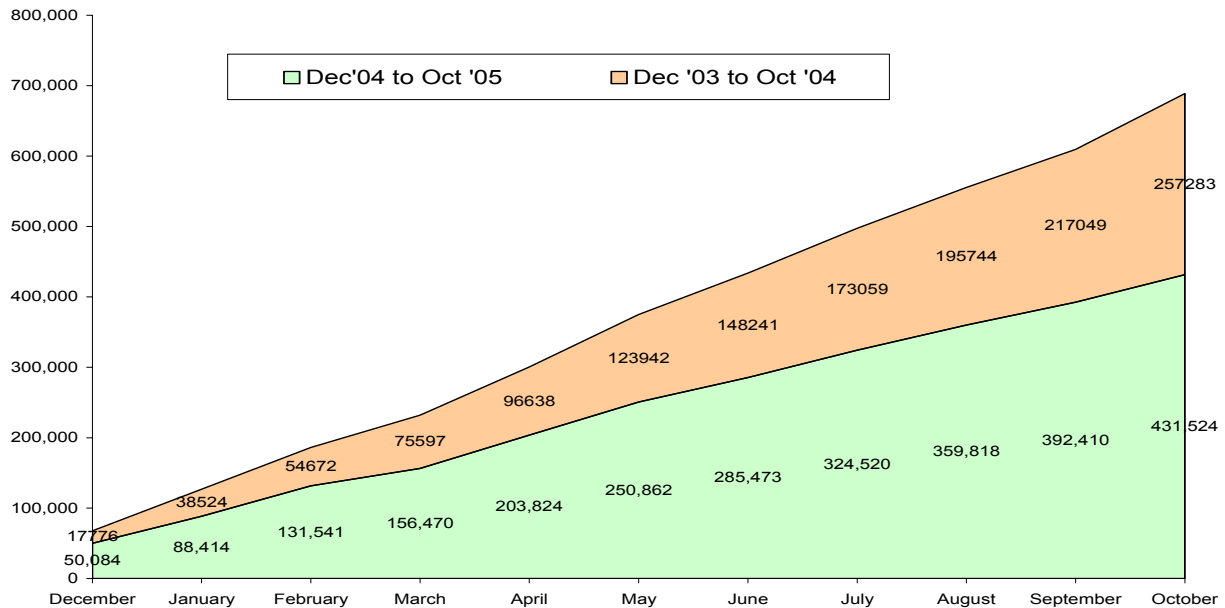
- company registration, core business, years of operation in India and financial stability (supported by recent financial statement and solvency certificate from the commercial bankers);
- annual employee turnover at the company
- CFLs and T8s (36W FTLs) offered should be under the company's own brand name;
- products must meet the technical specifications for the lighting products;
- in-house testing protocols and quality assurance plans are followed;
- a period of warranty offered;
- suppliers propose a methodology for warranty service and guaranteeing the replacement time-period;
- suppliers agree to bar-code the CFLs supplied under this program for identifying qualified products should a warranty issue be raised;
- suppliers offer a retail price for the lighting products offered for the program for direct sales and for the installment purchase scheme;
- suppliers have a well established distribution and retail network in the Bangalore Urban district; and
- suppliers agree to the payment procedure and to provide sales data for program monitoring.

Following a tender process, only three out of seven suppliers who submitted proposals met all the above criteria. These were Philips, Osram and Asian Electronics (a local company marketing their own brand of lamps).

Pilot Program Evaluation Results

During implementation of BELP, BESCOM tracked sales from participating suppliers on a monthly basis. Figure 2 below shows the increasing sales volume during program implementation, comparing to the same time-period for the previous year, but the program didn't grow as fast the second year.

Figure 2. Monthly Sales of CFLs under India's BELP Program



CFL sales increased steadily throughout the program period. A comparison of the sales during the program period and the corresponding period of the previous year reveals a year-on-year increase of more than 70%. IIEC did not do a detailed benefit-cost analysis for the six-month pilot program; however, they have estimated the benefits to the utility and consumers on the basis of 175,000 CFLs: an estimated peak demand reduction of 10.5 MW, and energy savings of 15.7 GWh.

Lessons Learned and Next Steps for CFLs in India

The key outputs of the program are:

- One of the key objectives of the program is to establish a model for a large-scale, utility-sponsored CFL program that could be replicated in another state in India. The BELP model is now being considered by several private and state utilities in India.
- The average CFL retail price in Bangalore fell by 16% as a result of the program. Non participating suppliers reduced their prices to be competitive with BELP and also offered one year warranty.
- All CFL retailers recorded significant increases in sales since the launch of BELP.

- As expected, the take-up on the installment scheme was low (around 20%) considering that the program was implemented in the urban sector. This take-up rate is expected to increase when the program is extended to the rural sectors, where income levels are much lower.⁴

Vietnam's CFL Procurement for Rural Households

Background of CFLs in Vietnam

Electricity of Vietnam (EVN) is embarking on its Phase 2 DSM Program during 2004-2007 with the aim of better managing loads, load curves, peak load savings and improving load factors. The Phase 2 target is to achieve more than 120 MW in system peak reduction and annual energy savings of about 64 GWh.

