The GEF Energy-Efficient Product Portfolio: Emerging Experience and Lessons

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The authors take full responsibility for any errors or omissions that may appear in the report.

List of Acronyms

CFL	compact fluorescent lamp
DIW	Thai Department of Industrial Works
DSM	demand-side management
EBRD	European Bank for Reconstruction and Development
EGAT	Electricity Generation Authority of Thailand
ELI	Efficient Lighting Initiative
ESCO	energy services company
EU	European Union
GEF	Global Environment Facility
GWh	gigawatt-hour
HEECP	Hungarian Energy Efficiency Co-financing Program
IDB	Inter-American Development Bank
IEA	International Energy Agency
IFC	International Finance Corporation
IFCT	Industrial Finance Corporation of Thailand
M&E	monitoring and evaluation
NGO	non-governmental organization
ODA	Overseas Development Assistance
PELP	Poland Efficient Lighting Project
SME	Small and Medium-sized Enterprise
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
USAID	United States Agency for International Development
USDOE	United States Department of Energy

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Executive Summary

From 1991 to 2000, the GEF approved eight projects designed to stimulate markets for energy-efficient products—lights, refrigerators, industrial boilers, and building chillers—in 12 developing and transitional countries. Project costs for this portfolio are about half a billion dollars, with GEF contributions of over $90 million leveraging additional co-financing of $430 million from other sources. Many of these projects take so-called "market transformation" approaches, which gained favor in developed countries in the 1990s. In general, market transformation programs aim to change market structure or function through both "supply push" and "demand pull" in order to sustainably increase the adoption of energy-efficient products, services, and practices.

The GEF projects reviewed in this report use a combination of approaches to remove supply-side and demand-side barriers to markets for energy-efficient products. Supply-side strategies include providing technical assistance and know-how transfer to manufacturers to upgrade their product designs, supporting minimum efficiency standards and regulatory mechanisms, facilitating voluntary agreements with manufacturers and distributors, piloting new distribution mechanisms through retailers or electric utilities, providing financial incentives to producers, providing quality testing, and providing financing for manufacturing upgrades. Demand-side strategies include educating consumers and professionals about the characteristics, costs, and benefits of the energy-efficient technology; running media campaigns to increase consumer awareness; reducing retail prices of technology through rebates, subsidies, or bulk purchases; providing consumer financing; and offering buy-back/recycling programs.

One of the most recent projects, the IFC/GEF Efficient Lighting Initiative, has developed a "toolkit" of market transformation approaches, including public education, standards and labeling, electric utility programs, financing mechanisms, targeted subsidies, and market aggregation. Project teams in seven countries conducted detailed market research to apply and tailor the toolkit to national circumstances. During project execution, extensive monitoring and evaluation and management reporting will allow the project to dynamically adapt to changes in market circumstances.

Individual projects in the portfolio suggest many lessons for future project design and implementation. For example, the Mexico lighting project suggests that (1) DSM programs can deliver a large number of compact fluorescent lamps (CFLs); (2) distribution through utility offices and consumer on-the-bill credit is feasible; (3) bulk procurement can lower retail costs; and (4) large programs can spur replication by attracting the attention of policymakers and utility managers. The Thailand DSM project suggests that (1) voluntary agreements with suppliers can be highly effective; (2) well-designed and extensive marketing can achieve significant energy savings at relatively low costs; and (3) appliance labeling can achieve large market shifts when done properly. The Thailand project also offers many instructive lessons on how to design utility DSM programs.

Programs oriented towards the private sector, such as the Poland efficient lighting project, have also been effective at transforming markets. That project demonstrated that educational and labeling campaigns with a single and straightforward message could significantly increase demand for efficient lighting. It also demonstrated high leverage in using subsidies to reduce retail prices. Through competitively selected agreements with manufacturers, GEF subsidies of $2.6 million leveraged total retail price reductions worth $7.2 million on 1.2 million CFLs.

The China efficient refrigerators and efficient boilers projects, although in early phases of implementation, are suggesting lessons related to technical assistance and know-how transfer to domestic manufacturers. In the efficient boilers project, the technology transfer process was slowed by technical incompatibilities, insufficient budgeted resources, and lengthy license procurement due to lack of bidder response. The efficient refrigerators project suggests that technical

know-how transfer through study tours and other exchanges between Chinese manufacturers and foreign manufacturers are not feasible because of foreign manufacturers' competitiveness concerns.

Project impacts from the portfolio are becoming significant. Three projects in Thailand, Mexico, and Poland have resulted in installation of more than 4.6 million CFLs and annual electricity savings of at least 3,500 GWh. Sustained retail price reductions in the CFL markets in those three countries of 30–35 percent were also achieved. The Thailand project resulted in the compete transformation of the fluorescent-light market, representing 20 million lights sold annually; market share of the more efficient lights went from 40 to 100 percent during the project. In Poland, the share of households with CFLs increased from 12 to 20 percent. In Thailand, the market share of efficient refrigerators went from 12 to 96 percent, and the share of efficient air conditioners went from 19 to 38 percent. Large changes in consumer awareness and understanding have accompanied these projects.

New institutions and regulatory changes are also important project outcomes. In Thailand, a demand-side management office was created within the national utility; that office successfully negotiated voluntary agreements with the private sector, conducted bulk procurement and distribution of CFLs, promoted public awareness, and instituted appliance labeling, among many other achievements. In Mexico, new DSM programs have been established since the original GEF project and new CFL standards enacted. In China, new energy-efficiency standards for refrigerators were enacted.

Market impacts appeared even before formal project implementation in at least three GEF projects. Increased expectations of future markets for efficient products, heightened awareness of energy savings potential, and greater understanding of market transformation approaches can be enough by themselves to affect markets. It appears that early project preparation activities and GEF's commitment to undertake such projects have encouraged market players to believe that that increased investment and publicity will occur, motivating them to increase their market presence, develop prototypes, and act to position their products to take advantage of the project. For example, early in the China efficient refrigerators project, one Chinese refrigerator manufacturer said that "because of the GEF project, we have seen increased pressure on the market for efficient refrigerators and we are already responding." New product standards were also a factor, arising in part from earlier bilateral donor assistance.

Evidence is emerging that the market changes brought about by GEF-supported efficient-products projects are sustainable. For example, retail price reductions for CFLs have been sustained after projects completed. High-efficiency refrigerators and florescent lights are now the norm in Thailand, and the units with the highest level of efficiency for these products dominate the market. In fact, surveys show that a variety of energy-efficient appliances promoted through the Thailand project have sustained markets, although some programs, like the labeling program for air conditioners, appear to have been less effective at achieving sustainable changes. Sustainability is difficult to assess in some projects because of the lack of established baselines and surveys of non-participants.

Experience from GEF market transformation projects is catalyzing similar activities locally and in other countries. The three completed projects in the portfolio are all being replicated in some form. The clearest example of replication is in Mexico, where the original GEF-supported utility DSM program led to further energy efficiency programs for lighting, with almost five million additional CFLs sold, as well as to programs for building insulation and air conditioning. The seven-country Efficient Lighting Initiative was developed in response to requests from countries that had heard of the Poland lighting project. And Sri Lanka and Vietnam are incorporating lessons from the Thailand DSM project into their own programs.

An analysis of market indicators shows that the GEF's market transformation programs have indeed managed to transform markets for energy-efficient products, and in so doing, have already achieved significant CO2 emissions reductions or are demonstrating highly cost-effective potentials for doing so—down to less than $1 per ton of carbon. Changes in private sector markets for lights, refrigerators, air conditioners, and building chillers offer large potential for energy savings. Less potential may exist now for DSM programs as utilities continue to privatize and lose public-interest mandates or oversight. However, experience suggests that even private utilities can be willing and interested partners in market transformation programs in some national contexts. Projects that attempt technical assistance and know-how transfer

to manufacturers may face difficult hurdles but are still worthwhile. Overall, it is very clear that the GEF can and should continue to conduct market transformation approaches.

We recommend eight principles for designers of future projects: (1) make sure to target both supply and demand sides of a market; (2) take a holistic view of the market by carefully examining all stages of the supply and demand chain; (3) leverage competitive market forces whenever possible; (4) build flexibility into program design so that program activities can respond effectively and rapidly to changing market dynamics; (5) carefully consider what vehicles for technical assistance and technical know-how transfer will be workable; (6) emphasize on standards, labeling, and building codes; (7) allocate a portion of the program's budget for activities that support replication and the dissemination of results; and (8) begin monitoring and evaluation early to measure pre-program baselines.

Well-designed market transformation programs depend on "market-based" thinking, which is not usually part of the traditional toolset of the engineers and economists who design energy efficiency programs. As a result, certain design strategies and program tools can be overlooked. A program team should consider hiring staff or consultants with experience in marketing, public relations, finance, and business planning. Market research takes on particular importance in a market transformation program.

1. Introduction

From 1991 to 2000, the GEF approved eight projects designed to promote markets for energy-efficient products—lights, refrigerators, industrial boilers, and building chillers (see Table 1). Total project costs for this portfolio are about $520 million, with GEF contributions totaling $90 million and additional co-financing of $430 million from other sources. The portfolio includes activities in Asia (China, Philippines, and Thailand), Latin America (Argentina, Mexico, and Peru), Eastern Europe (Czech Republic, Hungary, Latvia, and Poland), and Africa (South Africa). Five of the eight projects are partially or exclusively lighting projects.[1] Two projects are intended to spur technology innovation for more efficient designs by domestic manufacturers (China industrial boilers and refrigerators), one project helps domestic manufacturers improve product quality (China lighting), and almost all seek to accelerate diffusion of technologies that already exists in these markets. Four of the projects are implemented by the World Bank, two by the International Finance Corporation (IFC), and two by the UN Development Programme.[2]

Many of these projects have similarities to the so-called "market transformation" approaches that gained favor in developed countries in the 1990s. In general, market transformation programs make strategic efforts to intervene in particular markets to cause beneficial, lasting changes in the structure or function of the market—on both the supply and demand sides. These changes should in turn lead to sustained increases in the adoption of energy efficiency products, services, and practices (see Annex A for a brief review of global experience with market transformation). The similarity between the GEF energy efficiency program and market transformation approaches is no coincidence. When the GEF adopted long-term operational programs in 1997, a wide variety of so-called "barrier-removal" activities were designated as legitimate "incremental costs" for the GEF.[3] Existing thinking about market transformation programs contributed to the design of GEF's energy efficiency program and barrier-removal approaches. Even projects designed before 1997 have had market transformation goals and impacts.

The term "market transformation" first appeared in the energy efficiency literature around 1990. Analysts of electric utilities' demand-side management (DSM) programs observed that certain DSM programs were producing *sustained* changes in the marketplace that persisted beyond the programs' ends. For example, the Bonneville Power Administration, a public utility in the United States, discovered that its 4-year incentive program to replace inefficient streetlights had captured so much of the Northwest U.S. market that private distributors no longer even stocked inefficient fixtures. From its early roots, market transformation blossomed into an energy efficiency approach widely sanctioned as effective and low-cost. In fact, market

[1] One may well ask why so many of the GEF projects have promoted energy-efficient lighting, and particularly, CFLs. There are several answers to this question. CFLs offer very high level of savings – they reduce energy consumption by 75-80%. As lighting use is often peak-coincident, utilities facing peak capacity constraints appreciate the kW reduction benefits of CFLs. Lighting is a service used by all electrified homes, and the potential for increasing CFL usage in GEF client countries remains high.

[2] The IFC is the private-sector affiliate of the World Bank Group.

[3] See Martinot and McDoom (2000) for a description of the GEF energy efficiency program and incremental costs.

Table 1: GEF Efficient-Products Portfolio (as of 2001)

Project (date approved by GEF Council)	Implementing Agency & Budget (US$)	Description
Mexico High Efficiency Lighting Pilot (1991)	World Bank $10 million GEF $23 million total	Pilot a utility DSM program to sell CFLs to residential consumers
Thailand Promotion of Electricity Energy Efficiency (1991)	World Bank $9.5 million GEF $190 million total	Conduct a 5-year utility DSM program by the national electric utility responsible for power generation (EGAT); pilot different market intervention strategies that demonstrate on a large scale the potential for electric efficiency
Poland Efficient Lighting Project (1994)	IFC $5 million GEF $5 million total	Stimulate the national market for energy-efficient lighting in Poland, particularly for CFLs
China Efficient Industrial Boilers (1996)	World Bank $33 million GEF $101 million total	Develop affordable, energy-efficient, and cleaner industrial boiler designs; mass produce and market these designs; and disseminate more energy-efficient and cleaner boiler technologies throughout China
China Barrier Removal for the Widespread Commercialization of Energy-Efficient CFC-Free Refrigerators (1998)	UNDP $9.9 million GEF $41 million total	Assist a selected group of Chinese refrigerator manufacturers to design, produce, and market efficient refrigerator models, and provide consumer education, marketing, incentives, and product labeling to stimulate demand for efficient models
Multicountry Efficient Lighting Initiative (1998)	IFC $15 million GEF $50 million total	Promote market expansion for energy-efficient lighting in Argentina, Czech Republic, Hungary, Latvia, Peru, Philippines, and South Africa
Thailand Building Chiller Replacement Program (1998)	World Bank $2.5 million GEF $5 million total	Remove barriers to widespread replacement of low-energy efficiency chillers with new, high-efficiency, non-CFC chillers
China Barrier Removal for Efficient Lighting Products and Systems (2000)	UNDP $8.1 million GEF $26 million total	Promote efficient lighting by assisting Chinese manufacturers to upgrade designs of lighting products, educating consumers, lowering costs, and conducting market promotion activities

transformation is now a widely accepted energy efficiency policy in Europe, North America, and Australia, and among international organizations such as the International Energy Agency (IEA).[4]

In developing countries, market transformation programs have made some inroads, but not on the scale found in developed countries. Countries with notable programs beyond those supported by the GEF include Brazil, China, Philippines, South Africa, and Thailand. Still, GEF support for efficient products has represented a significant share of market transformation efforts in developing countries, with other support coming from country governments, bilateral donors, and foundations.

By 2000, enough experience and emerging lessons from the GEF portfolio had accumulated that the GEF Secretariat decided to review and assess that experience.[5] Research conducted in 2000 and 2001 by the authors is summarized in this report.[6] We first review GEF project designs and approaches, then analyze the emerging experience from each individual project and the project-specific lessons suggested by that experience. Based on individual project experience, we assess overall portfolio impacts and describe how project impacts are being sustained and project designs are being replicated. Finally, we attempt a synthesis of overall lessons and implications for future GEF strategies. Given the global interest in market transformation, GEF approaches and experience from its portfolio of efficient-products projects should help to inform effective global progress with energy-efficient products, as well as further GEF projects and strategies.

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[4] In particular, the UK has established a Market Transformation Program under the Department of the Environment, Transport, and the Regions, Australia's response to climate change includes market transformation efforts on energy-efficient motors and lighting, and the IEA supports a Market Transformation Working Group.

[5] This review was conducted as part of a larger effort to assess the entire climate change portfolio, which took place during 2000-2001; see GEF (2002). The authors did not review experience from the most recent addition to the portfolio, the China efficient lighting project, because that project had not yet started implementation at the time of the study; see GEF (2001b).

[6] Research sources included interviews with project managers and stakeholders, country visits to China, Mexico, Poland, and Thailand, GEF project documents (available at www.gefweb.org), unpublished project supervision and completion reports by the GEF implementing agencies, and published literature (see the list of references at the end of the report and individual citations throughout).

2. Project Designs and Approaches

An effective market transformation program acts as a catalyst to enhance existing market forces. It typically provides both "supply push" and "demand pull" for a particular technology. Market research, information, technology promotion, and technical assistance can all boost market demand for more efficient products while simultaneously increasing the willingness of suppliers to produce them. Technical and marketing assistance to manufacturers can help them overcome the one-time costs of converting to production and sales of more efficient products. Simultaneously addressing both supply and demand is often necessary to jump-start "stuck" markets, which occur when producers are unwilling to produce efficient products because no established market exists while consumers are not demanding these products because they are not produced or marketed.

The principal approaches to transform markets for energy efficiency goods, services, and practices around the world are well known. Many market transformation programs consist of combinations of these approaches:

- Regulated product standards or product labeling
- Regulated building codes (for performance or materials)
- Public procurement
- Public financing
- Financial incentives (i.e., reduced taxes or rebates)
- Voluntary agreements by the private sector
- Information and marketing.

