Précis

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High-Efficiency Lighting in Mexico

Roughly 2.6 million high-efficiency light bulbs were sold below-cost to residential consumers of electricity in two Mexican cities as part of a pilot demonstration project for high-efficiency lighting. If the project's main objective was to show how many high-efficiency light bulbs could be successfully distributed, it was well crafted. The ILUMEX project surpassed its physical targets and successfully demonstrated the technical feasibility of reducing both greenhouse gas emissions and local environmental contamination through the widespread installation of fluorescent lighting. The payback in learning about technical designs was high, but overall it failed to deliver lessons about the economic and financial design of sustainable models for the marketing of high-efficiency light bulbs, especially among poor consumers. The project designers did not ask if the model was replicable or financially sustainable.

Cutting Electricity Demand

The project was intended to demonstrate the technical and financial feasibility of reducing both greenhouse gas emissions and local environmental contamination through the widespread installation of high-efficiency lighting. The main project component was the promotional sale of about 1.7 million high-efficiency light bulbs among residential users in Guadalajara (Jalisco State) and Monterrey (Nuevo Leon State), at prices 60 percent below cost. Significant energy savings and environmental benefits were envisaged because high-efficiency lights consume 75 percent less energy than equivalent standard incandescent bulbs, and last 15 times longer. The initial residential purchase of energy-saving light bulbs was to be subsidized because households and other light consumers of energy rarely take advantage of energy-efficient technologies, even when it can save them money. Additional study objectives were to build institutional capacity for technological change and energy conservation, to provide a replicable model for managing energy demand, and to strengthen institutional capacity at CFE (Mexico's electric utility) for managing energy demand.

The ILUMEX project was co-financed by the World Bank's Global Environment Facility (GEF, which provided a grant of about $US10 million) and the Kingdom of Norway (with a grant of about $3 million).

Project Outcomes

By the grant's closing date, the project slightly surpassed the original target of 1.7 million fluorescent light bulbs sold—and CFE continued selling them through January 31, 1999, for a total of 2.6 million sold. Project costs remained remarkably close to original estimates and sales prices went up, so the average subsidy was only 49 percent—not 60 percent—of the bulb's cost. The energy savings and reduced CO_2 emissions were in line with initial estimates, but savings in power capacity (because reduced power consumption delays the need to invest in new capacity) were only one-third the initial estimates.

Moreover, the project lost its original focus on poor consumers because sales were slow among low-consumption households. (Overall, 9.6 percent of sales were to low-consumption households, 31.3 percent to intermediate users, and 59.2 percent to households consuming a lot of electricity.) Concerns about sales also led to increasing to 10 the original limit of 6 light bulbs per household, and expanding marketing efforts to the cities' entire metropolitan areas.

The program did not fulfill its expectations of promoting the sale of high-efficiency light bulbs to other consumers. The project did not systematically collect information to estimate its "free-driver effect" (the increase in fluorescent light bulb sales that could be attributed to the demonstration effect), but the staff of the project implementation unit suggest (partly on the basis of anecdotal evidence) that (1) during the project's life, retail sales to households actually declined because of competition from the project (and the expectation that subsidized sales would be extended to other cities); (2) some people transferred their home experience to the workplace, thereby increasing demand among services, commerce, and industry; (3) there were no retail price reductions; and (4) by project's end, more retailers stocked and displayed fluorescent light bulbs.

Based solely on energy savings, the project had an acceptable economic rate of return. The rate was significantly lower than projected at appraisal because of the overestimate of capacity savings, but if local and global environmental benefits were factored in, it could increase substantially. The distribution analysis (without environmental benefits) shows that all gains went to participant households. Those gains exceeded the appraisal estimate because the marginal electricity tariffs to high-consumption households were two to three times higher than the utility's marginal costs. CFE lost profits, mostly through electricity sales forgone, but CFE's financial losses were reduced by partial coverage of project costs by grants from the GEF and Norway.

Internationally, the project compares well with similar initiatives in terms of number of light bulbs distributed, unit cost, and level of subsidy. But the project design and implementation never addressed the issue of sustainability of sales in the long term, in the absence of subsidies. Whether fluorescent light bulbs will continue to be used after the project ends remains unknown.

