

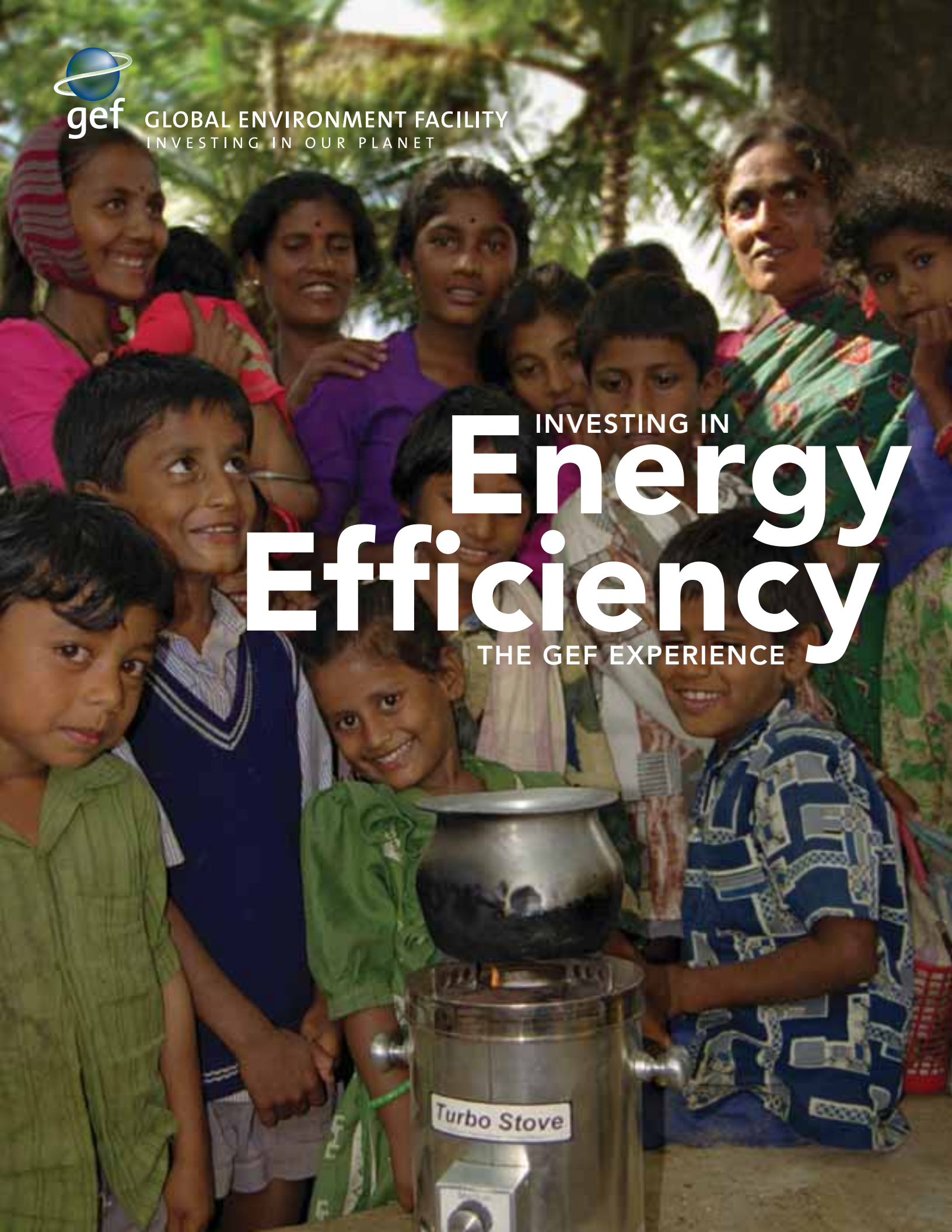


GLOBAL ENVIRONMENT FACILITY
INVESTING IN OUR PLANET

INVESTING IN

Energy Efficiency

THE GEF EXPERIENCE





Foreword

Cover Page: Energy efficient Turbo Stoves improve the quality of life for rural people in India

This Page: Technicians in a foundry, China. GEF has supported small and medium-size enterprises in China and other developing countries to improve their energy efficiency and reduce greenhouse gas emissions



Monique Barbut
CEO and Chairperson
Global Environment Facility

Between now and 2030, world energy demand is projected to grow by 1.6 percent annually, adding up to a dramatic 45 percent increase. Meanwhile, energy demand in developing and transition countries is predicted to grow even faster than in developed countries. Such rapidly growing energy demand is particularly challenging given that most of the world's population still relies on energy from limited fossil fuel sources and traditional biomass.

Dependable and affordable energy supplies are crucial to economic growth in both developed and developing countries—to power homes, connect communities, provide safe water, and promote economic and human development. Yet too often the world's most vulnerable citizens lack the means to make the environmentally friendly choices that would best protect human health and the planet's natural systems.

Over its 18-year history, the Global Environment Facility (GEF) has helped countries make local investments for global environmental benefits, while fulfilling its mission as the financial mechanism of the United Nations Framework Convention on Climate Change (UNFCCC) and other multilateral environmental agreements. Working with our partners in the public and private sectors, we have provided more than US\$8.6 billion for more than 2,400 environmental projects in 165 countries, leveraging more than US\$36 billion in cofinancing.

Today the GEF is one of the public sector's largest funders for energy efficiency in the world, with direct investments of

US\$850 million in more than 90 developing and transition countries and an additional US\$5.9 billion in cofinancing. These investments are expected to reduce carbon dioxide (CO₂) emissions by 1.3 billion tonnes by 2020.

The GEF has invested a substantial share of its resources in projects that remove market and other barriers to energy efficiency. Through its support, developing countries have introduced a combination of policies and regulatory frameworks, standards and labels for appliances, lighting, buildings, and industrial equipment. They have

established market-based approaches and financial instruments. Finally, the GEF has fostered technology transfer through the demonstration of energy-efficient technologies that directly affect current and future generations.

The GEF remains committed to improving energy efficiency as a pivotal way to meet the climate change challenge. We look forward to further partnerships with the public and private sectors to remain a premier source of funding for global environmental projects.