Standards and labels, in particular, have been advocated by many as the cornerstone of a balanced portfolio of energy efficiency programs. When designed well, they can produce large energy savings, are hugely cost-effective, and are a very effective way to limit energy growth without limiting economic growth. Furthermore, their benefits are relatively simple to quantify, they require modified behavior from a manageable number of manufacturers rather than the total consuming public, and the resulting savings are generally assured, comparatively simple to quantify, and easily verifiable (Wiel et al. 2001). Revising building codes is another approach that has a large potential in developing countries.[7]

The designs of GEF's energy-efficient products projects incorporate many elements of market transformation approaches, such as:[8]

- Market transformation activities are devised in direct response to identified market barriers. One can't design an effective market transformation program without first understanding the barriers or problems the program is intended to address.

- Sustainability is built into the program design from the start. Instead of saving energy building by building or product by product, a successful market transformation approach changes the entire market, so that efficient products become the norm and no longer require incentives.

[7] The GEF has one project for energy-efficient building codes, in Senegal and Côte d'Ivoire, which is not covered in this report. See Martinot and McDoom (2000).

[8] See Nadel and Latham 1998 and Nadel and Geller 1996.

• Market transformation establishes new products, services, or practices within existing market frameworks that can support the new products or services. This is consistent with GEF principles of incrementality and replication.

• Market transformation programs leverage private capital and ingenuity—and competitive market forces—to improve the efficiency of energy-using products. This is consistent with the GEF's goal of leveraging its funds to maximize cost effectiveness.

• Because many stakeholders can influence a market, market transformation programs emphasize partnerships between government, the private sector, NGOs, and other stakeholders, an approach consistent with GEF's goal to maximize stakeholder participation.

GEF projects use differing approaches to remove supply-side and demand-side barriers to markets for energy-efficient products. Tables 2 and 3 provide a topology of the market transformation approaches used in the GEF portfolio, separated according to supply-side and demand-side approaches. The following sections list each approach, and illustrate how the projects apply them.

Supply-Side Approaches

The main supply-side approaches found in projects include:

(a) Provide technical assistance and technical know-how transfer to manufacturers to upgrade their product designs or improve quality; provide assistance in improving business strategies. In order to introduce more efficient technology, the China industrial boilers project provides technical know-how transfer and technical assistance to nine competitively selected boiler manufacturers to allow them to develop high-efficiency boiler models. Similarly, the China refrigerators project provides technical assistance and training for compressor and refrigerator manufacturers to produce more efficient designs. Targeting compressor manufacturers is especially important, because virtually all Chinese refrigerators use Chinese-produced compressors, and compressor designs are less efficient than they could be. The project features specific incentives for these manufacturers to modify their product designs and convert production lines. In both projects, the actual costs of conversion are financed from commercial or government sources arranged as part of the project. The China lighting project surveys raw material and component input quality problems among manufacturers, assists with mitigating such problems, and conducts manufacturing technology retrofit demonstrations.

(b) Support development of minimum efficiency standards and regulatory mechanisms. Minimum efficiency standards help remove the least efficient products from the market, and "push" manufacturers to retool to provide more efficient products. The China projects for refrigerators, industrial boilers, and lighting all allocate funds for developing minimum energy efficiency standards. The China lighting project also develops design standards for six categories of buildings to assist architects with efficient lighting designs. The Thailand DSM project has also developed efficiency standards for selected equipment. The Thai government will consider the experience of the Thailand chillers project in its planned revision of chiller performance standards.

(c) Facilitate voluntary agreements with manufacturers, dealers, and distributors. An excellent example of market transformation comes from the Thai DSM program, where a neutral third party acted as an "honest broker" to facilitate change in the marketplace. The Thai fluorescent lighting market was dominated by less efficient, thick (T-12) fluorescent tubes. Manufacturers were hesitant to produce the thinner, more efficient (T-8) tubes because of a popular perception that the thick tubes produced more light. EGAT negotiated a voluntary agreement with all five Thai manufacturers and the sole importer of T-12 fluorescent tubes to switch from producing and importing T-12 tubes to T-8 tubes. In exchange for their commitments, EGAT offered a large-scale advertising campaign for the thin tubes. As a result, the Thai market was completely "washed" free of the less efficient (T-12) technology.

(d) Pilot new distribution mechanisms through retailers, dealers, or electric utilities. In the Mexico lighting project, the electric utility distributed CFLs through utility offices. In cooperation with the program, certain private companies offered their employees the opportunity to make installment payments on a CFL purchase through a monthly paycheck deduction. The Thailand DSM project introduced lamp distribution through a chain of 7-11 convenience stores, a new distribution mechanism in that market. In Latvia, the Efficient Lighting Initiative is running a pilot CFL program in which municipalities distribute lamps to their citizens.

Table 2: Supply-Side Market Transformation Approaches

	Mexico lighting	Thailand DSM	Poland lighting	China industrial boilers	China refrig-erators	Multi-country lighting	Thailand building chillers	China lighting
(a) Technical assistance and technical know-how transfer				yes	yes		yes	yes
(b) Development of standards and regulatory mechanisms		yes		yes	yes		yes	yes
(c) Voluntary agreements by private sector		yes	yes					
(d) Incentives for producers and dealers		yes			yes			
(e) New distribution mechanisms	yes	yes	yes			yes		
(f) Quality testing		yes	yes			yes	yes	yes
(g) Financing for manufacturing upgrades				yes	yes			

Table 3: Demand-Side Market Transformation Approaches

	Mexico lighting	Thailand DSM	Poland lighting	China industrial boilers	China refrig-erators	Multi-country lighting	Thailand building chillers	China lighting
(a) Consumer education	yes	yes	yes	yes	yes	yes	yes	yes
(b) Media campaigns to increase awareness among consumers	yes	yes	yes		yes	yes		yes
(c) Professional education		yes	yes	yes		yes	yes	yes
(d) Retail price decreases (subsidies, rebates, etc.)	yes	yes	yes					
(e) Bulk purchases or procurement by public agencies	yes	yes	yes			yes		yes
(f) Consumer financing (through banks, utility bills, etc.)	yes	yes	yes			yes	yes	yes
(g) Buy-back/recycling programs					yes			

(e) Provide financial incentives to producers and dealers. Two programs offer financial incentives to dealers to encourage them to actively stock and sell more efficient refrigerators: the China refrigerators project and the Thailand DSM program, which used dealer incentives in an effort to spur sales of high-efficiency air conditioners. The China refrigerators project also provides financial incentives to producers, in the form of a design competition with a one-million Yuan prize (equivalent to US$150,000) awarded to the producer with the best efficient-refrigerator design (similar to the "Golden Carrot" refrigerator program in the United States).

(f) Provide quality testing. Perceived and actual problems with quality can be a strong deterrent to the purchase of an energy-efficient technology. When a new technology is introduced to a market, there is often a perception that "it won't work here." Contemporary CFL markets in particular have products of widely varying quality. Quality testing is one way to overcome misperceptions and provide consumers with credible quality information. For example, the Thailand DSM project has established test procedures and provides testing capabilities and efficiency certification for selected equipment types, including fluorescent tube lamps and refrigerators. The Thailand chillers project dispels perceived risk by providing a performance guarantee for each chiller that is backed up by independent on-site testing. The Poland lighting project conducted random testing of CFLs to ensure that off-the-shelf products lived up to the quality commitments made by manufacturers. The Efficient Lighting Initiative has developed quality specifications for a range of lighting products, including CFLs and ballasts; the initiative will only promote products that meet these quality criteria and will randomly test off-the-shelf products in all seven participating countries. The China lighting project assists national test laboratories to improve their procedures and ensure testing consistency among laboratories; it also provides a product certification program.

(g) Provide financing for manufacturing upgrades. Both the China refrigerators and China industrial boilers projects include commercial or government loans to manufacturers to convert production facilities for producing more efficient models. These loans are provided in conjunction with technical assistance and technical know-how transfer to design the products themselves and upgrade production facilities.

Demand-Side Approaches

The main demand-side approaches found in projects include:

(a) Educate consumers about the characteristics, costs, and benefits of the energy-efficient technology. GEF market transformation programs typically operate in markets where consumers are poorly informed about the advantages of energy-efficient products. Therefore, all programs include a consumer education component. One commonly used tool is an energy efficiency label. The Thailand DSM project supported the development of an energy efficiency label, which rates refrigerators and air conditioners on a scale from one to five. Similarly, the China refrigerators project supports a national refrigerator labeling program to educate consumers at the point of sale. Both the Poland lighting project and the Efficient Lighting Initiative take a slightly different approach. Rather than use a government-sponsored energy efficiency label, they promote a "green leaf" product logo to identify high-quality and environmentally friendly products (see Figure 1). The logo appears on all products supported by the two programs. The Poland lighting project also conducted an energy and environmental education program in primary and secondary public schools. The Efficient Lighting Initiative is running a similar program. In China, consumer education is fostered through retailer displays and other materials, product labels, a "green lights" web page, and a series of books on efficient lighting design for households and small businesses.

Figure 1: The Poland Lighting Project and Efficient Lighting Initiative "Green Leaf" Logo

(b) Run media campaigns to raise consumer awareness of energy-efficient technology and increase its mass appeal. While it's essential to raise consumer *understanding* of energy-efficient technology through educational efforts, it is also important to raise consumers' *awareness* of a technology and increase the popularity of energy-efficient products, particularly when promoting a mass-market technology such as lighting. Thus all projects in the portfolio related to consumer and commercial products contain mass-media campaigns. As part of its voluntary agreement with manufacturers to "wash the market" of T-12 lamps, the Thailand DSM program allocated $8 mil-

lion for an awareness campaign. In addition to placing ads in national media, including television, radio, and print media, EGAT gave local demonstrations in city halls and schools and organized local seminars and schoolchildren marches. The national and local elements of the campaign reinforced each other. In the Philippines, the Efficient Lighting Initiative ran a large media campaign for CFLs, featuring one of the nation's most popular comedians. The Poland lighting project relied on a media campaign to promote CFLs and develop consumer awareness of the "green leaf" logo. In the Mexico lighting project, consumer outreach was conducted primarily through utility offices, which is where most customers pay their bills.

(c) Educate professionals about the characteristics, costs, and benefits of the energy-efficient technology. Energy professionals often have little information on the benefits of energy-efficient equipment; this situation discourages them from specifying or purchasing energy-efficient equipment. As professionals such as architects and facilities managers make decisions on a daily basis about end-use equipment that is likely to be in place in 5 to 20 years, professional education is an important element in a market transformation strategy. The China industrial boilers project provides technical assistance and training for industrial enterprises to help them understand, procure, and operate the higher efficiency boilers. In Thailand, high-level seminars, to educate chiller owners about the advantages of replacing their existing equipment with high-efficiency models, have been the key to opening up the Thai chiller replacement market. The Thailand DSM program publicized pilot projects in the building sector. Both the Poland lighting project and the Efficient Lighting Initiative sponsor education events (seminars, workshops) for lighting professionals. The China lighting project educates building design professionals about efficient lighting designs and assists service firms, such as installation contractors and building maintenance firms, to develop services related to efficient lighting.

(d) and (e) Reduce retail prices of technology through rebates or subsidies and conduct bulk purchases and procurements. GEF projects to develop CFL markets have used different mechanisms to reduce retail prices. PELP and Ilumex provide per-unit subsidies for CFLs on the order of several dollars. The Thailand DSM project, Mexico efficient lighting project, China efficient lighting project, and the Efficient Lighting Initiative also substantially lower retail prices by relying on the economies of bulk purchases from manufacturers.[9] The Poland lighting project took a unique approach to subsidies by obtaining subsidy contributions from lighting manufacturers. Manufacturers competed to provide the largest guaranteed sales at the lowest project subsidy cost, providing subsidies themselves on a contractual basis that specified wholesale and retail prices. This subsidy program allowed large retail price reductions with smaller project subsidies because of the manufacturer contributions, as well as the multiplier effects of value added taxes (VATs) and retail markups. In the industrial sector, the Thailand DSM project offers rebates to purchasers of new, more efficient motors and offers free audits to encourage replacement of existing inefficient motors.

(f) Provide consumer financing. Even though energy-efficient products save money in the long run, their purchase cost is often higher than that of standard products. Financing can help overcome this "first-cost" barrier, especially in developing countries, where capital constraints are high. GEF market transformation projects provide financing to the residential sector as well as to the commercial, industrial, and public sectors. On the residential side, the Mexico lighting project enabled consumers to finance the purchase of CFLs through monthly installments on their electricity bills. The Thailand DSM program worked with local credit card companies to offer interest-free loans for the incremental cost of highest efficiency air conditioners. The Thailand chillers project supports chiller purchases through a customer loan and performance guarantee. The Poland lighting project conducted a pilot program to offer consumers small loans to pay for CFLs (although that pilot proved unsuccessful, as no one took those loans). The China lighting project pilots new financing models, such as leasing, for efficient lighting investments on behalf of utilities and lighting product manufacturers.,. The China lighting project also supports the energy service company industry in China to finance lighting projects and add efficient lighting to existing services.

(g) Offer buy-back/recycling programs. The China refrigerators project gives purchasers of efficient re-

[9] The purchase specifications included quality criteria that led to the widespread use in Mexico of lamps with increased resistance to voltage fluctuations.

frigerators the opportunity to sell their old refrigerator back to the shop where the new one was purchased for destruction and recycling. This provision was considered important because otherwise consumers might not bother to dispose of the old refrigerator. Rather, the project supposed consumers would run both the new and the old refrigerators simultaneously (perhaps keeping one in the basement), thus negating energy savings from the new purchase. (Of course, consumers have a choice, but the buy-back/recycling program encourages them to make the environmentally responsible choice.)

Efficient Lighting Initiative "Toolkit" of Market Transformation Approaches

The design of the seven-country Efficient Lighting Initiative (ELI) is perhaps the most instructive and comprehensive approach to market transformation yet seen in the GEF portfolio. Early in the project, based on the results of a detailed market assessment in each country, local implementing teams finalized program strategies, defined project activities, and allocated project resources tailored to the situation in each country. This program design process was guided by an ELI "toolkit" of five basic market transformation approaches.[10] Allocations among the five different approaches were made according to several factors: the maturity of local markets, the relative benefits to be derived by focusing on different sectors and technologies, opportunities to leverage other activities and financing, and the basic orientation, experience, and capability of the local implementers. The five basic approaches, with examples of activities defined through this process and the stakeholders who have become involved, are as follows:

Electric Utility Programs. ELI is partnering with electric utilities in South Africa, Philippines, Argentina, and Peru to promote investments in energy-efficient lighting. In South Africa, ELI is developing a modular CFL luminaire suited to newly electrified homes. ELI will help the national utility ESKOM and local distribution utilities to provide subsidized luminaires to newly electrified customers in new or existing homes. In the Philippines, utilities have committed to develop pilot CFL leasing programs in cooperation with ELI, and regulatory authorities have supported regulatory reforms introduced by ELI to further promote utility investments in efficient lighting. In Argentina and Peru, electric utilities are expanding the traditional distribution channels for efficient lighting products by selling CFLs in their payment centers.

Public Education, Marketing, Training, and Standards. Public education and marketing activities are proceeding in all seven countries. In the Philippines, ELI founded a national advisory council on energy-efficient lighting whose board includes utility CEOs and launched a high-profile advertising campaign featuring a national celebrity as the ELI spokesperson. In Argentina, educational programs in primary and secondary schools and professional university courses for architects and engineers are planned. In Hungary, ELI offers courses on energy-efficient lighting to licensed electricians (who often specify lighting equipment without have received specialized training). ELI will also form advisory committees with representatives of NGOs, government agencies, industry, and technical professions.

Financing Mechanisms. ELI leverages program funds through innovative credit structures. For example, in Latvia, ELI initiated a pilot program with municipal governments to provide no-interest financing for CFL purchases through monthly electricity bills. In Czech Republic, Hungary, Philippines, and South Africa, ELI is promoting energy service companies and other financial vehicles such as project bundling to address commercial-sector financing barriers.

