

# CLOSING THE GAP

GEF EXPERIENCES IN  
GLOBAL ENERGY EFFICIENCY



GLOBAL ENVIRONMENT FACILITY  
INVESTING IN OUR PLANET



# Foreword



**Dr. Naoko Ishii**  
CEO and Chairperson  
Global Environment Facility

*Worldwide energy consumption will increase dramatically in the coming decades as economic development advances and the world population grows. Unless we find ways to use precious and finite energy resources more efficiently and expand renewable energy resources, we may exhaust economically available energy supplies while permanently damaging the environment with unsustainable economic development. To address these threats, the Global Environment Facility (GEF), since its inception, has identified energy efficiency as a priority area in protecting and improving the global environment.*

In financing energy efficiency projects and programs, the GEF has functioned as a catalyst by financing the incremental costs involved in making development greener, and by underwriting risks that enterprises may face when operating in innovative energy markets. The GEF has helped energy industries in developing countries and countries with economies in transition to scale up investments in efficient energy technologies. Through increasing engagement with the private sector, the GEF has supported and catalyzed innovative approaches in energy-efficient technology transfer to developing countries and countries with economies in transition. The pursuit of these efforts has enabled the GEF to accumulate an invaluable body of experience and knowledge, strengthen its culture of promoting innovation, enhance its network, and support key multilateral environmental conventions. Partnerships, knowledge, cooperation and finance uniquely position the GEF to take the lead in finding and sharing its experience and expertise with all parties concerned about global environment protection.

In 2012, the 21<sup>st</sup> anniversary of the GEF, the GEF Secretariat undertook an analysis to better understand its efforts to improve global energy efficiency and its role in supporting innovation, sustainability, and scaling-up investment in developing countries and countries with economies in transition. This brochure, *Closing the Gap: GEF Experiences in Global Energy Efficiency*, summarizes and presents results of the analysis. The analysis illustrates how the GEF is closing the global energy efficiency investment gap, namely, the difference between levels of investments in energy efficiency that appear to be cost-effective and lower levels that are actually occurring. GEF investments in global energy efficiency aim to mitigate greenhouse gas (GHG) emissions by bringing to the developing





world the same energy-efficient technologies now in wide use in developed countries. The analysis shows, with project and financing information, how GEF funds are invested and contributed to GHG emission mitigation.

As CEO of the GEF, I am determined to develop and support projects on a scale to deliver global

environmental benefits. At the same time I am keenly aware of the resource constraints facing the developed countries whose contributions are critical to making these projects happen. The experience we have developed in the energy efficiency field has so much promise, since GEF resources invested in energy efficiency are most cost-effective in generating global environment benefits in our climate change focal area.



## Introduction

The Global Environment Facility (GEF) invests in energy efficiency projects because of their importance in promoting low-carbon development in developing countries and countries with economies in transition. With the objective to understand the potential of global energy efficiency improvement, the GEF recently completed an analysis of the global portfolio of GEF-funded energy efficiency projects from 1991 to 2010. On the basis of relevant project data and information, lessons learned from the analysis provide information on how careful investment of finite public resources can mobilize additional investments in energy efficiency, and how energy efficiency investment barriers can be addressed. In order to reduce greenhouse gas (GHG) emissions, GEF investments aim to bring to the developing world the same energy-efficient technologies now in wide use in developed countries. This brochure summarizes the analysis and case-studies to assist national government policy makers, GEF Agencies, and professional staff in designing better energy efficiency projects.





# Background and Key Issues

The GEF is a multilateral institution with a membership of 183 countries committed to addressing global environmental concerns, including mitigating GHG emissions and adapting to climate change. Improved energy efficiency can play a catalytic role mitigating GHG emissions in GEF client countries. A recent study by the International Energy Agency (IEA 2012) reinforced the potential for significant GHG mitigation through energy efficiency. Governments who seek to increase investments in energy-efficient technologies will, by 2030, save 92 exajoules in energy per year (EJ/yr), or reduce approximately 8.2 gigatonnes of carbon dioxide equivalent (CO<sub>2</sub>eq) per year (IEA 2012). This reduction is equivalent to approximately twice the total energy-related CO<sub>2</sub>eq emissions from the European Union (EU) in 2010. Recognizing the great potential for future energy savings and GHG emissions mitigation, the GEF recently undertook an analysis of the GEF-funded global portfolio of energy efficiency projects over the past two decades. Using data from completed GEF projects and outside resources, this analysis aims to answer the following questions:

- What is the potential for future global energy efficiency improvement and how much investment capital is required to harness this potential?