Energy Efficiency: An Opportunity for Developing Countries

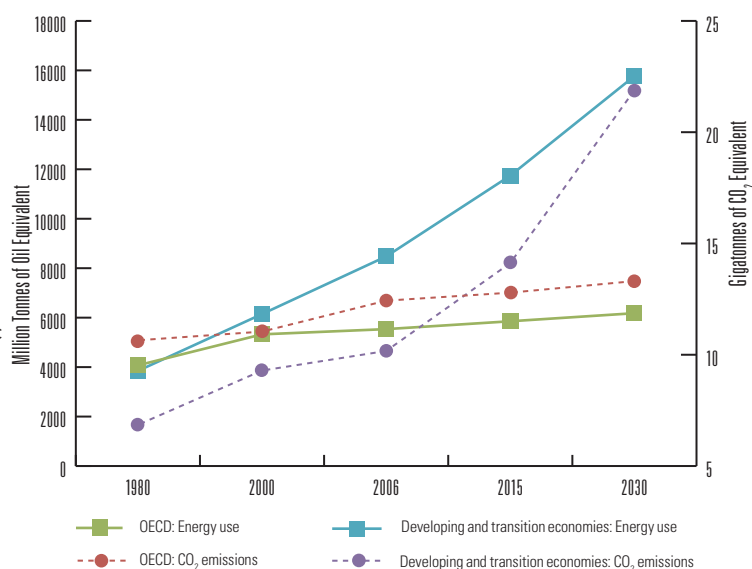
Worldwide demand for energy is increasing. Between now and 2030, world energy demand is expected to grow by 1.6 percent per year, resulting in an overall increase of 45 percent (IEA 2008). As a result, energy-related CO₂ emissions will increase by 1.7 percent per year, to reach 40.4 billion tonnes in 2030—a 55 percent increase over 2004 levels (IEA 2006). If not curtailed, increasing energy demand and the resultant increase in CO₂ emissions could significantly impede the international community's efforts to address human-induced climate change.

The increase in energy demand poses a particular challenge—and a unique opportunity—for developing countries and transition economies. Between now and 2030, these countries are expected to provide 80 percent of the world's economic growth, 76 percent of global energy-demand growth, and 64 percent of the energy-related CO₂ emissions growth (Figure 1).

Most developing countries and transition economies are energy importers, so the likely increase in future energy costs could jeopardize their economic growth. The commercial exploitation of their own resources, renewable or otherwise, involves long-term infrastructure development and requires significant investment with scarce financial resources. Under these circumstances, energy efficiency measures will not only limit demand and improve energy security, but enhance economic competitiveness, generate employment, and reduce local, regional, and global air pollution (IPCC 2007).

In addition to economic benefits, energy efficiency measures have great potential to reduce CO₂ emissions. According to IEA's projections, end-use efficiency could account for 45 percent of the global CO₂ emissions reductions by 2050 (IEA 2006) (Figure 2). Efficiency measures also save money for end

FIGURE 1 WORLD PRIMARY ENERGY DEMAND AND ENERGY-RELATED CO₂ EMISSIONS, BY COUNTRIES



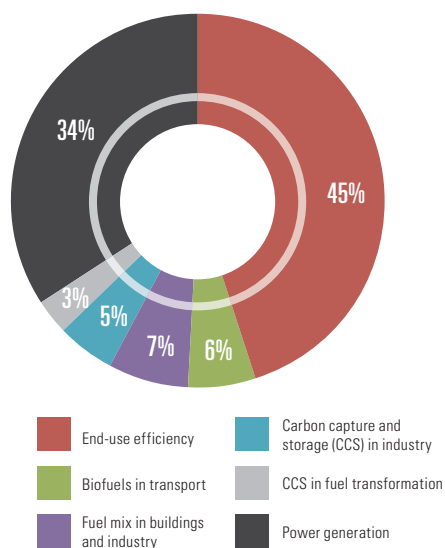
Source: IEA. 2008. World Energy Outlook 2008. Paris: Organisation for Economic Co-operation and Development (OECD).

users. They are so cost-effective (in terms of cost per tonne of CO₂ emissions reduction) that most of them even have negative abatement costs; that is, they are profitable to implement (Enkvist et al. 2007).

The building and industry sectors present particular opportunities to showcase energy efficiency measures.

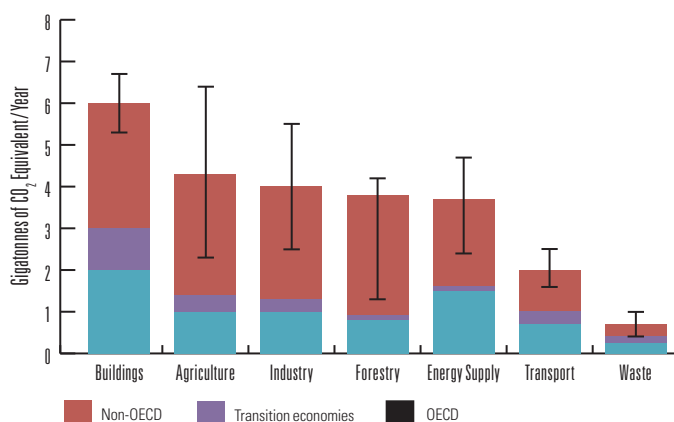
FIGURE 2 REDUCTION IN CO₂ EMISSIONS IN THE IEA MAP SCENARIO BY TECHNOLOGY AREA

(SHARE OF REDUCTION BELOW BASELINE SCENARIO IN 2050)



Source: IEA. 2006. *Energy Technology Perspectives 2006*. Paris: OECD.

FIGURE 3 ECONOMIC MITIGATION POTENTIAL BY SECTOR IN 2030 ESTIMATED FROM BOTTOM-UP STUDIES



Source: IPCC. 2007. *Climate Change 2007—Synthesis Report*. Geneva: IPCC. Uncertainty bar: Total sectoral potential at US\$100/tCO₂ eq in GtCO₂ eq/yr.

The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report (*Climate Change 2007—Synthesis Report*) shows that these sectors account for more than 41 percent of total potential emissions reductions (IPCC 2007) (Figure 3). This is especially true in developing countries, where rapid urbanization and industrialization drive most of the growth in energy demand and thus in CO₂ emissions. New investments in buildings and industry can be much more efficient than the current baseline and even more efficient than in some developed countries. As a consequence, developing countries and transition economies account for 67 percent of the CO₂ emission reduction potential in buildings and 75 percent of that in industry (Figure 3).