Targeted Subsidies. Targeted subsidies are being considered for a CFL promotion campaign in South Africa, an electronic ballast promotion in Peru, and public lighting projects in Hungary, where the subsidies, awarded on a competitive basis to projects that meet certain goals, are expected to have a snowball effect, generating many more lighting projects. Such subsidies, used as one element of selected short-term promotions and market aggregation activities, can help support public education efforts, draw attention to efficient lighting, and overcome initial cost barriers.

[10] The "toolkit" drew upon experience from previous GEF-supported energy-efficient lighting programs in Poland, Mexico, Jamaica, and Thailand, as well as non-GEF-funded activities other countries.

Market Aggregation. ELI activities in several countries will pool together the purchasing power of large organizations, such as electric utilities in Argentina, Peru, Philippines, or South Africa, to lower prices for efficient lighting products and strengthen delivery mechanisms. In Argentina, the project has begun to work with architects and contractors so that ELI-qualified products are specified in new commercial buildings.

Project Design Lessons Suggested by ELI

1. Program designs can and should remain flexible enough to respond effectively to changing market dynamics. Countless political, economic, or technological changes can affect the implementation of a market transformation program. In response, IFC has sought to create among ELI implementers a culture that emphasizes flexibility and responsibility for results, rather than a culture that encourages strict adherence to a plan. In each country, the implementation work plan is dynamic.[11] The quarterly reporting form allows for deviations from the work plan in response to market changes. Evaluation results were designed to be quickly fed back to the program managers, enabling analysis and a rapid response. So far, these arrangements are proving viable. This flexibility comes at a price, however; it requires attentive oversight and additional project management resources.

2. Detailed market research in each country greatly helps to define effective approaches tailored to specific national circumstances. The market assessment process, which took about 6 months to complete, included stakeholder consultations as well as surveys defined by the local implementers and contracted out to local market research firms. This process increased local "ownership," and, as it tailored the program to local conditions, it should enhance an approach's effectiveness in each country.

3. The implementation team for market transformation efforts should include staff or consultants with experience in dealing with marketing and public relations firms. A good marketing and public education campaign is generally a cost-effective investment of program resources. Energy efficiency projects are often implemented by engineers who may not have marketing experience. Available technical skills should be complemented by a marketing or public relations specialist.

4. Beginning monitoring and evaluation activities early in the project can provide valuable market assessment data for implementation decisions and program design. Early start-up of monitoring and evaluation enabled the ELI evaluation team to measure market baselines before program implementation began and has afforded close coordination and feedback between M&E and implementation. For example, early on, the M&E team identified data needs for the program and collected baseline data. The baseline market data in turn allowed the implementation team to refine the program design.

[11] Indeed, the first task of implementation was to conduct a market assessment whose results would refine the program activities initially proposed in the appraisal document.

3. Emerging Experience and Lessons

Mexico High-Efficiency Lighting Project

Project Experience[12]

Under this project, the national electric utility (Comision Federal de Electricidad, or CFE) set up independent trust funds to purchase CFLs and circular fluorescent lamps and sell them directly to consumers. The utility purchased the lamps in bulk from manufacturers through a competitive procurement. This mechanism enabled the utility to purchase high-quality products at a significant discount relative to retail prices and pass those savings along to consumers. As a result of economies from bulk procurement and a utility subsidy of about $7–10 per lamp, the consumer price for a high-quality lamp was reduced to about $5–8 (compared with a market price of up to $25 or more). The procurement also allowed the utility to set specific performance criteria, which ensured high quality and allowed the utility to introduce lamps with features new to the Mexican mass market, at prices comparable to those of lower quality products.

The project took place primarily in two Mexican states, Nuevo Leon (capital: Monterrey) and Jalisco (capital: Guadalajara). The program was advertised through mass media outlets. Initially, sales were limited to the capital cities. Because of the economic crisis, sales volumes were lower than expected: Middle-income households that were willing to purchase or lease CFLs became saturated faster than predicted, and fewer low-income homes were able to participate, as they needed all available income for food. In an effort to maintain high sales, the program expanded beyond the initial two target cities. Mexicans usually pay electricity bills in CFE offices so, initially, lamps were sold only through utility offices. They were also sold at special booths placed in factories, where workers could buy the lamps and then pay for them through salary deductions. This approach was devised in response to lower-than-expected sales among low-income customers.

Customers could pay for the lamps in full or in installments through a leasing arrangement with the utility. Customers who opted to buy on credit would pay for the lamps over 2 years, in 12 bimonthly installments. The rebate was calculated so that for customers paying the tariff of 75 kWh per month, the bimonthly payments would result in a 2-year payback through savings in their electricity bill, assuming certain characteristics of customer tariff class, CFL wattage, original incandescent wattage, and hours of use. Customers with higher tariffs had a faster payback. Tariffs were modified in the course of the program, and adjusted by inflation and international energy prices, so the actual payback period varied.

Ilumex got underway in April 1995, in the midst of the worst economic depression in recent Mexican history. The economic downturn was accompanied by frequent bank repossessions on unpaid loans for homes, cars, and household appliances. This had the effect of making Mexicans hesitant to take out loans, even the modest pay-on-the-bill CFL loans offered by CFE. Initially, the project targeted low-income

[12] See GEF (1994), Sathaye et al. (1994), Friedmann et al. (1995), Martinot and Borg (1998), and Krause et al. (2001) for more published information on this project. A country visit in January 2001 contributed to this section.

[13] Personal communication, Rafael Friedman, October 2000.

consumers because of the large subsidy the utility paid for electricity sold to these consumers. However, evidence suggests that the economic situation made it difficult for the program to achieve high sales within this customer class.

CFL distributors and retailers initially feared that these new distribution methods would lead to a loss in their own market share. However, they have found that, overall, Ilumex has increased their sales (presumably because the program has led to greater awareness of the benefits of CFLs).

The Mexican utility sold 2.5 million CFLs in 2-1/2 years. This high figure is all the more remarkable given that the devaluation of the peso took place 4 months before the start of CFL sales. The initial project analysis had anticipated a load factor of 4 hours per day, but in the end, due to the increased number of lamps per home, the load factor ended up being about 3.1 hours per day. This somewhat decreased the expected CO_2 savings per lamp, but this was compensated by sales of CFLs that exceeded the 1.7 million initially targeted. The ongoing conversion of fuel-oil power plants to natural gas (to address local air pollution issues) may also have diminished CO_2 emission reduction impacts.

Although market transformation was not an explicit project goal, a great variety of CFL lamp models appeared in retail stores after completion of the project, and average CFL prices have fallen by about 30 percent. This could be interpreted as a clear indication of market transformation. An interesting question is whether the apparent market transformation would have taken place without Ilumex. The answer from all stakeholders interviewed during a January 2001 GEF mission to Mexico is that the project definitely accelerated the pace of market transformation. Changes in the market may have been taken place anyway, but would have been much slower.

Finally, it is worth mentioning that, in 1998, based on experience gained during the project, CFE and FIDE, a public/private non-profit, undertook a follow-on lighting project, without subsidies and with reduced administrative costs. Within 2 years, the FIDE project sold 4.8 million CFLs nationwide[14] in both retail outlets and CFE offices. This new project is using the same delivery mechanisms as the original GEF-supported project. A media campaign promotes CFLs in a particular city for a period of 6–9 months, during which CFLs can be bought or leased at CFE offices. After the campaign ends, CFLs will be sold only in retail outlets. CFL manufacturers plan their own advertising campaigns around the timetable and locations of FIDE's campaign. In all cities where this program is being implemented, FIDE is collecting M&E data.

Lessons Suggested by Experience

1. DSM programs can deliver a targeted number of CFLs. Ilumex proved that in a developing country context, a DSM program can achieve a high level of CFL sales. This lesson served as part of the justification for future CFL programs in developing countries, including PELP and ELI.

2. Bulk purchases by a centralized agency can lower retail costs to consumers and increase product quality. Ilumex showed that a large bulk purchase can catalyze manufacturer delivery of better or cheaper products than those currently available on the market. The Ilumex technical specifications required manufacturers to deliver CFLs equipped with an internal thermal protector that would turn the lamps off if they overheated. This feature, which did not previously exist in the Mexican market, would allow the lamps to withstand potential voltage fluctuations. Ilumex's technical specifications allowed CFE to introduce a higher quality CFL into the Mexican mass market, at prices that were competitive with lower quality models. (Sturm 2000)

3. Utility offices can serve as sales outlets for large numbers of CFLs. CFLs promoted through Ilumex were only sold through CFE offices or through dedicated shops established by CFE. These sales outlets, despite being outside typical retail channels, generated a significant sales flow (2.5 million units over 2-1/2 years) in an efficient, low-cost, and expeditious manner. This worked because most customers are used to paying their bills at CFE offices.

4. The development of institutional capacity contributed to significant replication within Mexico. FIDE, the public/private non-profit involved in the implementation of Ilumex, reports that Ilumex enhanced its institutional capacity, both in terms of

[14] The FIDE program is not active in the two Ilumex cities (Monterrey and Guadalajara).

delivering efficient lighting programs and accessing international support for DSM activities. FIDE's new lighting project, which uses the same delivery mechanism as Ilumex, sold 4.8 million CFLs during its first 2 years of implementation.[15] FIDE has also obtained IDB funds for an efficient motor project.

5. Monitoring and evaluation should be built into the program from the start. CFE did not begin to gather certain evaluation data until the last year of project implementation, and final results were not known until after the project closing date. The findings showed that the peak capacity savings from Ilumex were lower than expected. Had this problem been noticed earlier, CFE could have attempted to address it. If monitoring and evaluation are built into the program from the start, and take place in a timely manner, then such problems can be avoided.

Thailand Promotion of Electricity Energy Efficiency (Thai DSM)

Project Experience[16]

This project was a comprehensive 5-year utility DSM program by the national electric utility responsible for power generation (EGAT). The project created a new DSM office and supported that office in developing and implementing a number of different market intervention strategies for energy efficiency, including the four market transformation efforts described below. EGAT was very keen to avoid subsidy programs, and instead pursued voluntary agreements, market mechanisms, and intensive publicity and public education campaigns. The project undertook a number of important activities:

Market switching from thick (T-12) to thin (T-8) fluorescent tubes. Thin T-8 tubes use less energy and are cheaper to manufacture than thick T-12 tubes. But manufacturers were reluctant to sell them because of a common consumer perception that "a thick tube gives more light than a thin one." EGAT negotiated a voluntary agreement with all five Thai manufacturers and the sole importer of the less efficient T-12 fluorescent tubes to switch from producing and importing T-12 tubes to the more efficient T-8 tubes. In return, EGAT supported the manufacturers with an $8 million consumer information campaign, which explained that thin tubes produce more light for the money. This agreement effectively and completely eliminated the less efficient T-12 tubes from the Thai market, estimated at 20 million tubes per year. In 1994, when the program began, efficient T-8 tubes had a 40 percent market share. By the end of 1995, the efficient T-8 tubes had achieved a 100 percent market share.

Refrigerator labeling. In 1994, EGAT negotiated with manufacturers a voluntary labeling scheme for refrigerators. The scheme awards refrigerators a label rated from 1-5, with 5 indicating the most efficient model. In conjunction with the scheme, EGAT sponsored a large advertising campaign to promote the label, and partnered with the Thailand Industrial Standards Institute to test domestically available refrigerators. In 1998, the label scheme was made mandatory, and in 1999, EGAT reached an agreement with the manufacturers to increase by 20 percent the efficiency requirements for each label level. Program impacts for the labeling scheme were slower than with the fluorescent tubes, but no less dramatic. In 1994, only one single-door model and 2 percent of double-door models qualified as a Level 5. By 2000, 100 percent of single door and 60 percent of two-door models met the Level 5 requirements. The EGAT DSM office estimated that the program has contributed to a 21 percent reduction in overall refrigerator energy consumption.

Air conditioner labeling. In 1995, EGAT also sought to develop a labeling scheme for air conditioners. However, in contrast to the small number of fluorescent tube and refrigerator manufacturers, the Thai air conditioner industry is more diverse and fragmented, with over 55 different manufacturers, many of which are small, local assembly operations. And, the incremental cost for more efficient air conditioners was significant. Therefore, EGAT worked with local credit card companies to offer interest-free loans for the incremental cost of Level 5 units, and also offered rebates to shop owners who sold Level 5 models during promotional summer periods. EGAT has been unable to reach agreement with the air conditioner industry on a suitable timetable for mandatory labels or increased requirements for each level of the label scheme. Without this agreement, it is unclear how further efficiency gains or energy savings impacts can be achieved under this program.

[15] See Krause et al. (2001).

[16] See GEF (1993), Martinot and Borg (1998), Singh and Mulholland (2000), and Sulyma et al. (2000) for more published information on this project.

CFL bulk purchases. EGAT purchased CFLs in bulk and re-sold them through a distribution network of 7-11 convenience stores. EGAT tested and labeled lamps to ensure consistent quality and also paid for advertising costs. Bulk distribution and partnership with franchised retail outlets allowed substantial reduction in transaction costs. Over 900,000 CFLs were sold as of early 2000, at 40 percent below the prevailing market price.

In addition to these major activities, EGAT undertook programs targeting the following sectors or end uses as part of the project: new and existing commercial buildings, industrial facilities, small and medium enterprises (SMEs), the agricultural sector, streetlighting, high-efficiency motors, and low-loss ballasts. The programs included developing ESCOs and creating a general positive attitude towards energy efficiency.

Lessons Suggested by Experience

The lessons presented below are drawn from a recent World Bank review of the Thai DSM program by Singh and Mulholland (2000). These lessons provide useful insight into issues related to utility implementation of market transformation programs.

1. In a market where there are few suppliers and good relationships exist between the program implementer and the suppliers, voluntary agreements with suppliers can be effective. The Thailand T-12 to T-8 conversion is a successful example of market transformation, in which virtually the entire market in Thailand switched to a more efficient product in a relatively short time period. This case shows that successful voluntary negotiations and agreements with manufacturers and importers can be conducted on a comprehensive market-wide basis in a short period of time, provided that suppliers are few in number and the utility has a good relationship with the private sector.

2. Well-designed and extensive marketing can help programs achieve significant savings impacts at relatively low costs. EGAT's promotions of energy-efficient fluorescent tubes and refrigerators consisted largely of voluntary agreements with manufacturers, twinned with utility-sponsored marketing campaigns. These programs increased demand by simultaneously increasing the supply of high-efficiency products and educating consumers on the advantages of these products. This approach proved effective: Within 1 year, the fluorescent tube market underwent a complete changeover to efficient models. Impacts of the refrigerator program were slower but no less dramatic: In 1994, only one model qualified for the highest efficiency rating, but by 2000, 100 percent of single-door and 60 percent of the two-door models received the highest efficiency rating.

3. Market research points to the most effective approaches. EGAT's most effective initiatives were implemented using a Thai approach of combining manufacturer collaboration and public promotions. Local cultural aspects are also crucial to ensure high consumer acceptance and participation in such measures. It may be more useful to limit outside expertise to discrete assignments and training activities, leaving local implementation staff to design the programs based on market research as well as internally developed strategies.

4. Lack of financing can be a serious barrier for commercial and industrial programs. EGAT had limited success in its commercial and industrial sector programs, largely due to a lack of viable financing sources. Thailand's future DSM efforts, and programs elsewhere, should actively address this barrier and arrange for complementary financing programs to support industrial and commercial energy audit programs, ESCO development, and non-residential end-use programs, such as motors and chillers. Where viable financing and other programs for energy efficiency exist, such as government support for energy efficiency, clear links should be established between utility DSM programs and other government efforts to ensure adequate coordination and complementarity between initiatives.

5. Mandatory labeling has clear advantages over voluntary labels. The contrast between project results in the refrigerator program, with mandatory labels, and the air conditioner program, with voluntary labels, suggests the importance of making labels mandatory. In particular, voluntary labels are not effective as rating mechanisms, since they provide no incentives for manufacturers to label lower efficiency models.

6. DSM programs require strong management and leadership. Without the strong proactive approach taken by the second director of EGAT's DSM Office, it is unlikely that EGAT's program would have developed and grown over the years. DSM programs require strong management and marketing, to both utility

management and the public, ensuring that programs receive the support needed to meet their objectives. Utilities should also seek measures to help insulate DSM operations from periodic management changes.