The project ultimately managed to deliver more than 2.6 million fluorescent light bulbs at more reasonable unit prices than in similar projects elsewhere—a considerable achievement for a project this size. The project audit concludes that the project succeeded in demonstrating the technical feasibility of reducing both greenhouse gas emissions and local environmental contamination through the widespread installation of high-efficiency lighting, but it failed

The Project Compared with Other Similar Initiatives

Country/ project origin	Project design	Number of FLs delivered	Cost per FL (US$)		
			For the buyer	For the project	Total
Mexico (GEF)	Subsidy to consumers	1,712,361	7.1	6.8	13.1
Poland (GEF)	Subsidy to manufacturers	1,600,000	9.0	3.2	12.2
Jamaica (GEF)	Subsidy to consumers	85,000	5.8	6.8	12.6
Thailand (GEF)	Bulk purchases	1,500,000	9.0	2.9	11.9
Brazil	Give-away	89,000	—	8.3	8.3
Denmark	Small subsidy plus quality control programs	1,000,000	11.0	4.4	14.4
U.K. 1	Subsidy to consumers	3,000,000	12.4	1.8	14.2
U.K. 2	Give-away	814,000	—	11.3	11.3
Peru	Publicity campaign, no subsidies	400,000	20.0	16.8	36.8
U.S. (several)	Subsidy to consumers		Rebates between 20% and 50% of retail prices	Usually none Paid out of a surcharge on electricity bills	

Source: E. Martinot and N. Borg (1998) "Energy-Efficient Lightning Programs. Experience and Lessons from Eight Countries."

to demonstrate the endeavor's financial feasibility and contributed only modestly to building the institutional capacity for technological change, energy conservation, and demand-side management (the promotion of energy-saving devices) at CFE, the electric utility.

Therefore the project's audit ratings were marginally satisfactory for outcome, modest for impact on institutional development, and uncertain for sustainability.

Lessons Learned

Despite its shortcomings, this pilot demonstration project pioneered a new and increasingly important field for the borrower, the Bank, the GEF, and the development community at large. It also provided several important lessons:

It is important to build into the design of demonstration projects ways to consider whether the project is replicable and sustainable. For any pilot demonstration project, and more so for a GEF grant, central questions to be addressed include whether the project is replicable, whether its outcomes are sustainable, in the long term, in the absence of subsidies, and what lessons can be learned from it. Project design should explicitly spell out the strategy, activities, resources, and monitoring committed to answering these questions. Sticking to and meeting a physical target is important, but not sufficient. By definition a pilot project is a small-scale endeavor that is not expected to make a large difference on the ground until it is replicated and the lessons learned from it can be applied.

Well-planned implementation is central to project performance. The project's implementation scheme—based on decentralized project implementation units and the establishment of independent trust funds with BANOBRAS (the National Bank of Public Works and Services)—was very successful. It gave Mexico's utility oversight of the project while ensuring a smooth flow of funds to the project implementation units.

Bulk procurement can leverage funding. As similar projects have already shown, bulk procurement of fluorescent light bulbs was an effective way to get technical improvements and significant price rebates from the light bulb manufacturers.

Assessing If a Pilot Demonstration Project Is Sustainable and Replicable

The ILUMEX project was the first of its kind in the Bank and Global Environment Facility portfolios. Assessing its outcome elicited a lively discussion among Bank staff. No one disputes the project's achievement in terms of light bulbs distributed, but views differ about whether the project was sustainable or replicable and what lessons could be learned from it. Among various conflicting positions argued at the Bank were the following.

Any project with a large subsidy component is unsustainable and difficult to replicate. Few will contest that some activities—such as elementary school and primary health care—are regularly subsidized, and subsidies would be one way to pay for positive environmental externalities (such as CO_2 abatements). The problem with ILUMEX was not the presence of a subsidy but that nobody ever asked, "Why is this level of subsidy necessary?" or "How will fluorescent light bulbs be marketed following the end of the subsidies?" When the actual subsidy went from 60 percent to 49 percent, for example, the project did not discuss whether the appropriate level of subsidy would be 60 percent, 49 percent, or 24 percent (as in the follow-up program). Among the many studies required by the Bank, not a single one asked for an analysis of alternative ways to finance the future distribution of light bulbs (for example, a surcharge on the price of electricity, selling CO_2 abatements, an environmental investment fund, or term sales at full price).

Another position was that sustainability was outside the project's reach because it depended on Mexico's willingness to raise electricity rates. *There is no basis for this argument.* Between 1995 and 1997, the relevant marginal price of electricity per kilowatt hour (the amount paid by households) was two to three times the utility's marginal cost, and growing. With kilowatt hours priced so high, households will gain so much in energy savings that the project is highly beneficial, and it should be easy in the future to make households pay full price for the fluorescent light bulbs.

Financial gains to households should not be construed as project economic gains because most of these gains are mere transfer payments from CFE and the donors. And it may be true that households will pay full price for fluorescent light bulbs in the future. However, the project design was based on the assumption that households are reluctant to do so, and the project results provide no clues to challenge that assumption.

The pilot project is justified because it is the first project in a new area, and there is much to learn. *This is precisely where the shortcomings of the ILUMEX project are evident. Its payback in learning about technical designs* (for example, about procurement, lamp specifications, opportunities for greenhouse gas verification, and activities implemented jointly) *was high. But by and large it failed to deliver lessons about the long-term financial sustainability of high-efficiency lighting projects.*

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