The GEF Strategy on Energy Efficiency

Recognizing the importance of energy for economic development, as well as the negative effects of inefficient energy use, the GEF has made it a strategic objective to support projects that not only promote the transfer of energy-efficient technologies but also enable work with regulatory institutions on reforming policies and regulations in this vital sector. As an operating entity of the UNFCCC's financial mechanism, the GEF has supported climate change mitigation efforts in developing countries during the past 18 years in close cooperation with recipient countries and the 10 GEF Agencies. The GEF's work on climate change has maintained a strong focus on the transfer of environmentally sound technologies (ESTs), closely allied with the UNFCCC's technology transfer framework.

In 1995, the GEF's operational strategy laid the foundation for its efforts in energy efficiency to mitigate climate change. Under this strategy, Operational Program 5 ("Removal of barriers to energy conservation and energy efficiency") focused on market transformation by removing barriers to the wide adoption of energy-efficient technologies.

The barriers targeted included price distortions (e.g., subsidized energy tariffs); regulatory barriers and biases (e.g., inability of governments to formulate and implement policies); lack of information; insufficient management capacity; inability to analyze nontraditional projects; higher perceived risk of alternative technologies; high transaction costs; high initial costs (e.g., inability to amortize, poor access to credit); and appropriation effects (e.g., the agent that



Smart grid sensors and controls and well-trained technicians enhance operating efficiency of the electric grid in The Bahamas

bears the costs cannot recover investment benefits). Through its barrier-removal strategy, the GEF invests in projects using the following approaches:

- Policy and regulatory reforms: energy efficiency and conservation policies, energy tariff regulations, demand-side and supply-side measures
- Standards and labeling: building codes, minimum energy performance standards and energy labels for appliances and equipment, efficient lighting
- Market-based approaches: establishment and operation of energy service companies (ESCOs)
- Financial instruments: investment grants, partial loan guarantees, loan loss reserve funds, special purpose and revolving funds, equity funds
- Technology demonstration and diffusion: demonstration, deployment, and transfer of energy-efficient technologies

By implementing this strategy, the GEF promotes replication that encourages market transformation. To sustain such transformation, all GEF projects strive to develop local capacity, disseminate best practices, and build public awareness.

The GEF has continually refined its approach to energy efficiency to reflect emerging scientific, technological, and

policy developments. From the third replenishment of the GEF Trust Fund (GEF-3) (2002–2006), the strategy focused on energy efficiency in buildings, appliances, and industry. This choice was consistent with the analysis of greenhouse gas (GHG) emissions reduction potential in these three sectors. In GEF-4 (2006–2010), the GEF Council reaffirmed these main features along with revised Focal Area Strategies, which also included energy efficiency in buildings, appliances, and industry.

The GEF-4 strategic objective covered the entire spectrum of building performance, including the building envelope; systems for heating, cooling, and lighting; and household appliances and office equipment. In the industrial sector (which includes energy firms and utilities), the strategy covered a wide range of the energy systems used for power production, manufacturing, and processing, including: combustion; steam; process heat; combined heat and power; compressed air, motors, pumps, and fans; and manufacturing technologies, such as kilns and furnaces, used in the production of basic materials. Governments' commitment to adopt and enforce standards and regulations, as well as their adoption of appropriate energy pricing frameworks, was essential for ensuring project effectiveness under the energy efficiency strategic program.

The GEF's Investment in Energy Efficiency

Portfolio Overview

From 1991 to December 2008, the energy efficiency portion of the GEF climate change portfolio amounted to about US\$850 million, with an average of US\$6.5 million per project. This GEF funding has been supplemented with US\$5.9 billion in cofinancing (Table 1). Funding for the energy efficiency portfolio increased by 12 percent from GEF-2 (1998–2002) to GEF-4 (2006–2010) (Figure 4). This trend is directly attributable to the increased importance that GEF-recipient countries place on energy efficiency.

Since its inception, the GEF has supported 131 energy efficiency projects. Regionally, most of the GEF's climate change investments are in Asia, Eastern Europe, and Central Asia—reflecting these regions' increased needs for energy, fueled by their high economic growth rates and significant populations (Table 2 and Figure 5).

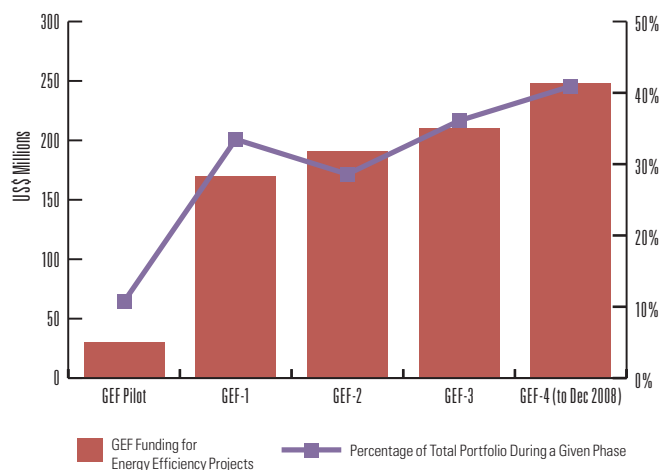
Differences in project design assumptions, time frames, project types, and intervention strategies make it difficult to estimate the impact of energy efficiency projects on CO₂ emissions reduction. Analysis of project documents indicates an expected direct CO₂ emissions reduction of 1.3 billion tonnes of CO₂ equivalent by 2020. As the GEF continues to increase its investments in energy efficiency projects, they will have an expanding global impact. By 2020, projects begun under GEF-4 (as of December 2008) are expected to mitigate an estimated 582 million tonnes of CO₂.

The average cost-effectiveness of GEF funding for energy efficiency projects is estimated to be about \$0.64 per tonne of CO₂ (direct emissions reductions only). This ratio is the lowest among all GEF programs, and it demonstrates the efficiency of CO₂ emission reductions through adoption of energy efficiency measures.