7. DSM programs should initially focus on skills development and pilots before activities are scaled up. EGAT's experience demonstrates the importance of implementing programs using a phased approach, although this could have been further strengthened by timely evaluation and program redesign. It is preferable to implement pilot initiatives, and then evaluate and refine them before expanding and scaling up implementation efforts. A second advantage of this approach, in countries and utilities new to DSM, is that it allows staff to gradually build their competency and improve their program design and analysis skills.

8. DSM programs should have clearly defined objectives from the start. EGAT continually confronted competing objectives, e.g., public purpose or commercial, and EGAT management commitment to DSM wavered, particularly in the face of capacity surpluses after the 1997 financial crisis. An important lesson is that DSM objectives should be clearly defined up front and have long-term in addition to shorter term objectives to help maintain continuity in operations. These objectives should address the primary goals on which a project is focused, such issues as public purpose or commercial, load management or energy conservation, economic/environmental benefits or financial gains, sectoral priorities, etc. The priorities identified will drive how programs develop.

9. The possibility of future utility privatization should be factored into DSM program design at the start. EGAT's eventual privatization was not considered when the DSM program was established. Potential privatization and restructuring, tariff reforms, etc., should be taken into consideration as DSM programs are being considered and an appropriate framework designed. Program financing, a key component of this framework, should be able to accommodate eventual pricing reforms and include appropriate regulation, oversight, and institutional and incentive schemes, e.g., DSM operational expenses and lost revenue cost recovery schemes.

10. If distribution utilities have better access to end users, DSM programs may be better based within distribution utilities than national generation utilities. Some of EGAT's programs were partially constrained because EGAT does not sell directly to end users and, therefore, did not have previous relationships with consumers. In many cases, distribution utilities may be a more appropriate home for most DSM programs. In those countries that still have vertically integrated utilities, any introduction of DSM efforts should explicitly involve the distribution staff and, as reforms progress, should provide for gradually shifting appropriate DSM program responsibilities to distribution utilities to make use of their established and unique customer relationships.

Poland Efficient Lighting Project

Project Experience[17]

This project offered specially priced CFLs during two winter "lighting seasons," roughly October through March, when sales of residential lighting products in northern hemisphere countries tend to be at their peak. In an effort to encourage the development of Polish CFL manufacturers, the subsidy was only available to manufacturers with facilities in Poland. During the winter of 1995-1996, four manufacturers of CFLs qualified for participation. One manufacturer encountered problems with the availability of components, and so used only a small amount of subsidies, and another had difficulties meeting Polish government electrical safety regulations and was unable to participate. The subsidy allocations initially made to the two non-performing manufacturers were reallocated to their more successful competitors.

During the winter of 1996-1997, three manufacturers participated, and the two that were successful during the first season were once again able to take the fullest advantage of the subsidies. The average subsidy per CFL during the second season decreased by more than 25 percent relative to the first season because prices for both subsidized and unsubsidized CFLs on the Polish market had decreased, and because consumer demand had increased.

[17] See GEF (1996b), Martinot and Borg (1999), Navigant Consulting (1999), and Granda et al. (2000) for more published information on this project.

The public education component of the project promoted the CFL subsidy program to the public by providing general consumer information on the benefits of energy-efficient lighting from a trusted, non-industry source. The project's "green leaf" logo, developed by a Polish advertising firm, was promoted as a consumer brand connoting energy efficiency and high quality (see page 7). In the generic advertising developed by PELP, the PELP logo appeared alongside the names and logos of widely respected Polish organizations: the Polish Consumer Federation, the Polish Ecological Club, the Polish Energy Conservation Agency (KAPE), and the Polish Foundation for Energy Efficiency (FEWE).

The logo was used on posters, in project publications, and in promotions in the Polish press that included a short television spot and printed media advertisements. Articles on the project and on energy-efficient lighting, written by project contractors and by professional journalists who attended the project's two press events, were also published in leading Polish newspapers and magazines.[18]

Choosing from over 40 different models offered by retailers, consumers bought a total of 1.2 million CFLs through the project, half within the first month of each promotion. This program was easy to manage, was considered cost-effective, and allowed use of available distribution channels. At every step of the project, an open and competitive process was used and the GEF implementing agency (IFC) went to considerable lengths to avoid any conflicts of interest in administering the program.

An evaluation of PELP's total program impacts, taking into account the overall market transformation impacts of the program, was built into PELP's project design. A program analysis projected increased CFL sales in Poland resulting from PELP from the start of the program until several years in the future. This projection was then compared to a baseline estimate of what Polish CFL sales would have been had there been no PELP. The baseline was based on aggregate CFL sales data from Central and Eastern Europe (minus Polish CFL sales). The difference between the two projections represents the total increase in energy savings resulting from PELP, including installation of CFLs during and after the program that were not subsidized by PELP ("free drivers"). The analysis suggests that PELP accelerated the growth of the Polish CFL market by about 3 years. This is consistent with views expressed by CFL manufacturers that participated in the program.

Lessons Suggested by Experience

1. The GEF was able to have a significant market transformation impact on the Polish CFL market. The project's goal was to transform the CFL market by altering the status quo of low demand and high prices. A manufacturer subsidy lowered CFL prices, while a mass media campaign increased demand. This two-pronged approach led to a decline in CFL prices by 34 percent in real terms from 1995 to 1998. In addition, the percentage of Polish households using CFLs increased from one in 10 to one in three. New manufacturers entered the Polish market, increasing competition, and the total number of CFLs in use increased to about 1.6 million units in 1996, up from 600,000 in 1994.

2. The CFL subsidy showed that a high-profile CFL promotion program could be operated at a reasonable cost using private sector delivery channels and approaches in a country with a restructuring economy. The project's reliance on manufacturers as the delivery mechanism allowed the program to remain close to the market and maximize use of existing distribution channels. This structure encouraged manufactures to compete for and intelligently apply the available subsidies, thereby enhancing competitive forces in the market.

3. Wholesale price discounts by manufacturers, representing competitive manufacturer "subsidies" to the project, resulted in high leverage of GEF funds. Manufacturers competitively bid wholesale price reductions in their proposals to participate in the project. These wholesale price reductions gave the GEF subsidies additional leverage, providing a final retail price decrease of $2.80 for every dollar of GEF

[18] It is interesting to note that media coverage of CFLs changed over time, from a simple introduction of the product to more elaborate discussion of the best models for various home applications. This evolution in the way the press covered CFLs mirrors the evolution of Polish perception of CFLs from an unfamiliar product to a more familiar one, and is a good indicator of market transformation.

subsidy, once avoided VAT and retailer mark-ups are included. Overall, GEF subsidies of $2.6 million leveraged total retail price reductions worth $7.2 million on over 1.2 million CFLs. This translates into an average retail price reduction of about $6 per CFL from an average GEF subsidy of $2.10 per CFL. The GEF subsidy induced an average consumer investment of around $10 per CFL.

4. GEF can coordinate different interested parties behind a single, easily recognized campaign with a straightforward message. Several parties, each with different interests, were involved with PELP. CFL manufacturers supported PELP because they wanted to sell more products. Environmental NGOs, as well as the Polish Energy Efficiency Agency (KAPE), supported PELP because of its potential to reduce local and global pollution. A consumer NGO supported the program because it could help Poles save money on their energy bills. PELP's media campaign presented Polish consumers with a single message about CFLs, in which the interests of these diverse parties converged.

5. Restricting participation to Polish manufacturers did not prove to be an effective way to strengthen local manufacturers. The "Polish content" requirement did not appear to benefit any parties. Rather, this requirement excluded the second largest manufacturer of CFLs serving Poland (OSRAM), thereby limiting consumer choice. Related to this, the program cannot be said to have provided strong benefits to small and medium enterprises (SMEs). Although every effort was made to encourage SME participation through widespread outreach and targeted negotiations, market conditions worked against their full involvement. The SMEs who initially participated in PELP were either consolidated into larger partners or chose to exit the market. It may be unrealistic for market transformation programs to expect to accomplish "mixed agendas" (such as supporting local manufacturers) in addition to their primary objective of accelerating technology diffusion.

China Efficient Industrial Boilers

Project Experience[19]

Chinese boiler technology still lags substantially behind international levels in terms of efficiency and performance. The Efficient Industrial Boilers project represents the first large-scale infusion of international boiler technology to China since the 1940s, when technologies were transferred from Russia, according to Bank staff. Started in 1994, this project had by 2000 finally entered the technical know-how transfer stage, whereby Chinese boiler manufacturers began to upgrade the technical designs of their boiler models. Project delays partly resulted from technology transfer complications and insufficient project resources.

Technology licenses for the nine boiler manufacturers and auxiliary equipment manufacturers were signed during the period of 1997-2000.[20] One of the reasons for the long delay between project start-up and the signing of the licenses is that the project had to engage in several rounds of international competitive bidding for technology licenses. Initially, pre-qualification of foreign suppliers of technology transfer licenses focused on large foreign companies. After initial discussions and outreach, letters of intent to bid were received from 18 such companies. But during a first round of bidding, some of the technology licenses received no response from any bidder, and others received a response from only one bidder. As a result, only one license was awarded during this first round. The project managers speculated that suppliers who initially expressed interest in bidding were dissuaded when they saw the limited project resources available to pay for licenses. About $17 million was available for nine technology licenses, and foreign suppliers did not think a contract of $1-2 million would be worth their trouble. In addition, some suppliers could not comply with the requirement that boilers be able to burn raw coal (for which boilers outside of China are not normally designed).

So the project engaged in a second round of license bidding, this time identifying smaller foreign suppliers and identifying two to four specific suppliers for

[19] See GEF (1996a) and GEF STAP (2001) for more published information on this project. The material in this section is based in part on country visits to China in September 1999 and November 2000 (meetings with Project Management Office, Wuxi Boiler Works).

[20] One auxiliary equipment contact remained to be signed by 2000.

each of the nine licenses to be procured, or about 20 suppliers total (some supplier candidates overlapped across the nine licenses). Even then, some licenses had the same trouble as in the first round, or others were awarded but the supplier subsequently withdrew from signed contracts. Eventually, after a lengthy and time-consuming procurement process, all nine technology licenses were contracted.

Of the nine licenses, six are making incremental technology improvements in the efficiency of existing boiler designs, and three are adapting technology for completely new boiler designs. The one license from the first bidding round was the only technology package for an entirely new boiler design—a circulating fluidized bed (CFB) boiler—at a cost of $2.9 million. In addition, some include transfers of more general design methodologies and analytical tools that will allow the Chinese manufacturers to improve their design capabilities. A total of $15.3 million has been spent on the nine licenses, and if auxiliary equipment technology transfer and equipment purchase are included, the total amounts to $20.8 million. The boiler technologies, obtained in 1999, are essentially those planned back in 1996; the project did not reevaluate technology needs despite the several years of elapsed time between initial project conception and final bidding of the licenses. However, in response to the evolving market needs, the final technology transfer contracts incorporated changes in the design and capacity of the boilers.

The subprojects have been small partly because Chinese manufacturers couldn't afford large cost sharing. The project required cost sharing in a 2:1 ratio, and the ability of manufacturers to contribute co-financing has limited the size of total funds.

Interesting provisions for replicating the technology licenses have been included in the license contracts. The technology licenses formally belong to the State Economic and Trade Commission (SETC). This agency has the option of selecting an additional two to three Chinese enterprises to receive each license. The foreign technology supplier must agree to the selection, after which it receives royalties, paid either over a 15-year period in decreasing amounts, or as a single lump-sum licensing fee. Thus many additional manufacturers can potentially benefit from the licenses once their usefulness is proved by the original manufacturers participating in the project.

The project has indirectly accelerated industry-wide efforts to improve boiler efficiencies to some degree. Every year, the government suspends production of certain boiler models that feature the lowest efficiency. The World Bank/GEF project has accelerated this process. The government is developing minimum energy efficiency standards, and the project has recommended more stringent emissions standards to the State Environmental Protection Administration (SEPA).

Lessons Suggested by Experience

1. The existence of the project, prior to any efficient-boiler production by participating manufacturers, has had an indirect effect on China's industrial boiler market. Stagnant for decades, the Chinese boiler industry has begun to consider higher efficiencies. Before the project, some non-participating manufacturers had begun to develop high-efficiency boilers, but over the course of project implementation, manufacturers' motivation has increased and work is proceeding faster. For example, one of the non-participating boiler manufacturers decided to initiate some technology improvements on its own. This manufacturer credits exposure to the project for its decision.

2. Technical incompatibilities, insufficient budgeted resources, World Bank administrative procedures, and lack of experience with license contracting procedures slowed the technology transfer process. Not many countries have coal-fired boiler technology that Chinese firms can use. Firms have found some foreign technology but it is still difficult to combine foreign technologies with Chinese conditions, and this has delayed project progress. There are not many coal-burned boiler manufacturers in the world that are willing and interested in transferring boiler technology to China. Even with the interested few, the problems of meeting the technical performance criteria using Chinese coal and complying with the commercial terms offered by the Chinese were often the sources of negotiation breakdowns. In addition, the strict and complex approaches and rules of contracting procurement and project management under the World Bank exacerbated the difficulties of implementing the project. While technology transfer normally follows a certain "business as usual" procedure, project disbursements required several layers of approval by the PMO, the World Bank, and the Chinese govern-

ment. This, coupled with unfamiliarity in the contract procedures either in the Chinese environment or, in some cases, the international practice (such as letters of guarantee), all contributed to the delays in finalizing technology transfer contracts.

3. Over the project's long implementation period (7 years), exogenous factors may have dampened the project's potential impacts. Boiler markets are changing more rapidly now than when the project was conceived. Several exogenous factors may limit the project's potential long-term impact. It is becoming easier for boiler makers to contemplate selling higher priced, high-efficiency boilers because the price of coal has been rising and, with it, demand for efficient boilers has risen. Environmental pressures, and stricter enforcement of environmental legislation, are also increasing demand. Emerging boiler technology needs, such as for large-scale, coal-fired boilers, have overtaken the original project plan. Although energy policies that penalize coal-fired boilers are starting to appear, especially in larger cities like Beijing, the demand elsewhere is expected to remain large enough to support the market for coal-fired industrial boilers in the short and medium term.

4. The time period required for the preparation and implementation of the project is too long. More than 8 years have already passed since the preparation stage began. During this period, all Chinese parties involved in the project, including units undertaking sub-projects, the PMO, and even the former Ministry of Machinery Industry as an administrative department of Chinese government, have experienced significant staff or organizational changes. The relevant market situation, policies, and regulations have also had certain changes. Two more years will be needed to complete the project as designed. The time needed for further relevant activities, such as widely marketing and spreading the new technologies, are not even included. A 2001 review of this project by the GEF Scientific and Technical Advisory Panel concluded that the overall project period is too long, to the point of having a negative impact on the project overall (GEF STAP 2001).

5. The level of funds necessary for technology procurement was underestimated. Since the project is divided into many subprojects, covering nine types of boilers and auxiliary equipment, the amount of funds allocated for each subproject is relatively small (around $2 million) for such technology procurement. As a result, many potential technology sources lost interest in project deals, leaving only a narrow selection of technologies to choose from. Given budget limitations, most of the GEF grant was used for the purchase of the technologies themselves, making fewer funds available for capacity building to support the technology transfers. The low budget also resulted in rather strict limitations being placed on the technology transfer agreements: The technology purchases were on a one-time buy and sell basis, and further improvements to and upgrading of the transferred technology was not included.

6. The project design should have considered demand-side barriers and allocated funds to them. The new boilers, at least in the demonstration period, are more expensive than the current products, and users do not yet recognize their advantages. It is not easy to persuade potential buyers to take the technology risk. The manufacturers involved in the project face strong competition from old products with lower production costs. It would have been helpful if the project design had incorporated possible demand-side barriers and allocated funds for them (in this case, funds for demonstrations and case studies).

China Barrier Removal for the Widespread Commercialization of Energy-Efficient, CFC-Free Refrigerators in China

Project Experience[21]

This project began implementation in 2000, but before then had achieved substantial results through the project development process.[22] Most notably, the project helped establish new national energy-efficiency standards for refrigerators. Other early impacts resulted from increased contacts with foreign manufacturers

[21] See GEF (1999a) for more published information on this project. The material in this section is based in part on a country visit to China in November 2000 (meetings with the Project Management Office, SEPA, Hualin refrigerator manufacturer, and a design institute of Guangzhou Refrigeration Company, a compressor manufacturer).