A centerpiece of the Phase 2 DSM program is a major national program to purchase and distribute more than 1 million CFLs to rural customers over the next three years. In the rural residential areas, the load factor is extremely low, and peak demand is twice as high as the low-load period. As is the case with utility systems in Sri Lanka and Bangalore, the main contribution to Vietnam's electric demand in peak time comes from residential lighting especially in rural areas.

EVN implemented a pilot CFL program in its Phase 1 DSM program during 2001 and 2002. Overall, the program was successful, and led to the following key conclusions:

- implementation of the pilot program revealed a measurable savings in household energy use of approximately 5%, as well as in peak demand at the substation level
- there are no major obstacles for a large-scale installation of CFLs in rural areas; and
- more than 80% of the participants expressed their willingness to buy CFLs in the future.

Following on the Phase 1 program, EVN designed its CFL program for Phase 2 with three primary strategic objectives: to subsidize large quantities of CFLs for poorer rural customers through a bulk procurement program; to provide a signal to manufacturers to increase their sales and marketing of CFLs; and to stimulate a long-term market transformation toward the use of CFLs instead of incandescent lamps.

Program Design

During the three-year Phase 2 DSM program (2004-2007), EVN will procure at least one million CFLs from suppliers and offer them for sale to rural households throughout Vietnam. Initially, the procurement will be made from a single CFL supplier using a bulk tender procedure, and the lamps will be distributed through Provincial PCs (power companies) and in both provincial cities and rural villages. The method of procurement and program design for the balance of the program will be reviewed based on the results of an international review of CFL program marketing experience.

⁴ The retail price of around US\$3 is considered to be a significant barrier in India, primarily in the rural sector. The installment scheme was design to address this.

Over the three-year program period, EVN intends to gradually reduce the subsidy amount provided to rural consumers. The subsidy will be combined with marketing efforts to promote the use of the more efficient lamps in and outside the distribution program; *this is an important point since a key long-term goal of the CFL program is to promote a market transformation toward the use of CFLs instead of incandescent lamps.*

Technical Specifications

A household survey carried out in 2001 found that the most popular size of incandescent bulbs were 40W, 60W, and 75W – each of these accounted for just more than 25% of incandescent lamps. There were smaller numbers of 25W bulbs, which accounted for just under 15% of incandescent lamps; and 100W bulbs accounted for about 5% of incandescent lamps in the survey.

In order to simplify the development of technical specifications, EVN chose specifications consistent with the ELI specifications for CFLs.⁵ These baseline specifications were chosen – with some minor modifications -- as they represent a well-known international standard for CFL quality that has been implemented in at least seven countries worldwide.⁶

Additionally, in order to simplify the procurement in Year 1, it was decided to select a single size and type of CFL for procurement: 75W equivalent, daylight, with screw-in base. The actual bidding specifications do not specify a lamp wattage, but rather a minimum lumen rating based on equivalent output to a 75W incandescent and taking into account lumen depreciation over time.

During the research on the technical specifications, one of the authors carried out extensive email conversation with a range of international experts involved with the ELI program. Interestingly, while the ELI specification calls for a luminous flux of 874 lumens to replace incandescent lamps up to 75W, we found that due to lumen depreciation (up to 20% in first 2,000 hours), a CFL rated at 1,100 lumens would be a more appropriate replacement for a 75W incandescent lamp.

Bulk Procurement

In December 2004, after an international tender using competitive bidding, EVN signed a contract with OSRAM Pty. Ltd. to purchase 300,000 CFLs at a unit price of US\$ 1.07 per lamp. This is a major accomplishment, since the CFLs meet international technical standards and will be under warranty for 15 months. They are also *approximately US\$ 1.50 per lamp less expensive than EVN had projected in its program budget.* The low procurement price means that EVN will not have to sell the lamps at a subsidy in order to stimulate consumer interest.

EVN decided to use the savings from its first procurement to conduct a second procurement. In early 2006, EVN completed another round of international competitive bidding, with OSRAM Pty Ltd. again the winner, with a delivered price of just under US\$ 1.00 per CFL.

⁵ The Efficient Lighting Initiative (ELI) Voluntary Technical Specifications for Compact Fluorescent Lamps (revision 10 July 2002). For more information, see www.efficientlighting.net.

⁶ Argentina, Czech Republic, Hungary, Latvia, Peru, Philippines, and South Africa.

Lamp Distribution

A unique feature of this program is the use of Vietnam's utility network and political structure to distribute the CFLs. After the lamps are purchased, a sample undergoes quality testing to meet the ELI standards. Once the lamps pass the quality test, distribution can begin, but the sample stays at the test laboratory for lumen maintenance testing, to ensure that the lamps retain at least 80% of their light output over the first 200 hours.

The CFLs are distributed through a regional power company (PC), to a provincial and then district power company. In the Phase 1 program (300,000 CFLs), the lamps were distributed to medium and large-size provincial towns, in order to have quick distribution to deal with a power shortfall.