Types of Interventions

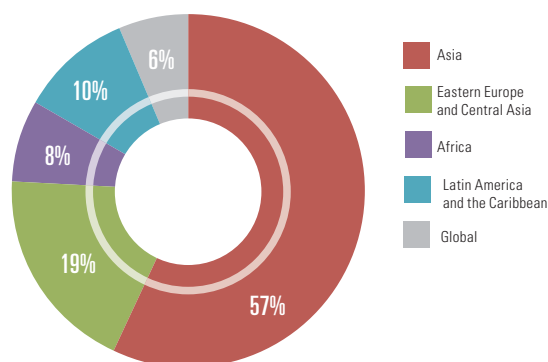
GEF energy efficiency projects span various economic sectors. They are carried out on the municipal, residential,

FIGURE 4 ENERGY EFFICIENCY SHARE OF THE GEF CLIMATE CHANGE PORTFOLIO



Source: GEF Project Tracking and Management Information System.

FIGURE 5 REGIONAL DISTRIBUTION OF THE GEF PORTFOLIO IN ENERGY EFFICIENCY BY FUNDING LEVEL



Source: GEF Project Tracking and Management Information System.

TABLE 1 LEVEL OF FINANCING IN ENERGY EFFICIENCY (IN US\$ MILLIONS)

Phase	GEF Financing	Cofinancing	Total
GEF Pilot (1991–1994)	30.1	213.2	243.3
GEF-1 (1994–1998)	169.9	873.2	1,043.1
GEF-2 (1998–2002)	190.8	1,477.1	1,667.9
GEF-3 (2002–2006)	209.9	1,303.6	1,513.6
GEF-4 (2006–2010) to Dec 2008	248.2	2,018.5	2,266.7
Total	848.9	5,885.6	6,734.5

Source: GEF Project Tracking and Management Information System.

and industrial levels and address the market, regulatory, financial, and technological barriers mentioned earlier. In addition to building capacity and raising awareness, which are within the scope of all the projects, the GEF relies on the following five general project models to remove existing barriers:

- Projects that focus on policy and regulatory frameworks
- Projects that develop standards and labeling programs
- Projects that rely on market-based approaches
- Projects that establish financial instruments
- Projects that focus on specific sectors and technologies

TABLE 2 REGIONAL DISTRIBUTION OF THE GEF ENERGY EFFICIENCY PORTFOLIO

Region	Number of Projects	GEF Financing (US\$ millions)	Cofinancing (US\$ millions)
Asia	58	485.0	3,988.5
Eastern Europe and Central Asia	35	159.8	738.5
Africa	18	64.6	364.0
Latin America and the Caribbean	14	87.5	502.7
Global	6	52.1	291.9
Total	131	849.0	5,885.6

Source: GEF Project Tracking and Management Information System.

During the GEF Pilot Phase (1991–1994) and GEF-1 (1994–1998), the energy efficiency portfolio focused on technology demonstration and policy and regulatory transformation. Under GEF-2 (1998–2002), the distribution was tipped toward technology transfer, standards and labeling, and financial instrument interventions. GEF-3 (2002–2006) was marked by a prevalence of market-based solutions and policy and regulatory transformations.

Today, the GEF portfolio focuses on (a) establishing comprehensive standards and labeling programs and regulatory

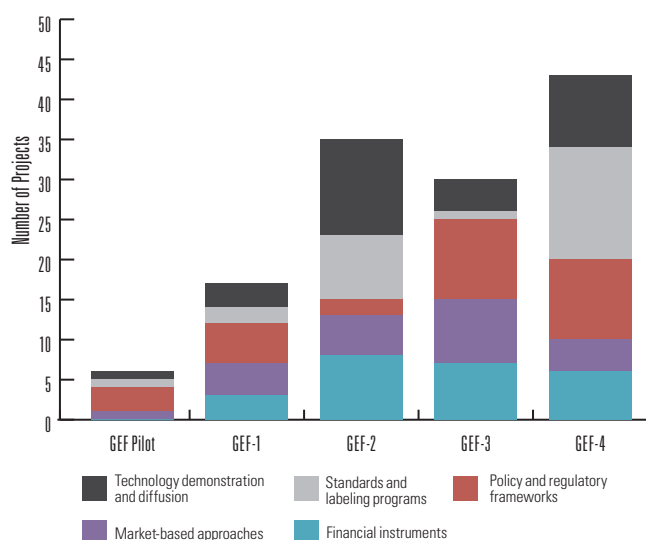
frameworks and (b) demonstrating and deploying energy-efficient technologies. In addition, the GEF is expanding the scope of its assistance to encompass more integrated systems approaches, particularly for standards and labeling programs in the industrial and residential sectors (Figure 6).

Regionally, Eastern Europe and Central Asia accessed GEF funding mostly during the first three GEF phases (1994–2006) for projects using market-based and/or financial mechanisms. Asia (particularly China) also began to receive GEF funding early (in 1991), directing it toward projects dealing with regulatory frameworks, market transformation, and technology transfer. While Asia continued to attract the largest share of GEF funding throughout all GEF phases, the funding share of the transitioning economies in Eastern Europe and Central Asia has consistently declined in favor of financing for least developed countries (LDCs) in Africa and Latin America and the Caribbean. Recent projects in the latter regions focus on regulatory frameworks and market-based approaches, as was the case in the Asian countries in the early phases of the GEF.



Technician in a heat and hot water boiler manufacturing facility that utilizes energy-efficient metal working techniques, Russia

FIGURE 6 TRENDS IN GEF INTERVENTIONS BY NUMBER OF PROJECTS



Source: GEF Project Tracking and Management Information System.

Policy and Regulatory Frameworks

Since the GEF's Pilot Phase, the World Bank and the United Nations Development Programme (UNDP) have been the primary implementers of projects addressing policy and regulatory frameworks. This approach targets overall energy policy; demand-side and supply-side measures; energy tariff regulations; power sector reform; energy efficiency policies, laws, targets, and plans; establishment of energy efficiency agencies; and promotion of energy efficiency audits. National authorities are highly involved in these projects—leading policy drafting, adopting project components, and participating in and facilitating capacity-building initiatives among public administrators.

Examples of projects include a UNDP project in Bulgaria that developed an energy efficiency strategy to mitigate GHG emissions and supported the development of the Bulgarian Energy Efficiency Act and the National Energy Efficiency Program (Box 1). In India, the Energy Efficiency project of the World Bank helped the government to decentralize procedures in the power sector and to promote energy efficiency. Additional projects include GEF-3 China-based projects on heat reform and building energy efficiency (World Bank) and end-use energy



efficiency (UNDP) as well as a GEF-4 project on thermal power efficiency in China (World Bank).