[22] The project development process was a multiyear process, to which various funders, such as USAID and EPA, contributed. The GEF proposal was one of the outcomes of years of research and project development efforts in the China refrigerator arena with the help of such bilateral assistance.

and increased awareness among government officials and manufacturers that efficient models were "an idea whose time has come." For example, in 2000, three large refrigerator manufacturers (Haier, Kelong, and Xinfei) displayed prototypes of efficient models at an international exhibition. These prototypes benefited from acquisition of foreign technology based on the early project preparation stages. Smaller manufacturers also displayed prototypes; in all, manufacturers representing about 80 percent of market share had new prototypes. But full manufacturing versions had yet to be produced.

In 2000, the project sponsored several study tours abroad and focused on technical assistance and training activities. Compressor manufacturers wanted to gain exposure to international experience and then decide what types of project activities would be most useful to them. The study tours focused on foreign universities and research centers, but were unable to gain access to foreign manufacturers.

The project also established an information dissemination center with the existing Chinese Household Electrical Appliance Association (CHEAA; now an independent association with 300 existing members) and a national testing agency with the existing Chinese Household Electric Appliance Research Institute (CHEARI).

In 2000, the project announced a competition for manufacturers to innovate with energy-efficient designs, with a one million Yuan prize (worth about $150,000). This attracted considerable media attention and increased the exposure of consumers to energy-efficient refrigerator publicity.

There are now 24 refrigerator manufacturers in the Chinese market, with an annual production capacity of about 20 million units. The 16 manufacturers participating in the project represent about 95 percent of the market share of the domestic market. Five of these 16 are joint ventures. With serious consolidation in the past few years, the industry is down from 60 manufacturers prior to the project. There also was no foreign participation prior to the project. So the industry has changed drastically since the project was initially conceived in 1996, and manufacturers are larger and have more foreign resources. This means that the project will probably prove of greater utility on the demand side and of declining utility on the supply side. For example, some demand-side activities like labels need to be brought forward in the schedule, according project consultants, rather than waiting until the original timing specified in the project plan.

Smaller manufacturers can still benefit from training and design tools, provided they survive. In fact, the project assistance may help them survive. "What has overtaken the project are the market leaders," said one market observer when asked whether the market had overtaken the project.

In 1997, total domestic production from all 24 manufacturers was 8.8 million units, and this increased to 11 million in 1999. There is still serious overcapacity, so the business has become very competitive. Representing about one-quarter of total production, exports continued to grow while domestic demand remained flat. There appears to have been a slight downturn in 2000, with only 10 million units produced as a result of the slowing of the economy and consumer spending. Also, electricity prices have fallen, reducing incentives to conserve electricity.

Interestingly, demand for refrigerators in rural areas is increasing, while demand in urban areas is declining. This trend should result in a greater influence on purchases of efficient refrigerators, as electricity rates are higher in rural areas than urban. On the other hand, more consumer education programs are required in dispersed rural areas, where they are likely to be more expensive and time-consuming than in concentrated urban areas.

Lessons Suggested by Experience

1. Project-sponsored manufacturer incentives are complicated by partial foreign ownership of Chinese manufacturers. A manufacturer design competition has been initiated with a prize of one million Yuan (equivalent to about $150,000). But in administering the competition, the project has faced the dilemma of whether to allow foreign subsidiaries or joint ventures with substantial foreign ownership to participate. What is the maximum allowable foreign ownership? How can foreign ownership share be determined when financial statements may not give a clear portrait, or the situation keeps changing from day to day? Partial foreign ownership is growing among the leading enterprises in the industry, and thus becomes an impractical criterion for excluding participants in the competition.

2. Technical know-how transfer through visits by Chinese manufacturers to foreign manufacturers has proven unfeasible. The original project plan called for Chinese manufacturers to take foreign study tours that included visits to foreign manufacturers. But requests to four foreign companies were turned down. The foreign companies said they would only allow Chinese academics to visit them (even delegations with policymakers were refused, presumably because there was no way to ensure they weren't manufacturers in disguise). So, during study tours, the Chinese manufacturers visited only foreign academic institutions and concluded that such visits generated limited practical knowledge. Similarly, foreign manufacturers have refused to come to China to train domestic manufacturers, so the project has had to hire foreign academics and retirees to come to China rather than people active in industry. But Chinese manufacturers need the concrete know-how that can be gained only from other manufacturers. Besides technical know-how, "we need to see how the technologies are marketed and sold," said one Chinese manufacturer. In addition, foreign compressor manufacturers, concerned about international competition from Chinese compressor manufacturers, have been willing to conduct training workshops in China to present their products and experience to Chinese *refrigerator* manufacturers (as potential customers) only; they were unwilling to conduct workshops if Chinese *compressor* manufacturers were present.

3. Project preparation and approval activities have, by themselves, had a large influence on the market for energy-efficient refrigerators. Even before project activities started, future expectations changed as a result of the project being prepared and approved. "Because of the GEF project, we have seen increased pressure on the market for efficient refrigerators and we are responding," said one participating refrigerator manufacturer. China's potential entry into the WTO is another contributing factor (and a reorientation of production for exports), along with increased foreign competition in domestic markets (which is less significant, given the huge hurdles that foreign firms face to operate in China). But the Chinese government has told manufacturers that "with UN [UNDP/GEF] help, efficient refrigerators are the way it's going to be," according to one manufacturer. New refrigerator standards, enacted during the project development phase, also contributed to the future market.

4. Manufacturers are already responding to future expectations about the market. As one example, the share of efficient refrigerators (consumption of less than 75 percent of the current standard) of one participating manufacturer went from 2 percent in 1997 to 10 percent in 1999. These efficient models are sold with bright, door-affixed labels proclaiming their energy consumption at 30 percent below Chinese standards. Prior to 1997, technological change was relatively stagnant, but has increased rapidly in the past few years. "We have to get on this train," said the manufacturer.

5. The market for energy-efficient refrigerators faces an uphill battle for price competition not envisioned in the project design. There was a 30 percent decline in the prices of ordinary-efficiency refrigerators from 1997-2000 as manufacturers reduced their profits and cut costs in response to increased competition. Thus the "gap" in price between ordinary and energy-efficient refrigerators has increased to about 20 percent, higher than expected in the project design.

6. Manufacturers appreciate both marketing and technology assistance from the GEF. One refrigerator manufacturer said that the main value of the GEF project is the increased consumer awareness produced by the project's awareness campaigns. This makes the marketing job of energy-efficient product producers easier. Manufacturers also have appreciated access to foreign expertise in technology and business and the facilitation of government-to-government technology transfers under the project.

Multicountry Efficient Lighting Initiative (ELI)

Project Experience[23]

The IFC/GEF Efficient Lighting Initiative started implementation during 1999-2000 in a phased approach across seven countries. ELI's experience in its seven countries of operation was presented earlier on page 9. Along with greatly increased interest in efficient lighting and dialogue among a variety of stakeholders in the countries concerned, ELI has also

[23] See GEF (1999b) for more published information on this project. The material in this section is based in part on interviews and discussions with project managers and stakeholders.

obtained results on a global level in the promulgation of technical specifications and qualification of products. Early in project implementation, ELI developed technical specifications for a wide range of energy-efficient lighting products in order to forestall the potential "market spoiling effect" of low-quality lighting products. Products meeting specifications are allowed to bear a special ELI logo as "ELI-qualified products" and are eligible for ELI support. In mid-2000, ELI sent notice, through its database of lighting manufacturers, that ELI technical specifications were available on the ELI website. By early 2001, over 16 manufacturers from more than six countries had submitted requests for ELI qualification, resulting in 98 products being qualified.

Lessons Suggested by Experience

The lessons suggested by experience will be apparent upon further project implementation and impacts, although a number of important project design lessons were highlighted in the design and preparation process (see page 10). Other lessons that can be drawn now include:

1. Utilities can be willing and interested partners in market transformation programs, at least in certain national circumstances. The interest of utilities in several ELI countries suggests that utility demand-side management programs incorporating efficient lighting continue to be viable in developing countries. Utility partnerships with ELI have taken place where sufficient motivation exists for the utility to be interested in a lighting DSM program—be it for peak reduction, demand reduction, or public relations reasons. In some cases, national circumstances limit utilities' interest in DSM; for example, in the Czech Republic and Hungary, where the very survival of local utilities is threatened by pending market liberalization, utilities were not interesting in investing significant resources in DSM. However, utility partners are not essential for effecting market transformation. Rather, the manufacturers, distributors, and retailers of the technology being promoted are the key partners. Nevertheless, where utilities would benefit from the intended market transformation, they can be valuable partners with the means to efficiently reach the end user, facilitate consumer education, and provide consumer finance. However, depending on utility partners can be risky given the electric utility corporate culture, which is often characterized by slow decision making, political influence and uncertainties, and an emphasis on maximizing electricity sales.

2. A multicountry program approach has led to the involvement of a greater number of manufacturers and to a potentially larger program impact. In small, non-competitive markets, the barriers to entry, and the ratio between cost of entry and the returns, can deter manufacturers. ELI is lowering the barriers to entry by providing a single entry point into seven country markets, supported by a credible logo that can help a new market entrant gain consumer trust. For example, as a result of early ELI activities, a U.S. manufacturer entered the Argentine market, and was planning to establish local manufacturing facilities there. The 16 manufacturers requesting ELI qualification in response to ELI technical specifications is another example of the supplier "pull" of a multicountry program approach.

3. The tension between product quality and cost, and its implications for effective program approaches, has become apparent in early project activities. To ensure high quality, ELI technical specifications require a minimum product lifetime of 6,000 hours. However, such lamps generally cost at least twice as much as a lamp with a lifetime of 3,000 hours or less. Although lamps with short lifetimes are still cost-effective for consumers, there is concern that lower quality lamps may have a "market spoiling effect." The extent of this effect is not known. ELI may be promoting a level of quality that some people in ELI countries cannot afford. The project is considering ways to modify the standards to allow lower quality, lower cost products.

Thailand Building Chiller Replacement Program

Project Experience[24]

The World Bank/GEF Thai Building Chiller Replacement Program is the most recent addition to the GEF portfolio of market transformation projects. Implementation was expected to start in 2001. Nevertheless,

[24] See GEF (2001a) for more published information on this project. The material in this section is based in part on a country visit in February 2001 (meetings with the Department of Industrial Works, IFCT, the World Bank, EGAT, manufacturers, and potential program participants).

lessons are already emerging from the considerable work that went into project preparation.

Chillers are very large air conditioning units that cool the air and reduce humidity in big facilities such as factories, hotels, or shopping centers. Approximately 1,400 chillers in Thailand are inefficient models that still require CFCs. The typical chiller lifetime is between 25-30 years, and about two-thirds of the inefficient chillers are less than 15 years old. Today's models are 30-40 percent more efficient than those manufactured before 1993, and can pay for themselves in 4-5 years. However, replacing an existing chiller with a new, more efficient model is not common practice in Thailand. Reasons for this include lack of awareness of the benefits of efficient chillers, the high up-front investment new chillers require (over $100,000), a perceived technology risk, and limited technical capacity. The Thai Chiller Replacement Project is designed to remove these barriers.

In the initial project brief submitted to the GEF in 1998, the Electricity Generating Authority of Thailand (EGAT) was to have implemented the project. When its privatization was subsequently announced, EGAT was no longer in a position to be a suitable implementer.[25] The World Bank therefore proposed as its implementing partner the Industrial Finance Corporation of Thailand (IFCT), a Thai development bank partly owned by the government. This change caused some delays, partly because the project needed to be restructured from a utility program to a financial program, and partly because of negotiating difficulties.

IFCT and the project's owner, the Thai Department of Industrial Works (DIW, housed in the Ministry of Industry), designed the project in close cooperation with chiller owners, manufacturers, government departments, and other parties.[26] In 2000, as part of the appraisal process, IFCT organized a series of workshops under the auspices of the DIW to inform chiller owners of the advantages of energy-efficient chillers and invite applications for participation in the project. Of 56 applicants, IFCT was able to meet its goal of identifying 24that met the project's technical criteria and also satisfied IFCT's financial due diligence.

The GEF-supported project has already raised expectations and produced commitments to further replication of pilot results. If the demonstration project (replacing 24 existing chillers) is successful, the government plans to expand it to replace an additional 400 chillers, resulting in a 57MW reduction in electricity demand. Such replication might be financed from the Thai Energy Conservation Fund. The Ministry of Industry and the Ministry of Science, Technology, and Environment have already expressed their support for a follow-on project.

Lessons Suggested by Experience

1. The project approach to replacing existing chillers has generated enthusiasm among chiller suppliers and chiller purchasers; in particular, soft loans can be an effective means of stimulating the market. Interviews and surveys suggest that chiller buyers like the project because a low-interest loan allows them to spread the first cost of a new chiller over several years. Other reasons cited include: (a) a performance guarantee shelters them from the risk of poor chiller performance, (b) a new chiller reduces their electricity costs, and (c) the project teaches them about new chiller technology and their own energy consumption. Chiller suppliers like the project because it has opened up a new market for them (the retrofit market), helped the customer overcome the first-cost barrier, and promises to provide good public relations because of the project's case studies, which rely on an independent evaluation of chiller performance.

2. Documents and approaches developed through this project have the potential to be replicated. It is likely that other tropical developing countries could benefit from a chiller replacement program. Tech-

[25] The Thai Government introduced EGAT's privatization as a consequence of the country's financial crisis. It seemed likely that by the time of the project's closing, EGAT would no longer be a government entity, and that any government guarantee provided for a loan scheme would therefore no longer be valid. Therefore, it was deemed appropriate to find another partner for implementation. EGAT is now running its own chiller program, which is complementary to the GEF project because its primary target is the public sector. The EGAT program does not offer a technical shortfall guarantee or independent verification of results, and does not plan to issue detailed case studies.

[26] These included the Ministry of Finance, the National Energy policy Office, and EGAT. Also, as part of its technical assistance responsibilities under the Montreal Protocol, UNEP worked with the DIW to assemble technical material related to chiller replacement.

nologies and barriers (low awareness, high first cost, the difficulty of obtaining a loan, aversion to technological and financial risk) are likely to be similar in other countries. While actual program design and implementation would vary according to local barriers and institutional capacities, the extensive technical materials that IFCT and DIW have developed as part of the appraisal process could easily be adapted for use in other countries.

3. The project appraisal process has already had an impact on the chiller market. As part of the appraisal process, IFCT organized seminars to inform chiller owners about the advantages of efficient CFC-free chillers and solicit applications for participation in the program. As a result, chiller owners are better informed about energy efficiency and ozone issues. They are aware that the pilot is taking place. As a result of the program's informational activities, at least two chiller owners with multinational parent companies have undertaken chiller retrofits on their own; in this case, the parent company has enough cash to cover the up-front costs without a loan. Most importantly, the appraisal process for this pilot project has stimulated the Minister of Industry to announce support for a second phase of the project (assuming the pilot is successful).

4. When a financial institution plays an important role in a project, the project design team should include a finance specialist. For historical reasons, the project development team at the Department of Industrial Works was largely staffed by ozone specialists and did not include a finance specialist. This caused difficulties when program implementation was re-assigned from a utility (EGAT) to a financial institution (IFCT). The cooperation between DIW and IFCT would have been easier had a finance staff person been included on DIW's team.

5. GEF implementing agencies should allow sufficient flexibility when working with SMEs and financial intermediaries. Negotiations between the World Bank and the project's implementor (IFCT), a financial institution with partial government ownership, were unusually protracted. Both parties agree that a principal cause of the difficulties was the World Bank's procurement and disbursement policies; as these arise from the Bank's traditional involvement in very large loans to governments, they are not well suited for the swift approval of smaller projects, in particular, projects implemented through financial intermediary institutions. The slow pace of approval frustrated many participants, and may even have discouraged some potential participants.

4. Impacts, Sustainability, and Replication

Program Impacts and Indicators

The GEF has developed seven indicators to measure the impact of its climate change programs (GEF 2000):

1. Energy production or savings and installed capacities
2. Costs per technology unit or measure installed
3. Business and supporting services development
4. Financing availability and mechanisms
5. Policy development
6. Awareness and understanding of technologies
7. Energy consumption, fuel-use patterns, and impacts on end users

Three projects in the portfolio were completed by 2001 (Mexico, Poland, and Thailand). Project evaluations, field visits, and other evidence suggest the following impacts, primarily from these three projects, categorized using the above seven indicators.