In the second phase (700,000 CFLs), the lamps will be distributed through the local political entities known as communes. There will be more than 500 communes involved in the program. Each Commune Retailing Group will have a distribution service contract with its Provincial PC to cover program administration costs – e.g., distribution of promotional materials, sale and distribution of lamps, collection of payments, service of warranties, etc.

Typically, each District PC (working on behalf of its Provincial PC) will have to develop and manage approximately 5-10 contracts with Commune Retailing Groups in its service territory. EVN and the PCs will need to develop a standard contract that can be used as the basis for the distribution contracts.

The Need to Build Up Market Channels

Once EVN decided to use the bulk procurement, they then considered options for procuring multiple sizes (e.g., 75W and 60W equivalents) from multiple manufacturers). However, they concluded that such a multi-package procurement would have several drawbacks. First, standard EVN and World Bank equipment procurement procedures do not allow for more than one “winner” on a bid, and to establish such a scheme would require significant time input and creativity. Second, procurement of two, or possibly four, lots (e.g., 2 lamp sizes from 2 suppliers) would complicate the distribution efforts, since the CFLs have to be distributed to ports in three regions in Vietnam (North, Central, and South) and would also reduce the economies of scale of a single large procurement.

Although EVN is confident that this seemingly complicated distribution scheme can deliver CFLs to rural customers (communes distribute many kinds of products and goods, including micro-credit), they realize that the current, single-supplier bulk purchase scheme, because of its lack of flexibility, is not a long-term solution to building up the market for production/import, distribution, and purchase of CFLs.

Initial Program Results

The first batch of 300,000 CFLs began in November 2005, and was expected to be completed in three months. As of March 2006, more than 200,000 of the lamps had been sold, and EVN was adjusting its promotion and distribution (to include more cities) to accelerate the sale of the final lamps.

Next Steps

EVN has procured its second large batch of 700,000 CFLs, and the lamps arrived in Vietnam during March and April 2006 for quality testing. EVN will distribute the CFLs to rural households as mentioned above at a price that is significantly discounted compared to local market prices.

In 2005, EVN commissioned an international consultant to review the success of CFL program marketing approaches that have been implemented in other countries (especially Sri Lanka, India, Thailand, Philippines, South Africa) (Ablaza 2006). In mid-2006, IIEC will carry out an evaluation of the initial bulk procurement program and make recommendations for the final stage of the CFL program, which will be implemented starting in late 2006 or early 2007. It is likely that this next stage of the program will use market-based program approaches similar to those used in the Bangalore program, involving certification of multiple suppliers, price competition to ensure a lower price for consumers, and a supplier warranty of at least one year. The goal is to design a program that will help build up long-term market channels and sales of CFLs.

Conclusions and Lessons Learned for the Future

The lessons from recent CFL programs in Sri Lanka and Bangalore – which use a utility-bill-payback scheme, along with a supplier guarantee for the CFL – indicate that such programs can be effective at stimulating consumer purchase of CFLs. In addition, by allowing multiple suppliers to participate in the program, there can be a significant spillover effect: in the Sri Lanka program, for example, the number of CFL programs sold directly through retailers was three times as high as the number of CFLs sold through the utility-bill-payback scheme. In other words, each CFL sale in the utility program (with payback through the customer's bill) successfully leveraged three CFL sales in the private market (with all payment by consumer upon purchase). The Sri Lanka approach has been refined and is now being applied by Bangalore Electric Supply Company (BESCOM) in India, with features that include pre-qualification of suppliers; supplier warranty; customer payback through their utility bills; joint utility-supplier marketing efforts; and initial cost of CFLs covered by suppliers, with payback made by BESCOM after they receive consumer payments through the billing system.

Initially, the Vietnamese utility (EVN) considered a more market-based scheme for the program design, but they decided on the bulk procurement method due to their desire to target rural householders for the program, and their concern that if the lamps were channeled through the manufacturers, they would not be able to control where the CFLs were eventually installed. However, as the experience in Vietnam demonstrates, bulk purchase programs, while attractive in theory, have several limitations:

- first, due to World Bank procurement guidelines and procedures⁷, the procurements can target only a single manufacturer and, perhaps (as is the case in Vietnam) a single lamp size;

⁷ In the case of Vietnam, EVN was told that World Bank procurement guidelines make it very difficult to have multiple awards on one bid, or to have separate bid lots and to exclude a winning bidder from subsequent lots.

- second, the utilities or program sponsors have to be involved in all aspects of procurement, distribution, and retail, and all of this entails a lot of work compared to a model that relies on multiple suppliers to sell CFLs through their own distribution and retail channels; and
- finally, while bulk procurement can help the utility get a very good price, it actually works against development and strengthening of CFL market channels, since it involves only a single manufacturer, and thus makes it hard for others to compete in the market.

EVN has researched the supplier-based approach to CFL program approaches used in Sri Lanka and Bangalore, and is considering modifications to the bulk purchase approach for the final stage of the program, which will begin in late 2006 or early 2007.

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