In terms of demand-side management (DSM), GEF projects rely on the financial, organizational, and technical strengths of local utility companies to deliver small-scale energy efficiency investments in the utility, building, and municipal sectors. The World Bank has supported projects promoting energy efficiency in Mexico, Thailand, Vietnam, and Jamaica through utility-based DSM demonstrations.

During GEF-4, the United Nations Industrial Development Organization (UNIDO) also began to implement projects emphasizing the development of regulatory frameworks. Two examples are a UNIDO project promoting energy efficiency in selected small and medium enterprise (SME) clusters in India and a joint UNIDO-UNDP project on improving industrial energy efficiency in Turkey.

Projects in Thailand, the Philippines, Laos, Vietnam, Peru, Ecuador, Argentina, the Russian Federation, Belarus, Kazakhstan, Mongolia, and Mauritius also address policy and regulatory frameworks to promote energy efficiency.

BOX 1 BULGARIA – ENERGY EFFICIENCY STRATEGY TO MITIGATE GREENHOUSE GAS EMISSIONS

GEF Agency: UNDP
GEF: US\$2.5 million
Cofinancing: US\$3.9 million
Dates of Implementation: 1996–2004

BACKGROUND

During the project period, Bulgaria implemented significant economic reforms. By the end of the project, the economic and investment climate allowed private investors to enter the market to finance energy efficiency retrofits and projects in both the public and the private sectors.

PROJECT OVERVIEW

The project aimed to introduce municipal-level practices to overcome barriers to improved energy efficiency and reduced emissions of GHGs and other environmental pollutants. The project was organized into two main elements:

- National capacity building to establish sustainable energy policies and programs and to enhance public awareness in municipalities
- Demonstrations to accelerate sustainable energy projects in municipalities (in street lighting, district heating, and energy efficiency in buildings) by showing their potential for energy and economic savings and for GHG emission reductions

The capacity-building activities focused on municipalities as the critical political and socioeconomic unit to bring about change in Bulgaria. They included municipal energy management, training, and financing.

The project helped promote energy efficiency by developing capacity to prepare energy efficiency projects based on practical experience from successful demonstrations.

By initiating actions to establish sustainable energy policies, the project contributed to the development of the Energy Act (2003) and the Energy Efficiency Act (2004), which together established provisions recognizing housing associations as legal entities entitled to preferential energy prices and energy efficiency projects financed by the Energy Efficiency Fund. In response to the success of accompanying demonstrations, 37 municipalities established their own energy efficiency programs—a notable achievement. On the basis of these programs, many energy efficiency projects related to municipal buildings, district heating systems, and street lighting were developed and implemented.



Children studying at night with aid of a light-emitting diode (LED), Ghana. GEF is one sponsor of the Lighting Africa Initiative

Standards and Labeling

UNDP, which excels at capacity building worldwide, has been the customary agency to implement projects establishing standards and labeling. GEF-supported interventions typically focus on instituting building codes; minimum energy performance standards and energy labels for appliances and efficient lighting fixtures; consumer education; and testing and certification of appliances. In countries with substantial manufacturing capacity, the GEF has also supported enterprises to develop new energy-efficient appliance models and to acquire technical information and knowledge from more advanced countries.

For example, in Tunisia, 10 out of 12 local appliance manufacturers now offer locally certified energy-efficient models (Box 2). Similarly, through its project to promote widespread commercialization of energy-efficient refrigerators in China, the GEF and UNDP provided technical assistance to refrigerator and compressor manufacturers, who improved their average energy efficiency by 29 percent between 1999 and 2005. Under this project, sales of top-rated energy-efficient refrigerators increased from 360,000 in 1999 to 46 million units in 2008, helping to drive increased production capacity. In addition, China's refrigerator exports in recent years have grown by 35 percent annually.

Under GEF-4, UNDP is implementing a significant program on energy efficiency in buildings, including more than 20 national projects. For appliances and equipment, UNDP supports a large regional program to remove barriers to the cost-effective development and implementation of energy standards and labeling. This program aims to transform the markets of household and office appliances (e.g., refrigerators and air conditioners); equipment (e.g., electric motors and fans); and lighting products (e.g., compact fluorescent lamps and ballasts) throughout Asia (Bangladesh, China, Indonesia, Thailand, Vietnam, and Pakistan).

Today, a large share of projects implemented by UNIDO involve standards and labeling, particularly through a regional program in Southeast Asia (Indonesia, Malaysia, the Philippines, Thailand, Vietnam) focused on reducing industry's carbon footprint through compliance with a management system for energy.

BOX 2 TUNISIA – BARRIER REMOVAL TO ENCOURAGE AND SECURE MARKET TRANSFORMATION AND LABELING FOR REFRIGERATORS

GEF Agency: UNDP
GEF: US\$0.7 million
Cofinancing: US\$1.2 million
Dates of Implementation: 1998–2004

BACKGROUND

A study of the Tunisian refrigerator market conducted before the onset of the project showed that to achieve a more sustainable and rational energy consumption pattern, the government had to focus on energy efficiency within the refrigeration sector. The report demonstrated that major energy savings would be achievable through market penetration of the more efficient refrigerator models. The study also identified the critical barriers (institutional, technical, information, capacity, and market) that had to be addressed for such a market transformation to occur.

At the time, Tunisian standard setting followed European and international practices. The National Institute for Standardization and Industrial Property was the lead agency responsible for the design and approval of the proposed labeling format and testing procedures for this project. During the project preparation phase, six standards were applicable to household refrigeration in Tunisia. However, issues regarding refrigerator energy consumption and efficiency had not been considered.

PROJECT OVERVIEW

In addressing various barriers, the project ensured that all local refrigerator manufacturers developed and adopted energy efficiency and consumption labels, thereby guaranteeing consumer awareness of the positive economic impact of purchasing any potential unit. In addition, effective testing, monitoring, and enforcement capacity were developed to comply with labeling standards and requirements. The economic, technological, and environmental implications of labeling significantly aided implementation of Tunisian sustainable development policy. Furthermore, barrier removal activated market forces and promoted more efficient appliance models. Finally, the project allowed local manufacturers to join market development and comply with labeling criteria and future binding standards that limit energy consumption.