1. Energy production or savings and installed capacities. Three projects in Thailand, Mexico, and Poland have resulted in installation of more than 4.6 million compact fluorescent lamps (CFLs) and annual electricity savings of at least 3,500 GWh (equivalent to several months' output from a 1,000 MW coal power plant). Other energy consumption reductions were achieved through industrial, commercial, and residential energy-efficiency improvements in the Thailand project. One of the most notable achievements of that project was the compete transformation of the fluorescent light market, representing 20 million lights sold annually, in which virtually all sales of less-efficient T-12 lights were replaced with sales of T-8 lights that are 10 percent more efficient.

2. Costs per technology unit or measure installed. The three completed projects clearly decreased prices of the technologies they targeted. The Poland project resulted in a sustainable price decrease for CFLs of at least 35 percent. In fact, one of the project's key impacts was the lowering of CFL prices. In Thailand, sales of low-price CFLs increased in part because of the widespread publicity campaign promoting the benefits of CFLs sold at 7-11 convenience stores nationwide, which were offered at lower prices due to bulk purchases by the national electric utility. Bulk procurement in the Mexico project, coupled with utility-provided subsidies, reduced consumer prices to $5-8, from pre-project prices of up to $25. Since project completion, average CFL prices have further declined, by up to 30 percent, and the project is credited with accelerating price reductions that would have happened more slowly otherwise.

3. Business and supporting services development. Several projects have been instrumental in strengthening supporting institutions for energy efficiency. As part of the Thailand DSM Project, the national electric utility (EGAT) created a demand-side management office. This office successfully negotiated the voluntary T-12 to T-8 lamp changeovers, conducted bulk procurement and distribution of CFLs through convenience stores nationwide, led campaigns to promote public awareness of energy efficiency and conservation, promoted awareness of appliance energy labels, and disseminated classroom educational materials. The experience that the Mexican utility CFE gained during the Mexico project has allowed it to proceed with additional DSM programs without GEF support, including the sale of an additional 4 million CFLs. The China Efficient Refrigerators Project resulted in the enactment of new energy efficiency standards

for refrigerators. The China Industrial Boilers Project has provided nine Chinese boiler manufacturers with technology licenses from foreign suppliers for upgraded or new industrial coal-fired boiler technologies that are more efficient.

4. Financing availability and mechanisms. The Poland project established an innovative subsidy mechanism whereby an overall GEF subsidy of $2.6 million leveraged a total CFL retail price reduction worth $7.2 million through competitively solicited manufacturer wholesale price cuts as well as the multiplier effects on price cuts from value-added taxes and retail markups. The Mexico project introduced two new mechanisms for consumer financing of CFLs: pay-on-the-bill financing, whereby the price of the lamp is deducted off of a customer's electricity bill in installments, and a similar procedure managed by employers, in which an employee's investment in CFLs is made through paycheck deductions. Both of these financing approaches are still being used after the completion of the project.

5. Policy development. Policy development has focused on national codes and standards for energy-efficient equipment. In the Mexico project, the development of national CFL quality standards began in the early stages of project development. The standards were then launched and enforced during the project. An increasing number of CFL models are being sold and labeled according to these standards. In the Thailand project, EGAT's DSM Office worked with the Thai Consumer Protection Agency to make energy efficiency labeling mandatory on single-door refrigerators. In the China project, national energy efficiency standards for refrigerators were enacted.

6. Awareness and understanding of technologies. The Poland project has produced the most data of any project on changes in awareness and understanding of technologies, in this case, of CFLs.[27] Before the project began, only one in 10 Polish households owned at least one CFL. This increased to one in three households a year after the program. Also, about 97 percent of the CFL purchasers surveyed intend to replace their existing CFLs with new CFLs after they burn out. After the project, a larger number and wider variety of stores (from small shops to supermarkets) began to sell CFLs. Stores also began to carry a wider variety of CFL models. Print media coverage of CFLs increased and shifted from describing CFLs to explaining where and how to best use them. The Ministry of Education wrote, "It is apparent that as a result of the project, large numbers of students and teachers have gained useful insight into the use of energy and its impact on the environment." The Thailand project conducted a major public awareness campaign that made 87 percent of Thais aware of energy efficiency issues, particularly the advantages of energy-efficient lighting, refrigerators, and air conditioners.

7. Energy consumption, fuel use patterns, and impacts on end users. The Poland project increased the percentage of households with CFLs from 11.5 percent to 19.6 percent. The Thailand project also had significant impacts on market shares: An air conditioner program increased the market share of energy-efficient air conditioners from 19 percent in 1996 to 38 percent in 1998, and a refrigerator program transformed the single-door refrigerator market, increasing the market share of the most efficient units from 12 percent in 1995 to 96 percent in 1998. One of the most notable achievements of that project was the compete transformation of the fluorescent light market, representing 20 million in annual sales, in which virtually all sales of less-efficient T-12 lights were replaced with sales of T-8 lights that are 10 percent more efficient.

Sustainability

Evidence is emerging that the market changes brought about by GEF-supported efficient-products projects are sustainable. For example, 2 years after the close of the Poland Efficient Lighting Project, the market changes resulting from the project were still in place. Retail prices of CFLs in Poland decreased by 34 percent in real terms, and Polish CFL market experts and manufacturers agree that the project was largely responsible for this dramatic price decrease. The project helped increase sales volumes and manufacturer competition, and the public education campaigns helped increase consumer demand to the point at which the price decrease was sustainable.

In Thailand, a refrigerator program appears to have sustainably transformed the refrigerator market. High-efficiency refrigerators are now the norm, and the unit

[27] A comprehensive monitoring and evaluation program was designed and effectively implemented for the Poland Efficient Lighting Project.

with the highest level of efficiency dominated the market as early as the program's second year. In fact, surveys show that a variety of energy-efficient appliances promoted through the Thailand project have sustained markets. Customers have been highly satisfied with the reliability of the energy-efficient products, which suggests that the gains from the market transformation programs are not likely to be reversed.

The Thailand DSM market transformation programs for fluorescent tubes also had sustainable impacts on the market. In particular, the voluntary agreement concluded between EGAT and fluorescent tube manufacturers effectively and completely "washed" the Thai market clear of inefficient T-12 fluorescent tubes. In 1994, when the program began, efficient tubes had a 40 percent market share, and by the end of 1995, the efficient tubes had achieved a 100 percent market share.

The Thailand DSM CFL program and the labeling for air conditioners appear to have been less effective at achieving sustainable changes. Through advertising campaigns, the CFL program successfully addressed consumer information barriers and, through bulk purchases, it ensured that CFLs remained in the market during an economic downturn. The program reached only a small proportion of consumers, primarily because conventional lighting distributors were excluded from the program, but also because only two sizes of CFLs were promoted (11W and 13W). An unintended impact was the increase in sales of lower priced, lower quality CFLs. Unfortunately, consumers familiar with the poor performance of the lower priced, lower quality CFLs may assume that higher priced, higher quality CFLs are also unreliable.

It remains to be seen whether the air conditioner labeling component of the Thailand DSM program will lead to sustainable changes. Customer awareness and knowledge of labeled energy-efficient air conditioners has increased, the market share for energy-efficient units has increased, and peak demand and energy savings have been realized. But EGAT has not been able to establish a mandatory labeling agreement, and manufacturers of lower efficiency products have been reluctant to apply a voluntary label to their products. Part of the difficulty is that EGAT is negotiating with over 55 air conditioner manufacturers.

The sustainability of EGAT's DSM office remains questionable in view of the planned privatization of EGAT. However, despite the end of the GEF project and depletion of grant funds, the DSM office was continuing to operate in 2000, and its 176 staff positions remained. With the anticipated availability of the Thai government's Energy Conservation Fund to support future operation, it is expected that the DSM programs initiated under the project will be sustained and new programs will be launched, at least until EGAT is privatized. The longer term institutional fate of the DSM office remains uncertain.

Sustainability is difficult to assess in some projects, such as the Mexico lighting project, because of the lack of established baselines and surveys of non-participants. However, it is possible to say with some confidence that average CFL prices in Mexico have dropped by about 30 percent since the completion of that project, and the variety of available models has significantly increased. People familiar with the project agree that while the market may have eventually evolved on its own, the project definitely accelerated the pace of the CFL price drop and increased the availability and variety of models.

Replication

Experience from GEF market transformation projects is catalyzing similar activities locally and in other countries—in the same technologies as the original project or in different technologies. All of the completed projects (Ilumex, PELP, and Thai DSM) are being replicated in some form. The clearest example of replication is when the implementing organization continues to run the program after all GEF funds have been disbursed. This has been the case in Mexico. FIDE is a public/private non-profit involved in the implementation of the efficient lighting project. Its positive experience with the project led it to run an ambitious follow-on program. Between 1998 and 2000, the new FIDE program sold 4.8 million CFLs all over the country both in retail outlets and through CFE offices.[28] Thanks to experience gained through

[28] The promotions run for 6-9 months in selected cities. Manufacturers are coordinating their advertising campaigns with the FIDE campaign. The sales campaign is accompanied by an advertisement campaign (local TV, radio, posters, etc.). At the end of each city's campaign, CFLs are no longer sold through CFE, but only through retail outlets. In all cities where this program is implemented, information is being collected to assess what was the situation before, during and after the project starting.

the original project, the new program was able to run without subsidies, with reduced administrative costs, and with shorter terms for CFL repayment (4 months). CFE staff indicated that their experience with the original project played an important role in the design of subsequent nationwide energy saving programs, particularly by: (a) establishing internal management units, (b) formulating technical specifications and laboratory tests, and (c) undertaking periodic technical and financial reviews.

The Mexico efficient lighting project has also inspired other Mexican organizations to conduct energy efficiency programs. For example, the trust fund for thermal insulation in the Mexican state of Mexicali (FIPATERM) has developed Ahorro Sistematico Integral (systematic integrated savings), a household efficiency program that integrates air conditioning, roof and wall insulation, and weatherstripping to reduce summer electricity consumption. This program follows the lighting project's commercialization scheme, and aimed to introduce 500,000 CFLs over 5 years, starting in 1998 (Friedmann 2000).

In Thailand, the original DSM program was expanded in 1997 to include the Bangkok distribution utility, MEA. Under the World Bank-supported Metropolitan Distribution Reinforcement project, a portion of project funds were allocated to MEA to help them initiate their own DSM programs, which complemented EGAT's efforts.

Replication of GEF-supported projects in other countries beyond the original project locations is also occurring—a key goal of the GEF's long-term strategies. Sometimes replication may be in the form of follow-on GEF projects, as was the case with the Efficient Lighting Initiative (ELI). During the implementation of the Poland lighting project, IFC received requests from numerous countries wishing to host a similar CFL promotion program; these requests prompted IFC to design ELI. Although ELI is being implemented in seven countries (Argentina, Czech Republic, Hungary, Latvia, Peru, Philippines, and South Africa), IFC received expressions of interest in replicating the Poland experience from many other countries, including Brazil, Bulgaria, Egypt, India, Lithuania, and Russia. Organizations from Botswana, Mozambique, and Zimbabwe have approached ELI team members to get advice on how to run similar lighting programs locally. The implementation team has floated ideas about exporting ELI to other countries in the region.

Another example of international replication comes from the Thailand DSM project. The experience gained by EGAT in its early years implementing that project contributed to improving the designs of the IDA/GEF-assisted DSM component of the Sri Lanka Energy Services Delivery Project and a Swedish International Development Agency (SIDA)-sponsored DSM Project in Vietnam. It should be noted, however, that the broader GEF goal of encouraging other countries to undertake large-scale, utility-based DSM programs was only marginally achieved. A major constraint has been the fact that many utilities in the region are undergoing an unbundling and privatization process, which is altering the rationale for utilities to undertake such initiatives.

Conclusions and Recommendations

An analysis of market indicators shows that GEF support has indeed managed to transform markets for energy-efficient products. The GEF has already achieved significant CO_2 emissions reductions and is demonstrating highly cost-effective potentials for doing so—to less than $1 per ton of carbon. Many of the lighting programs have resulted in cost-effectiveness in the $5-10 per ton range. Replacing existing building chillers before the end of their useful life also appears to be particularly cost-effective because chillers last about 25-30 years. Replacing existing Thai chillers with more efficient models pays back within 4-5 years and can reduce CO_2 emissions at less than $1 per ton of carbon, and at a cost of only half that in GEF funds per ton, given the project leverage of other financing sources.

There appears to be no single prescriptive approach that guarantees the success of a market transformation program. The variety of approaches used reflects the barriers and opportunities in each target market, as well as the capacity and creativity of each program design and implementation team. Some notable program schemes include the voluntary agreements negotiated between the Thai electric utility and Thai importers and manufacturers of fluorescent tubes, in which EGAT funded a massive education campaign on the benefits of more efficient "thin" tubes, in exchange for a complete production changeover to thin tubes; the Poland lighting project's per-lamp price subsidy, competitively allocated at the manufacturer level, which led to a subsidy multiplier effect at the retail level; and the Thailand chillers project's combination of low-cost loans and performance guarantees, which have been met with enthusiasm by both manufacturers and potential purchasers.

It is interesting to note that increased expectations of future markets for efficient products, increased awareness of energy savings potential, and increased understanding of market transformation approaches can have early indirect effects on the target market. These effects may occur even before a program starts formal implementation. Appraisal of a GEF project suggests to market players that increased investment and publicity are likely to occur. This motivates manufacturers to increase their market presence, develop prototypes, and take other actions that put them in a good position to take advantage of the project. This phenomenon has been observed in at least three GEF projects. One Chinese refrigerator manufacturer said in the very early stages of the GEF efficient refrigerators project: "Because of the GEF project, we have seen increased pressure on the market for efficient refrigerators and we are already responding."

It is very clear that the GEF can and should continue to conduct market transformation approaches. In fact, given the effectiveness of such approaches in achieving global environmental objectives as well as domestic economic and environmental benefits, it is surprising that GEF implementing agencies have not made greater efforts to support developing countries with these approaches.

Changes in private sector markets for lights, refrigerators, air conditioners, and building chillers offer large potential for energy savings. Less potential may exist now for DSM programs as utilities continue to privatize and lose public interest mandates or oversight. However, experience suggests that even private utilities can be willing and interested partners in market transformation programs in some national contexts.

Projects that go beyond accelerating an existing market to creating an entirely new market, such as the Thailand chiller retrofit project, may provide some of the largest gains. Projects that attempt technical assistance and know-how transfer to manufacturers may face particularly difficult hurdles, but such hurdles are worthwhile if know-how transfer will ultimately improve domestic innovation and lower costs in the recipient firms and countries.

Based on the emerging experience and lessons, we can recommend eight fundamental design principles for future projects:

1. Target both supply and demand sides of a market. Increased supply by itself may not result in increased purchasing by consumers, unless demand is also stimulated. Conversely, greater awareness and understanding of technologies by consumers is ineffective unless they have opportunity, credit, and quality products available.

2. Take a holistic view of the market by carefully examining all stages of the supply and demand chain before designing the program. This may require extensive market research.

3. Leverage competitive market forces whenever possible. The Poland lighting project provided a good model of this principle, although other approaches are feasible. Leveraging competitive market forces will both make a program more cost-effective, and perhaps more importantly will limit market distortions caused by subsidies.

4. Build flexibility into program design so that program activities can be modified effectively and rapidly based on changing market dynamics. Inevitably, exogenous political, economic, or technological changes will affect the implementation of a market transformation program. In response, program managers should create a culture that emphasizes flexibility and responsibility for results, rather than strict adherence to a plan.

5. Carefully consider the vehicles for technical assistance and technical know-how transfer that will be workable, and realistically appraise the costs of such efforts (perhaps with pilot activities prior to final cost estimation). Added flexibility also may be important. Emerging experience suggests that the costs and challenges associated with technical know-how transfer may be high or, at minimum, difficult to estimate in advance.

6. Emphasize standards, labeling, and building codes. Building codes and minimum energy efficiency standards and labeling are among the most powerful tools for transforming a market, as they remove the least efficient products from the market and encourage the purchase of higher efficiency products.