Energy efficiency labels for refrigerators raise consumer awareness on efficient energy use, Tunisia

THE PROJECT ACHIEVED THE FOLLOWING OUTCOMES:

- Passage of three laws on energy efficiency and equipment and appliance labeling
- Capacity building among public institutions, refrigerator manufacturers, and local professionals
- Decision-maker awareness of issues related to energy efficiency in refrigeration technologies
- Establishment of interinstitutional links in the energy efficiency field associated with the refrigerator market
- Dialogue between the public and private sectors

It is estimated that the project will reduce emissions equivalent to 3.4 Mt CO₂ over the 2005–2030 period.



Modern transportation systems require new approaches to energy efficiency, Brazil

Market-Based Approaches

GEF projects fostering market-based approaches address energy efficiency issues through establishment and operation of energy service companies (ESCOs). The GEF has supported ESCOs that include energy performance contracting in energy efficiency investments to serve the SME, residential, services, and industrial sectors. In this context, ESCOs are viewed as a partial financing mechanism for energy efficiency investment. Alternatively, some ESCO projects also concentrate on the development of utility-based ESCOs as an element of a DSM or financing program (Singh 2005).

The establishment of ESCOs allows such firms to profit from advising and supporting consumers to implement energy efficiency measures as well as from engagement in energy performance contracting. The World Bank and UNDP, the two GEF agencies most active in this area, have initiated projects leading to ESCO creation, development of an ESCO industry, and establishment of utility-based ESCOs. In China, a two-phased energy conservation project (Box 3)

and a utility-based energy efficiency finance program exemplify this approach. Similarly, a World Bank project in Brazil directed resources toward creation and demonstration of pilot ESCOs. Once established, the Brazilian ESCOs implemented performance contracts and created credit facilities from commercial or development banks to encourage third-party financing of subsequent ESCO projects. A UNDP project in Chile, meanwhile, demonstrated the commercial viability of industrial energy efficiency improvements through creation of two ESCOs.

Another approach finances and promotes already existing ESCOs. This model was followed in the Indian Renewable Energy Development Agency (IREDA) project, which provided financing to private sector ESCOs to implement performance contracts with large industrial and commercial users such as steel and chemical plants and distilleries. Other GEF project examples include an energy efficiency cofinancing program in Hungary, technical assistance to the Centre for Energy Conservation in Peru, and an industrial energy efficiency program in Tunisia.

BOX 3 CHINA – ENERGY CONSERVATION PROJECT PHASE II

GEF Agency: World Bank

GEF: US\$26 million

Cofinancing : US\$255 million

Dates of Implementation: 2001–2010 (expected)

BACKGROUND

Modeled in many ways on ESCOs operating abroad, three large ESCOs were successfully developed in China during the first phase of the China Energy Conservation Project. As of May 2001, the first three ESCOs had successfully undertaken 173 energy performance contracting projects, with an aggregate investment of about US\$34 million, and they continue to grow profitably. The second phase of the project built on this success to expand China's ESCO industry into a major energy efficiency investment modality, operating under purely market conditions with loan financing from domestic banks.

PROJECT OVERVIEW

The project's objective was to develop a self-sustaining and growing ESCO industry in China. The project involved domestic banks as the financiers of the industry, thus completing the full necessary market framework, and developed a service-oriented ESCO association for mutual ESCO assistance.

The second phase of the China Energy Conservation Project aimed to expand domestic investment in energy efficiency projects through the aggressive development of China's nascent ESCO industry, thereby achieving large-scale energy efficiency improvements and associated reduction in the growth of CO₂ emissions.

THE PROJECT INCLUDED TWO COMPONENTS:

- An ESCO service component to provide in-depth practical technical assistance to new and emerging ESCOs on the establishment and development of their businesses
- An ESCO loan guarantee program to enhance opportunities for new and emerging ESCOs to get loans from domestic banks and to engage the banks in the development of a sustainable ESCO industry



Production line in an energy-efficient auto parts manufacturing facility, China

As a result, the GEF initiated the now highly prosperous ESCO industry in China and provided funds to back commercial banks to promote ESCOs' work on energy performance contracting. Today, the ESCO industry is one of the government's principal means of promoting energy conservation in China. More than 140 energy efficiency measures have been implemented through the GEF program. In 2007 alone, China's ESCOs invested US\$1.03 billion in energy performance contracting projects, saving about 53 million tonnes of coal equivalent over the life of the project assets created during that year. The ESCOs' total national investments surpassed the performance target for the fourth year of project implementation by more than 15 times, while energy conservation and carbon emissions reduction results surpassed performance targets by more than 8 and 9 times, respectively.

The project is projected to achieve direct reduction of 86 Mt CO₂ equivalent over the project's lifetime.

Aluminum smelting is an energy intensive process and efficiency improvements yield economic growth and energy security benefits, Tajikistan



Financial Instruments

The GEF is at the forefront of efforts to advance innovative financial instruments that promote energy efficiency, including investment grants; partial loan guarantees; and special-purpose funds such as loan loss reserve funds, revolving funds, and equity funds. Several GEF agencies (namely, the World Bank, the International Finance Corporation [IFC], and UNDP) have implemented most of the projects featuring such instruments. Starting with GEF-3 and GEF-4, however, GEF Agencies such as the European Bank for Reconstruction and Development (EBRD) and the Inter-American Development Bank (IADB) have contributed to the growth of this share of the portfolio.

In countries such as Bulgaria, Hungary, Russia, China, and the Philippines—where the banking sector is relatively developed, commercial banks are liquid and willing to accept some risks, and market baseline activity is sufficient—projects have been implemented to underwrite partial risk and credit guarantees to ESCOs, end users, SMEs, industries, and

municipalities (Taylor et al. 2008). In addition, the GEF has helped establish several revolving and loan loss reserve funds under (a) the energy efficiency cofinancing program in Hungary (IFC) (Box 4), (b) the chiller replacement project in Thailand (World Bank), (c) an energy efficiency project in Bulgaria (World Bank), and (d) reconstruction of a public lighting systems project in Slovakia (UNDP).