7. Allocate a portion of the program's budget for activities that support replication and the dissemination of results, including preparing papers, conducting workshops, making project documentation accessible (i.e., on the Web), and actively sharing experience and supporting outside stakeholders who are considering or initiating similar approaches.

8. Begin monitoring and evaluation early, so as to measure pre-program baselines. Early start-up of M&E offers another important benefit: By tracking relevant indicators in parallel with program implementation, the M&E can provide real-time feedback on market conditions that can be used to refine the program design.

Above all, market transformation programs depend on "market-based" thinking that is not usually part of the traditional toolset of the engineers and economists who typically design energy efficiency programs. As a result, they may overlook certain design strategies and program tools. The program team should consider staff or consultants with experience in marketing, public relations, finance, and business planning. Market research takes on particular importance in a market transformation programs. Future programs that seek to increase the penetration of an energy-efficient technology can benefit from guidance, such as that contained in this report, based on emerging experience and lessons, design principles, programmatic tools, and management practices associated with effective market transformation programs.

Annex A: Market Transformation History and Global Trends

Historical Background

Historically, the concept of market transformation grew out of utility demand-side management (DSM) experience in North America and Sweden in the 1980s and early 1990s. Utility-run DSM programs had used audits, information, rebates, and other tools to achieve a target penetration of energy-efficient products. These programs typically sought to meet short-term energy efficiency objectives, such as a target kWh level of savings per year. They did not explicitly address the underlying market barriers that hinder the long-term adoption of energy-efficient products and practices (Nadel and Latham 1998). In these early days of energy efficiency programs, the term and concept of "market transformation" did not yet exist.

At the beginning of the 1990s, DSM analysts observed with interest that certain DSM programs were producing sustained changes in the marketplace: the changes that were brought about by the program persisted beyond the program's closing (Keating et al. 1998). For example, the Bonneville Power Administration in the United States discovered that its 4-year incentive program to replace inefficient streetlights had captured so much of the Northwest market that distributors no longer stocked inefficient fixtures. Utilities were not the only actors behind these early market transformation initiatives. Through its procurements, the Swedish National Board for Industrial and Technical Development (NUTEK) introduced high-efficiency products that remained on the market long after the conclusion of the procurement.

The first formal and explicit presentation of market transformation as a theory took place at the 1992 Summer Study of the American Council for an Energy-Efficient Economy, which is widely recognized as the conference of record of the energy efficiency community (Keating et al. 1998). At that time, the term market transformation was introduced to describe programs in which market actors, such as utilities, government, industry, and public interest organizations, were working together to create lasting changes in the market so as to increase the penetration of energy-efficient goods and services.

After the 1992 Summer Study, some energy efficiency program designers began to put into practice the new concept of market transformation. From these early roots, market transformation blossomed into an energy efficiency approach widely sanctioned as effective and low-cost. Market transformation is now a staple energy efficiency policy in several European countries, in North America, and among international organizations such as the European Union (EU) and the International Energy Agency (IEA). Several annual conferences are dedicated to the topic. Several developing countries have adopted market transformation practices, most notably Thailand, with support from the World Bank/GEF Thailand Promotion of Electricity Energy Efficiency (Thai DSM) project.

Because of the complex nature of markets, no organization can single-handedly catalyze a market transformation. Different types of organizations have each played different roles historically:

- **Governments** can enact legislation, such as mandatory standards or labeling, that leads to market transformation. They can initiate voluntary programs, such South Africa's Green Buildings for Africa. They can use their influence as a large-scale purchaser to help create a demand for a product or service (South Africa's Energy Star computers). They can enact regulations that support the introduction of market trans-

formation programs (the Thai Energy Conservation Promotion Act), or set aside funds to support market transformation (the Thai Energy Conservation Promotion Fund). Governments can also allocate funds to support industry directly (China Green Lights).

• **Electric utilities** have proven to be effective agents for market transformation when they have a strong motivation to reduce electricity consumption. Certainly, North American and European utilities have run successful market transformation programs (B.C. Hydro motors program, Danish utilities' CFL programs). The Thai DSM programs were all run by EGAT, the national utility. Utilities are also involved in other GEF market transformation programs in Mexico (Ilumex), South Africa (ELI) and the Philippines (ELI).

• **International assistance agencies** such as USAID provide valuable support for market transformation. Through their selection of projects to fund, they also influence the types of projects undertaken. The GEF is the funding agency responsible for the largest number of market transformation programs in developing and transitional countries. Other significant funders of market transformation include USAID (support for standards and labeling, and for voluntary programs such as the Philippines Green Buildings Program), UNDP (the China Green Lights Program), the UN Foundation (support for standards and labeling via the Collaborative Labeling and Appliance Standards Program--CLASP[29]), and private grant-making foundations such as the Energy Foundation.

• **International financial institutions** such as the World Bank, the IFC, and UNDP have acted as implementing agents for GEF market transformation projects. Funding from the European Bank for Reconstruction and Development (EBRD) to ESCOs has had a market transformation impact, supporting the growth of ESCOs in Central and Eastern Europe. The IFC too is involved in funding ESCOs. For example, BEE is a Polish street lighting ESCO that the IFC funded through a small sum left over at the end of PELP.

• **Manufacturers, wholesalers, retailers, and industry associations,** though they are not likely to initiate a market transformation effort themselves, have an important role to play as program allies.

• **Local and foreign NGOs** often act as catalysts for market transformation by putting pressure on their governments to act, by as acting honest brokers who bring partners together and facilitate discussion, or by implementing program elements. For example, Polish NGOs played important roles in PELP, conducting background research, implementing elements of the program, and preparing publicity material for a range of local media outlets. The International Institute for Energy Conservation (IIEC) and the Alliance to Save Energy are American NGOs with field offices in GEF client countries. These NGOs have been longstanding "motors" behind the implementation of market transformation in GEF client countries. IIEC played a role in initiating or supporting Ilumex, PELP, Green Buildings for Africa, the Philippines Green Buildings Program, and the EBRD's support to ESCOs in Central and Eastern Europe.

• **Energy efficiency business councils** have been established in India and Hungary. In the Philippines, ELI has established a National Advisory Council on Energy-Efficient Lighting. These organizations can play a role in lobbying for and implementing market transformation programs.

• **Transnational organizations** such as the IEA, APEC, or MERCOSUR are well placed to conduct surveys of market transformation activities like the establishment of standards that have international trade implications, to act as a conduit for information, and to convene market players at conferences where they can share information (as is done by the Climate Technology Initiative of the IEA).

Global Experience with Market Transformation Interventions

The following is a brief survey of the application of market transformation practices throughout the world. The survey draws upon a vast body of market transformation experience throughout the world, and is illustrated by examples from both developed and developing countries. Measures used to catalyze market transformation include standards and labeling,

[29] CLASP was founded in 1999 by the International Institute for Energy Conservation (IIEC), the Alliance to Save Energy, and Lawrence Berkeley National Laboratory, and is supported by USAID, the UN Foundation, the Energy Foundation, and U.S. Department of Energy.

building codes, procurement, voluntary agreements, financial incentives, financing, and information. From the inherent complexity of markets, it follows that no single policy instrument can deliver all of the potential for market transformation.[30]

Standards and Labeling

Product performance standards define a minimum legal efficiency level for a particular product class, such as refrigerators, and eliminate from the market all products that do not meet this minimum efficiency level. Typically, product standards—a supply-side measure that pushes energy-efficient products onto the market—are supported by legislation requiring manufacturers to place an energy efficiency label on all products for sale—a demand-side measure that creates consumer pull towards energy efficiency.

Mandatory labeling and standards can affect most of the energy that will be used in a building 2 decades from now. Labels and standards deserve to be the cornerstone of a balanced portfolio of energy efficiency programs: When designed well, they can produce large energy savings, they are hugely cost-effective, they are a very effective way to limit energy growth without limiting economic growth, their benefits are relatively simple to quantify, they require change in the behavior of a manageable number of manufacturers rather than the total consuming public, and the resulting savings are generally ensured, comparatively simple to quantify, and can be easily verified (Wiel et al. 2001).

As part of an effort to help promote the wider use of standards and labeling for home appliances, the International Energy Agency (IEA) has documented the use of standards and labels for home appliances. It found that 22 industrialized countries have enacted energy efficiency standards (IEA 2000a).[31] Developing and transitional economies are also adopting standards or labeling. Countries that have adopted (or are in the process of adopting) mandatory or voluntary standards include Brazil, Bulgaria, China, Colombia, Costa Rica, Czech Republic, Ecuador, India, Indonesia, Iran, Korea, Malaysia, Mexico, Philippines, Poland, Russia, Taiwan, and Vietnam. Countries that have, so far, only implemented labeling programs include Lithuania, Romania, Singapore, and Thailand (IEA 2000a, Wikler 2000, Dasek 1999, Gabriello and Prias 2000, Marin and Sanchez 2000, Balseca 2000).

There is potential for further adoption of standards and labels in developing and transitional economies and for assisting those countries in the process of adopting standards. In recognition of this situation, two NGOs and a research laboratory joined forces to create CLASP (see footnote 29). CLASP's mission is to promote efficiency standards and labels in developing and transitional countries through partnerships with agencies, stakeholders, and relevant institutions in those countries. CLASP is currently supporting the participation of an international standards and labeling expert in GEF's China refrigerators projects. In Ghana, CLASP is working with the national government to estimate the potential savings from energy efficiency standards and labeling programs.

Building Codes

While standards address the efficiency level of individual products, building codes address the energy use of entire buildings or of building systems such as heating, ventilation, and air conditioning. Building codes are often set through a consensus or political process, so code requirements are generally limited to measures that are already well accepted. Once institutionalized, a code can be revised to strengthen the standards of efficiency and encourage more widespread use of energy-efficient equipment and design practices (Meyers 1998).

[30] There is a wealth of market transformation information available on the web. Examples include sites for the International Energy Agency DSM implementing agreements (http://dsm.iea.org), the American Council for an Energy-Efficient Economy (www.aceee.org), the Alliance to Save Energy (www.ase.org), CLASP activities on standards and labeling (www.clasponline.org), European refrigerator procurement (www.efficientlighting.net/html/links), European lighting market transformation efforts (www.etsu.com/eulightdesign/marketing), Green Buildings for Africa (www.greenbuildings.co.za/showcase), general market transformation links (www.energy-plus.org/English), UK market transformation programs (www.mtprog.com), and proceedings of the SAVE Conference for an Energy Efficiency Millenium, Graz, Austria November 1999 (www.eva.wrs.ac.at/save-conference/programmes/htm).

[31] The 22 countries are Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Greece, Italy, Ireland, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom, and the United States. The 15 members of the European Union (EU) have enacted certain EU-wide standards, e.g., for refrigerators.

The use of building codes is widespread in developed countries. In developing countries, they are less common, and their effectiveness is particularly dependent on enforcement. From 1982 to 1992, USAID supported the development of codes in five Asian countries. Each country has implemented and enforced the codes with a different degree of rigor. In Singapore, the code is strictly enforced. In the Philippines, the code has been issued, but it is not enforced. Thailand made its code mandatory in 1997. In Malaysia and Indonesia, the codes are voluntary, and provide guidelines that building designers are encouraged to use. Transitional countries often have building codes in place as a legacy from the Soviet era, but countries have been slow to update these codes to reflect modern performance standards; rather, codes still rely on specifying individual building materials, some of which may no longer exist.

Procurement

Procurement is a non-regulatory approach to transforming a market. A simple *bulk procurement* can reduce the price and increase the availability of existing products; a *technology procurement* seeks to go one step further and catalyze the appearance of new features in an existing product (e.g., higher energy efficiency levels, lower standby power consumption). Procurement works as follows: A large buyer, or a coordinated group of smaller buyers, plans a purchase large enough to interest manufacturers. The buyers' group formulates requirements for energy efficiency, price, quality, and other features of the product in question. Interested manufacturers submit tenders; the buyers' group evaluates the tenders and selects one or more winning manufacturers.

The initial purchase creates a "demand pull" that is meant ultimately to influence all manufacturers (not just the winners) to supply products meeting the bid criteria. The market transformation impact of procurement is usually further enhanced by supporting activities such as rebates, information, labeling, awards, etc. As procurement programs are based on voluntary actions, they are usually faster to implement than regulatory standards (Engleryd 2000, Engleryd and Ofverholm 1999, IEA 2000c).

Beginning in the 1980s, Sweden pioneered the use of procurement as a tool to improve energy efficiency. To date, Sweden has run over 30 procurements, for such residential and commercial equipment as combination refrigerator/freezers, heat pumps, windows, high-frequency lighting ballasts, and visual display units (computer screens). The winning models of the heat pump procurement, which ran from 1993 to 1995, were 30 percent more efficient and 30 percent cheaper than heat pumps prior to the competition. Within a year, these models were firmly implanted in the Swedish market, and even began to generate interest in other European countries (IEA 1997).

Procurement is now being used in other countries, such as Finland and the United Kingdom (which has established a Market Transformation Program under the Department of the Environment, Transport, and the Regions), and by groups of developed countries, under the auspices of the EU or the IEA.[32] Over 90 European organizations are participating in "Energy-plus," a procurement program for a refrigerator whose energy performance significantly exceeds that required by the current "A" (best) label of the EU. Starting in December 2000, seven refrigerators qualified by Energy-plus will be commercially available.[33] Energy-plus is a good example of procurement being used to pull the market even further beyond the common practice brought about by standards and labels.

Procurement is also being used in developing countries. In February 2000, the South African government issued a one-million-Rand (about $150,000) tender for computers, which specified that all models purchased must be delivered with the Energy Star feature enabled (IIEC 2000). The GEF Mexico High Efficiency Lighting Project used procurement to bring down the price of CFLs, and to introduce certain product features new to the Mexican mass market. The GEF Efficient Lighting Initiative (ELI) is also using procurement to bring down CFL prices.

Voluntary Commitment and Recognition

Another non-regulatory approach for transforming markets is to obtain voluntary commitments from companies to improve their energy efficiency practices. Such commitments can be used on the supply side,

[32] See http://www.mtprog.com, http://dsm.iea.org, and http://www.motiva.fi.

[33] See http://energy-plus.org.

to accelerate the introduction of new technologies, or on the demand side, to increase the penetration of energy-efficient goods, services, and practices.

The EPA's Green Lights program and its successor, the Energy Star Buildings program, approach markets from the demand side. Organizations sign a Memorandum of Understanding committing them to audit their facilities and then implement upgrades to lighting and other equipment (cooling, windows, etc). The organizations only implement upgrades which meet an agreed-upon minimum payback criterion. In 2000, the European Union launched a similar program, called GreenLight.[34]

Green Lights and Energy Star Buildings have been replicated in several developing countries. The Philippines now has a Green Buildings/Resorts program in place, which received funding from USAID and is partially modeled on the Green Lights program (Verdote et al. 2000). The program's goal is to convince building owners to invest in sustainable energy technologies. The program is run by an international NGO with offices in the Philippines; participants include utilities, government agencies, suppliers and manufacturers of energy-efficient products and services, foundations, professional organizations, environmental NGOs, and the corporations that commit to upgrading their facilities. South Africa has also initiated a similar program, named Green Buildings for Africa. As a flagship demonstration site, the facilities of the South African utility (ESKOM) were the first buildings to be upgraded under the program.[35]

Financial Incentives

Market transformation programs use different financial incentive mechanisms to reduce the price of energy-efficient equipment, and thereby reduce the first-cost barrier (Meyers 1998). The most common incentives are price rebates or grants, though tax credits and no-cost direct installation have also been used. In most cases, financial incentives have been directly offered to end users. Another approach is to offer incentives to manufacturers or builders to encourage them to supply more efficient products, with the assumption that most of the incentive will be reflected in a lower price for the product. Vendor incentives can help increase product availability, and by increasing sales volume, can bring prices down in the long term.

The relative merits of these approaches vary depending on the market niche and the program goals. Consumer incentive programs can give the program sponsor direct contact with consumers and an opportunity to educate consumers regarding efficient energy use. Manufacturer incentives have the benefit of less paperwork and lower administrative costs. When manufacturers are required to pass the incentive in full onto their customers, manufacturer incentives also result in a larger reduction in the retail product price for the same level of incentive, because distributor and dealer markups and value-added taxes are also reduced.

The Poland Efficient Lighting Project (PELP) used manufacturer incentives to increase the leverage of GEF funds. A $1 GEF subsidy resulted in a $2.80 retail price reduction by the time the product reached the end of the distribution chain. The subsidies were allocated on a competitive basis; manufacturers that offered the GEF the highest CO_2 emissions reduction per dollar of subsidy received the largest subsidies for their sales. As an additional motivation to manufacturers, their performance was assessed halfway through the program, and subsidies were reallocated in favor of those manufacturers with the highest sales.

To stimulate adoption of high-efficiency motors, B.C. Hydro had been offering an information-only program, which was not proving effective. After extensive research, the utility identified two barriers that reinforced each other: both vendor stocks and consumer demand were low. In order to reduce these barriers, B.C. Hydro decided to offer an incentive to both purchasers and vendors of high-efficiency motors. As a result, high-efficiency motors became a standard vendor stock item, leading to a natural decrease in their price; B.C. Hydro was able to gradually eliminate the incentive without adverse effects (Henriques 1993).

Incentives also have a role to play at the supply source. Special-purpose funds can help manufacturers retool to provide more efficient products. The China Green Lights program includes low-interest loans and grants to finance capacity expansion for domestic manufac-

[34] See http://www.eu_greenlight.org.

[35] See http://www.greenbuildings.co.za.

turers of CFLs. The GEF China refrigerators project will provide incentives for energy-efficient product design and conversion of factory production lines.

Financing of Energy Efficiency Investments

Actions that improve energy efficiency often require a significant initial investment of capital in exchange for future savings in energy costs. The provision of financing overcomes the barrier of lack of capital and also spreads the end user's payments over time, creating the potential for a positive cash flow (Meyers 1998).

Pay-on-the-bill financing for the residential sector is effective because it requires little or no action on the part of the customer. The use of this tool depends on a country's customs and legal systems. European and North American utilities have had much experience with pay-on-bill programs. Experience among GEF client countries is less widespread. Utilities in Peru sent low-income customers a coupon that they could redeem for a CFL; the customer reimbursed the utility for the cost of the lamp through a 24-month, pay-on-the-bill scheme. In Poland, however, utility regulations effectively prohibited utilities to engage in pay-on-the-bill schemes, and so PELP was unable to make use of this financing strategy. In South Africa and the Philippines, ELI will work with the utilities to arrange a pay-on-the-bill scheme for newly electrified residential customers.

On the non-residential side, energy service companies (ESCOs) are a powerful force for transforming the market for energy efficiency services. ESCOs typically provide energy efficiency upgrades on a paid-from-savings basis: The ESCO's services result in a reduction of the client's energy bill, and the client pays the ESCO a portion of those bill savings. This financing scheme reduces the client's first-cost burden. Since the mid-1990s, the EBRD has been supporting the development of ESCOs in Central and Eastern Europe. Thanks to its support, several large ESCOs are now operating in the region.

Low- or zero-interest loans can help facilitate purchases of energy-efficient equipment, by spreading the high first-cost over several payments. The GEF Thai chillers program helps business owners replace existing chillers with more efficient models by offering a loan for the purchase of a new chiller. In South Africa, ELI is helping transform the residential real estate market: ELI is working with financial institutions to develop product financing and home mortgage products that either provide consumer financing for energy-efficient lighting or grant a lower mortgage interest rate to housing with energy-efficient lighting.

Information and Marketing

For most energy-efficient products, lack of information on the product's advantages (or existence) is a strong barrier to sales. Therefore, providing information is a pillar of any market transformation program. Voluntary programs such as the U.S. Green Lights and Energy Star Buildings programs are essentially information programs. They provide information on the financial benefits of energy efficiency, technologies appropriate for different applications, local contractors that can install the technologies, decision support tools for analyzing upgrade options, and sources of grants or loans for the upgrades. The Green Buildings for Africa and Philippines Green Buildings programs operate in a similar way.

Often, information is part of a strategy that includes other approaches as well. The GEF Thai fluorescent lighting program used an $8 million nationwide advertising campaign to promote the replacement of T-12 fluorescent lamps with energy-efficient T-8 models; the promise of such a large advertising campaign helped lure manufacturers into signing voluntary agreements to eliminate T-12 lamps in favor of T-8 lamps. The nationwide advertising campaign in PELP was timed to accompany a temporary CFL price reduction. The campaign served the double purpose of alerting consumers to the price reduction and educating them on CFLs.

Technology transfer and technical assistance are information tools for the supply side of a market. These tools can be instrumental in helping developing country industries manufacturer high-quality, reasonably priced, energy-efficient products. Technology transfer is a main element of the GEF China refrigerators project and boilers project.

There are many additional ways market transformation programs can use information to reach their goals, limited only by the creativity of program designers. Demonstration buildings have been used by North American and European programs (Green Lights, European GreenLight), and are especially important in a developing country context, where

energy efficient technologies and practices may not yet be standard, and equipment purchasers need to "see it to believe it". The Green Buildings for Africa and Philippines Green Buildings programs have both used high-profile demonstration buildings as proof-of-concept models. The CFL market worldwide has suffered a loss of consumer confidence due to an influx of low-quality products. In response to this problem, ELI enables manufacturers to mark packages of qualified CFLs with a logo that identifies high-quality lamps. Other information tools include education for schoolchildren, energy audits, best practices, and labels, which were discussed previously.

Annex B: Stakeholder Involvement

The nature of market transformation approaches demands participation by a wide variety of stakeholders and careful selection of an appropriate executing agency. In the GEF portfolio, the nature of the executing agent has varied widely. Two projects, in Mexico and Thailand, are executed by national electric utilities.[36] Two China projects are implemented by government agencies; the efficient industrial boilers project is executed by a specialized project management office under the direction of the State Administration of the Machinery Industry (formerly a Ministry), and the efficient refrigerators project is implemented by the Ministry of Environmental Protection. The Thai chillers project is executed by a mix of public and private entities: The Thai Department of Industrial Works (under the Ministry of Industry) is the project manager, but decided to delegate most tasks to the Industrial Financial Corporation of Thailand (IFCT), a Thai development bank with partial government ownership.

IFC projects are executed through private sector agents. IFC assigned responsibility for the Poland lighting project to an association of Dutch utilities (the Netherlands Energy Company B.V.), which then established an independent project company (NECEL) in Poland to implement the project. The Efficient Lighting Initiative is administered and managed on a regional basis by three foreign electric utility organizations, each with a different geographical area of responsibility. Different types of organizations are in turn responsible for on-the-ground implementation: a local subsidiary of the foreign utilities (Argentina, Philippines), an independent local utility (Peru), a local firm (Hungary, Latvia), a local NGO (Czech Republic), or an independent subsidiary of a local utility (South Africa).[37]

The participation of stakeholders has been an essential part of the design and implementation of GEF market transformation programs (see Table 4). Stakeholder groups can be categorized into government, electric utilities, industry/manufacturers, the financial sector, NGOs, and "other," including non-GEF sources of donor assistance. Three projects include participation by all six of these stakeholder categories (Thailand chillers, Thailand DSM, and the Efficient Lighting Initiative). The participation of stakeholders has been an essential part of project design and implementation. For example, cooperation with government has helped ensure that a project's activities are harmonized with current or planned legislation (Thailand chillers). Close relationships with industry allow project implementers to closely follow market developments (Efficient Lighting Initiative). NGOs have been able to act as neutral endorsers of a project, thus enhancing the credibility of the project's message (Poland lighting).

[36] In Mexico, the federally owned Comision Federal de Electricidad, and in Thailand, the Electricity Generation Authority of Thailand

[37] Danish Power Consult (DPC), the consulting arm of Danish utilities, is administering ELI in Europe. DPC in turn works through local organizations in each country. In the Czech Republic, ELI is being implemented by SEVEn, a local NGO. In Hungary and Latvia, DPC has contracted a local consulting firm to implement ELI (EGI Kft. in Hungary, and Sia. Ekodoma in Latvia). The Spanish utility Endesa is responsible for implementing ELI in Latin America. Endesa has delegated implementation responsibility to its Peruvian and Argentinian utility subsidiaries, EDELNOR and Edesur. Finally, the Spanish utility Soluziona Ingeneria implements ELI in South Africa and the Philippines. In South Africa, Soluziona Ingeneria has hired Bonesa, an independent company established by ESKOM, the South African utility. Soluziona Ingeneria has a local office in the Philippines, and has hired internal staff to implement ELI directly.

Table 4: Participation of Stakeholders in GEF Projects for Energy-Efficient Products

Project	Government	Industry	Electric Utilities	Financial Sector	NGOs	Other / ODA
Mexico High Efficiency Lighting Pilot (1991) World Bank $10 m. GEF $23 m. total		Some companies offered employees opportunities to purchase CFLs via a paycheck deduction	Comision Federal de Electricidad (CFE) was responsible for execution, and contri-buted $10 m.			Government of Norway, $3m grant. FIDE, a public/ private trust, has carried on lighting promotion modeled on Ilumex.
Thailand Promotion of Electricity Energy Efficiency (1991) World Bank $9.5 m. GEF $190 m. total	Ministry of Finance was recipient of grant, and allocated funds to EGAT. National Energy Policy Office, Department of Energy Development and Promotion, and Energy Conservation Center of Thailand also played roles.	EGAT negotiated agreements with various industry sectors, such as with manufacturers of lighting or refrigerators.	Electricity Generating Authority of Thailand (EGAT) responsible for execution	Banks offered line of credit to large consumers in air conditioning program.	International Institute for Energy Conservation (IIEC); industry associations such as the Federation of Thai Industry, and Thai Tourist Association assisted with research.	Government of Australia, $5.6 m grant; Japan OECF, $25m loan
Poland Efficient Lighting Project (1994) IFC/World Bank $5 m. GEF $5 m. total	Government participation in advisory committee; Ministry of Education endorsement of school projects.	CFL manufacturers (including GE, Philips, Vox Maya) signed formal agreements, including contributions to retail price subsidies.	None: Utilities interested in a DSM pilot, but Polish law prohibited them from leasing CFLs, so ultimately they could not participate.	DSM pilot offered consumers option of a loan for purchase of CFLs, but none took up the offer.	Four NGOs[38] endorsed consumer advertising materials, and one ran elements of project (Polish Ecological Club).	Cooperation with Dutch ODA (Novem) on development of lighting audit standards, and with German NGO (WWF) on student education.
China Efficient Industrial Boilers (1996) World Bank $33 m. GEF $101 m. total	Project management office, under State Economic and Trade Commission	Nine participating boiler manufacturers and five auxiliary equipment manufacturers		Responsible for loans to boiler manufacturers to upgrade production facilities		U.S. assistance for development of standards

[38] Polish Ecological Club, Polish Consumer Federation, Polish Energy Efficiency Foundation, and Poland Energy Efficiency Agency

Table 4: Participation of Stakeholders in GEF Projects for Energy-Efficient Products (cont'd)

Project	Government	Industry	Electric Utilities	Financial Sector	NGOs	Other / ODA
China: Barrier Removal for Energy-Efficient Refrigerators (1998) UNDP $9.9 m. GEF $41 m. total	Ministry of Environ. Protection; Electrical Appliances Association; Household Electric Appliance Research Institute	Sixteen participating refrigerator manufacturers		Banks are loaning funds to refrigerator manufacturers to upgrade production facilities.		U.S. assistance for development of standards
Thailand: Building Chiller Replacement Program (1998) World Bank $2.47 m. GEF $$5.2 m. total	Department of Industrial Works is project owner; co-funding from National Energy Policy Office	Project was developed in close cooperation with Thai chiller suppliers, who agree to certain conditions when their products are sold through the project.	Project was initially to be implemented through EGAT, but due to EGAT's announced privatization, the project was restructured.	Project implementer is the Industrial Financial Corporation of Thailand, a Thai development bank with partial government ownership.	Industry associations such as the Hotel Industry Association informed their members about the project.	$2.47 from the Multilateral Fund for the Implementation of the Montreal Protocol (MLF); $260,000 from the National Energy Policy Office.
ELI: Argentina $2.0 m.	MoU with Energy Secretary: standards, tariff reform, etc; Secretary of Industry and Commerce: consumer protection. Also government as client for ESCO services.	Demonstration projects.	ELI seeking permission from electricity regulatory agency for distribution companies to sell CFLs to customers.		Consumer association to cooperate in CFL testing; NGOs helping with education activities in primary and secondary schools.	Argentina Institute of Standardization (IRAM) may formally adopt ELI standards.
ELI: Czech Republic $1.25 m	Czech Energy Agency cooperated on information and financing; training for municipalities; successful lobbying resulting in favorable changes in legislation.	Training and financing will be provided to lighting SMEs. Large lighting manufacturers (GE, OSRAM, Philips) are assisting with training and audits.	Small-scale involvement of local utilities.	Czech Savings Bank issuing loan for streetlighting project. Discussions ongoing with local banks about bundling smaller projects.	Executing agency is SEVEn, a Czech NGO. NGO "Teresa" involved in lighting/ efficiency education in primary and secondary schools.	

Table 4: Participation of Stakeholders in GEF Projects for Energy-Efficient Products (cont'd)

Project	Government	Industry	Electric Utilities	Financial Sector	NGOs	Other / ODA
ELI: Hungary $1.25 m	Training provided to municipalities with support from Ministries of the Interior, of Economics, and of the Environment.	Training and financing will be provided to lighting SMEs. Large lighting manufacturers (GE, OSRAM, Philips) are assisting with training and audits.	Small-scale involvement of local utilities.	Banks participating in IFC/GEF Hungary Energy Efficiency Co-financing Program (HEECP) may provide financing to lighting SMEs.	NGO involvement planned but not yet finalized.	Close cooperation with (HEECP), possible cooperation with a UNDP/GEF Efficiency in Public Buildings project
ELI: Latvia $650,000	Cooperation with municipal governments on CFL promotion and financing;	Facilitation of industry working group on lighting norms; training for lighting industry.	Latvenergo playing a supporting role in municipal efficient lighting promotion.	Ongoing dialogue with banks on support for energy-efficient lighting loans.	Local NGOs will play a role in municipal CFL campaigns.	Additional support for information dissemination on new lighting norms expected from Danish Energy Agency.
ELI: Peru $2.1 m.	Demonstra-tion project in Peruvian Navy; support to municipal streetlighting projects.	Cooperation with supermarket chains on CFL promotion.	Edelnor and Luz del Sur preparing CFL programs; assistance to Grupo Gloria on streetlighting projects.			Cooperation with universities to integrate efficient lighting into curriculum.
ELI: Philippines $2.5 m.	Collaboration with Department of Energy—Energy Utilization Management Bureau and Fuels and Appliance Testing Laboratory. Collaboration with Department of Trade and Industry Bureau of Product Standards. Technical assistance to the Energy Regulatory Board.	Cooperation with local offices of Philips, GE and OSRAM, as well as Yatai International Corporation, on CFL promotion. Electronic ballast manufacturers interested in having their products qualified include Philips, Matsushita, and the local firm Quantum Electronics Corporation.	CFL leasing pilot program created with Manila Electric Company and likely with Cagayan Electric Power & Light Company. Possible cooperation with the 119 electric cooperatives under the supervision of the National Electrification Administra-tion for village electrification projects.	Discussions underway with Philippine Office of the IFC to support utilities, manufactur-ers and ESCOs with direct lending or with loans through accredited local banking intermediaries such as the Planters Development Bank.	ELI has created the National Advisory Council for Energy Efficient Lighting (NACEEL). The local office of IIEC is a strong ally in some country activities. Possible alliance with Energy Management Association of the Philippines and Institute of Integrated Electrical Engineers.	

Table 4: Participation of Stakeholders in GEF Projects for Energy-Efficient Products (cont'd)

Project	Government	Industry	Electric Utilities	Financial Sector	NGOs	Other / ODA
ELI: South Africa $2.5 m.	Cooperation with the South African Ministry of Mines and Natural Resources	Partnering with lighting manufacturers including GE, Philips, Osram, and others.	Eskom providing 76% of total program funding. Small municipal electricity distributors also targeted for partnering.		IIEC's South Africa office has been a major subcontractor. Other South African NGOs may take implemen-tation roles.	

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