More recently, the United Nations Environment Programme (UNEP) and EBRD have been establishing an equity fund through a regional program in Eastern Europe to finance energy efficiency investments. In addition, UNDP and IADB are collaborating to provide partial performance guarantee mechanisms to enable ESCO borrowing from commercial banks under the Brazil energy-efficient buildings project.

BOX 4 HUNGARY – ENERGY EFFICIENCY COFINANCING PROGRAM (HEECP)

GEF Agency: IFC
GEF: US\$5.7 million
Cofinancing : US\$113.2 million
Dates of Implementation: 1996–present

BACKGROUND

Hungary was a particularly appropriate market for developing this energy efficiency financing model. At the project's inception, the financial sector was already operating in a liberalized environment adequate to develop financial products responsive to the long neglected business niche of energy efficiency project finance, particularly in the SME sector.

PROJECT OVERVIEW

This project was designed in two phases. HEECP II was developed to follow up on the first phase of HEECP, a US\$5 million pilot project that generated considerable interest among Hungarian financial institutions in this market. HEECP provided guarantees and technical assistance to support the financing of energy efficiency-related projects including, but not limited to, investments in efficient lighting, building and district heating, boiler and building control systems, motors, and industrial process improvements.

HEECP II built on the accomplishments of HEECP, aiming to significantly expand cofinancing based on the experience and success of the initial program. IFC, GEF, and remaining HEECP funding was combined to provide a US\$16 million guarantee facility to local financial institutions to build a far-reaching pool of funds to finance energy efficiency projects in the country.

Expansion of the guarantee program was expected to facilitate up to US\$76 million in new energy efficiency financing. In addition, technical assistance was provided to help financial institutions, ESCOs, and end users who were planning investments to evaluate energy efficiency projects. This was expected to result in secondary benefits not directly related to capital financing by enhancing local capacity for energy efficiency project financing and technical competence.

AS A RESULT OF THE ENERGY SAVINGS REALIZED THROUGH HEECP II, THE PROGRAM WAS EXPECTED TO

- Reduce capital costs for new power and transmission and distribution capacity
- Decrease the country's reliance on imported energy



Energy-efficient street lighting in Latvia is exemplary of GEF projects financed across Central and Eastern Europe

- Improve residents' living standards
- Enhance municipalities' ability to reallocate resources
- Increase competitiveness of the SME sector
- Reduce national deficits from direct and indirect energy costs

The project's estimated result is a direct reduction of 2.6 Mt CO₂ equivalent over the project's lifetime.



Liucun Hollow Brick Plant, China. GEF supported the construction of this energy-efficient tri-arch brick kiln and promoted the diffusion of this technology in Bangladesh

Technology Demonstration and Diffusion

In accordance with UNFCCC Conference of the Parties (COP) guidance, the GEF has been at the forefront of financing the transfer of environmentally sound technologies to developing countries. The GEF's energy efficiency projects, for instance, focus on technologies that are mature, available on the international market, and profitable but not previously adopted due to human, institutional, technological, policy, or financial barriers.

Priority technologies include energy-efficient lighting fixtures, appliances, stoves, industrial technologies, district heating systems, boilers, and CFC-free chillers. The targeted industrial sectors include construction materials (brick, cement, and glass), steel, coke making, foundry, paper, ceramics, textile, food and beverage, tea, rubber, and wood. Some technology transfer projects also include activities addressing power generation and cogeneration (combined heat and power), transmission, and distribution systems.

Taking the lead in this area, UNDP has successfully implemented such sector- and technology-specific projects as: the China

Energy Conservation in Township and Village Enterprises initiative, which spanned four sectors; the India Energy Efficiency Improvement in Steel Rerolling Sector project; the Vietnam Energy Conservation in SMEs project, spanning five sectors; and a project transferring energy-efficient brick kiln technology from China to Bangladesh ("south-to-south" technology transfer).

The World Bank is also active in this field, helping transfer building chiller technologies (for example, chiller replacement programs in India, the Philippines, and Thailand); efficient industrial boiler systems (for example, in China); and residential cooking stove technologies (for example, improved household stoves in Mongolian urban centers). In addition, the World Bank and the IFC hold a substantial share of projects promoting the use of efficient lighting technologies, including a high-efficiency lighting pilot program in Mexico (Box 5); an efficient lighting initiative in Argentina, Peru, and South Africa; and a GEF-4 Lighting the Bottom of the Pyramid project in Kenya and Ghana.

BOX 5 MEXICO – HIGH-EFFICIENCY LIGHTING PROJECT (ILUMEX)

GEF Agency: World Bank

GEF: US\$10 million

Cofinancing : US\$13 million

Dates of Implementation: 1991–1997

BACKGROUND

Compact fluorescent lamps (CFLs) offer an energy-efficient solution to help Mexican consumers save money and avoid the GHG emissions caused by electricity use. With support from the GEF and leveraged funding, this project set out to sell 2.6 million CFLs to demonstrate the technical and financial feasibility of switching to CFLs and, ultimately, to transform the Mexican residential lighting market by: modeling change; improving government capacity; changing consumer preferences; and improving the production capacity of manufacturers, distributors, and vendors.

PROJECT OVERVIEW

To sell the CFLs, ILUMEX followed a simple model that relied on bulk purchases of high-quality CFLs, CFL sales in local utility service centers, low-interest financing, an installment payment system on electricity bills, and subsidized prices. Mexico's main public utility

company, Comisión Federal, initially implemented the project in urban Guadalajara and Monterrey, then scaled up the project for implementation in the states of Jalisco, Nuevo León, and parts of Colima, Nayarit, Coahuila, and Tamaulipas.

The 2.6 million CFLs were sold by the project's completion in 1998. The project's value was demonstrated by its successful replication effect: the project model was used in a nationwide program by Mexico's Trust Fund for Electrical Energy and in a program run by Luz y Fuerza del Centro, a Mexico City utility. The project also illustrated the importance and functionality of a DSM approach, confirmed the technical and financial viability of CFL use, and clarified the significance of subsidies in promoting new energy-efficient technologies. As a result, Mexico now has one of the most developed institutional models for energy efficiency initiatives.

Buildings use about 40 percent of energy worldwide and energy efficiency improvements yield dividends, Iran



The GEF's Role in Promoting Energy Efficiency

GEF financing of energy efficiency projects has produced valuable, even critical, results for developing countries and economies in transition. It has promoted energy efficiency by (1) helping to remove barriers to implementation and dissemination of energy-efficient technologies and practices, and by (2) supporting market transformation for energy-efficient appliances and the widespread adoption of energy-efficient technologies and sustainable financial mechanisms in the industry and building sectors. Specifically, the GEF's support has been praised for its combination of investment funding with technical assistance and for its development and introduction of new financial mechanisms and pilot projects, which often have overcome high transaction costs and initial risks (Taylor et al. 2008).

The GEF's experience in the energy efficiency field points to these lessons learned for future operations:

- A full assessment of the energy efficiency market should be conducted early during project preparation.
- Critical barriers to the implementation of energy efficiency projects within target markets should be identified, and customized interventions to address them sustainably should be determined in advance.
- Project design must be flexible enough to react to changes in the broader financial sector while remaining transparent at all times.
- Projects involving financial intermediation should develop robust mechanisms for financial and technical overview and appraisal.
- Risks should be shared among all program participants (Taylor et al. 2008; Singh 2005; UNDP 2005).



Conclusion

Investments in energy efficiency have positive effects, not only on reducing GHG emissions but also on competitiveness, employment generation, and health conditions. With rising energy demand, it is widely regarded as more cost-effective to invest in end-use energy efficiency improvements than to satisfy such demand through increases in energy supply (IPCC 2007). In addition, energy efficiency shows the highest potential to reduce GHG emissions among a variety of alternatives. According to the IPCC, energy efficiency improvements in the building sector alone would avoid about 30 percent of the projected GHG emissions and achieve net economic benefits by 2030 (IPCC 2007).

To address the global challenge of climate change, the GEF has invested substantial resources in energy efficiency programs in developing countries. Since its establishment in 1991, the GEF has become one of the largest public sector investors in energy efficiency projects, committing close to US\$850 million of its funds and leveraging an additional US\$5.9 billion in cofinancing, a significant portion of which has come from the private sector in developing countries.

In helping developing countries to remove regulatory, policy, and market barriers, the GEF allows them to capitalize on the

energy, environmental, and economic benefits of energy efficiency solutions. The GEF also helps government agencies to adopt energy efficiency standards, formulate policy and regulatory frameworks, pioneer innovative financial instruments, and promote market-based mechanisms. The GEF's success would not have been possible without the true cooperation of its partners, particularly the local and national governments of developing countries.

Energy efficiency activities promote global environmental benefits, support sustainable local economic development, and will remain a major part of the GEF's response to the global pressures of ever-increasing GHG levels. Together with its partners, particularly recipient countries and the GEF Agencies, the GEF will enhance and expand investments in energy efficiency in the industrial, municipal, and building sectors. The GEF will direct its support toward developing and enforcing strong policies, norms, and regulations to achieve large-scale energy savings and GHG emissions reductions. The GEF will aim at scaling up energy efficiency investments across the broad spectrum of developing countries and economies in transition at their many different stages of development.

ABBREVIATIONS AND ACRONYMS

CCS	carbon capture and storage
CFLs	compact fluorescent lamps
CO ₂	carbon dioxide
COP	Conference of the Parties
DSM	demand-side management
EBRD	European Bank for Reconstruction and Development
ESCOs	energy service companies
ESTs	environmentally sound technologies
GEF	Global Environment Facility
GHG	greenhouse gas
HEECP	Hungary Energy Efficiency Cofinancing Program
IADB	Inter-American Development Bank
IEA	International Energy Agency
IFC	International Finance Corporation
ILUMEX	High-Efficiency Lighting Project (Mexico)
IPCC	Intergovernmental Panel on Climate Change
IREDA	Indian Renewable Energy Development Agency
LDCs	least developed countries
Mt	mega (10 ⁶) tonne
SMEs	small and medium enterprises
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organization

REFERENCES

- IPCC (Intergovernmental Panel on Climate Change). 2007. *Climate Change 2007—Synthesis Report*. Geneva: IPCC.
- IEA (International Energy Agency). 2006. *Energy Technology Perspectives 2006*. Paris: OECD (Organisation for Economic Co-operation and Development).
- IEA. 2008. *World Energy Outlook 2008*. Paris: OECD.
- GEF (Global Environment Facility). 1995. Chapter 3: Climate Change. In *Operational Strategy of the GEF*. Washington, DC: GEF.
- Legro S., and G. Ballard-Tremeer. 2005. *Heating in Transition*. New York: UNDP (United Nations Development Programme).
- Enkvist, P. A., T. Naucler, and J. Rosander. 2007. "A Cost Curve for Greenhouse Gas Reduction." *The McKinsey Quarterly* 1.
- Taylor, R. P., C. Govindarajalu, J. Levin, A. S. Meyer, and W. A. Ward. 2008. *Financing Energy Efficiency: Lessons from Brazil, China, India, and Beyond*. Washington, DC: The World Bank.
- Singh, J. 2005. *World Bank GEF Energy Efficiency Portfolio Review and Practitioners' Handbook*. Washington, DC: The World Bank.

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ABOUT THE GEF

The Global Environment Facility unites 178 member governments—in partnership with international institutions, nongovernmental organizations, and the private sector—to address global environmental issues.

An independent financial organization, the GEF provides grants to developing countries and countries with economies in transition for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer, and persistent organic pollutants. These projects benefit the global environment, linking local, national, and global environmental challenges and promoting sustainable livelihoods.

Established in 1991, the GEF is today the largest funder of projects to improve the global environment. The GEF has allocated \$8.6 billion, supplemented by more than \$36 billion in cofinancing, for more than 2,400 projects in more than 165 developing countries and countries with economies in transition. Through its Small Grants Programme, the GEF has also made more than 10,000 small grants directly to nongovernmental and community organizations.

The GEF partnership includes 10 Agencies: the UN Development Programme, the UN Environment Programme, the World Bank, the UN Food and Agriculture Organization, the UN Industrial Development Organization, the African Development Bank, the Asian Development Bank, the European Bank for Reconstruction and Development, the Inter-American Development Bank, and the International Fund for Agricultural Development. The Scientific and Technical Advisory Panel provides technical and scientific advice on the GEF's policies and projects.

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