- How effective are investments in energy efficiency in achieving global environmental benefits (GEBs) by reducing carbon emissions?
- How successfully does the GEF leverage co-financing from governments, the private sector, multilateral banks and financial institutions, and other key stakeholders, to invest in global energy efficiency?
- How has the GEF facilitated the transfer of energy-efficient technologies from developed to developing countries?
- In what ways can the GEF promote national and local energy efficiency policies and standards to catalyze investments in energy efficiency?
- What is the value of capacity building activities for energy efficiency in developing countries and countries with economies in transition?

Answers to these questions are addressed by analyzing 49 GEF completed energy efficiency projects and by consulting outside authorities. These answers are presented as experiences and lessons learned below.





## Experiences and Lessons Learned

A number of lessons can be learned from the analysis of the GEF's completed energy efficiency investment projects over the past two decades. They are summarized as follows:

- 1) **Involving and engaging governmental agencies at all levels is critical in identifying key stakeholders and obtaining their commitment to project.** If a project is developed and implemented in fast growing economies such as China or India, it is particularly important to have support from the national government. National government energy policies, standards, codes, and regulations have long-term impacts on energy efficiency investments.
- 2) **Regulations for energy efficiency should be strengthened at the national level.** In addition to encouraging manufacturers to adopt more efficient technologies, governments should enforce regulations to ensure that the appropriate national energy efficiency standards and codes are being set and met.
- 3) **It is essential to ensure that sufficient finance is being provided from local organizations, including resources from lenders and beneficiary enterprises themselves.** In this way, local stakeholders have an ownership stake in the projects and the recipient countries are better able to realize project benefits.
- 4) **Clear and consistent energy policies and standards are needed for achieving sustainable impacts after projects are complete.** National energy efficiency standards should be higher than, or at least consistent with, the standards set by manufacturers themselves. Otherwise, manufacturers may lack incentives for investing in research and development of energy-efficient technologies. A good example is the efficient



industrial boilers project in China, aimed at improving the energy efficiency of small and medium-scale coal-fired industrial boilers across the country. Before the GEF intervention, government agencies would set lower boiler efficiency standards than those set by manufacturing companies. Therefore, more expensive and efficient boilers were not sold at competitive prices, which in turn resulted in poor energy savings and GHG emission reductions. Through efforts to strengthen energy efficiency and environmental policy reform, manufacturers were able to mass produce and market energy efficient boilers at more competitive prices.

**5) Market-driven analysis should be conducted to evaluate the cost and benefit of new energy-efficient technologies.** It is difficult for project developers and project reviewers to estimate project benefits. For example, during project preparation stage of the boilers project in China, improvements made to industrial boiler production and design were projected to reduce GHG emissions by approximately 160 million tonnes of CO<sub>2</sub>eq. However, during post-evaluation (sixteen years later), the emission reductions were lowered to 40 million tonnes of CO<sub>2</sub>eq. Dramatic changes in market conditions (e.g. numerous company exits and entries from and into different industries) were not anticipated by project developers, and emission reductions were over-estimated.

**6) Overly complicated procedures for project implementation should be avoided.** For example, the bidding procedure for purchasing a patent to develop energy efficient technology locally should be transparent and concise. Simple procedures encourage participation and open competition and prevent delays in project implementation.

**7) Strengthened capacity to implement energy efficiency projects, particularly in least developed countries (LDCs), will help reduce the number of slow moving projects.** Although the GEF has invested 32 percent of its energy efficiency resources in capacity building, including training, policy improvement, and institutional development, the combination of the GEF and co-financing invested in capacity building

represents only 15 percent of total funds invested by all stakeholders. This implies that project stakeholders may underestimate the role of their own investments in capacity building, or expect that investments in capacity building should be the GEF's responsibility. The historic lack of capacity building in countries to develop and manage GEF projects is a key factor that has caused some projects to progress slowly. Therefore, more funding should be mobilized to address capacity building issues within countries.

**8) Successful projects often balance both tangible and intangible investments and create sustainable market transformations for energy efficiency technologies over both the short- and long-term.** Resources aimed at hardware investments and tangible technological improvements generate substantial and almost immediate GHG emission reductions. Therefore, these projects are often able to achieve significant GEBs in a short period of time. On the other hand, resources utilized in soft investments such as for policy development, capacity building, and enabling activities tend to generate long-term GEBs, which can be difficult to measure. While these projects achieve high institutional and commercial value, due to the fact that they can help transform market environments, stimulate associated economic growth, and encourage environmentally conscious decision-making, they often result in few direct GHG emission reductions during the project period. Therefore, investing in both tangible and intangible assets can help overcome market barriers to energy efficiency improvements.

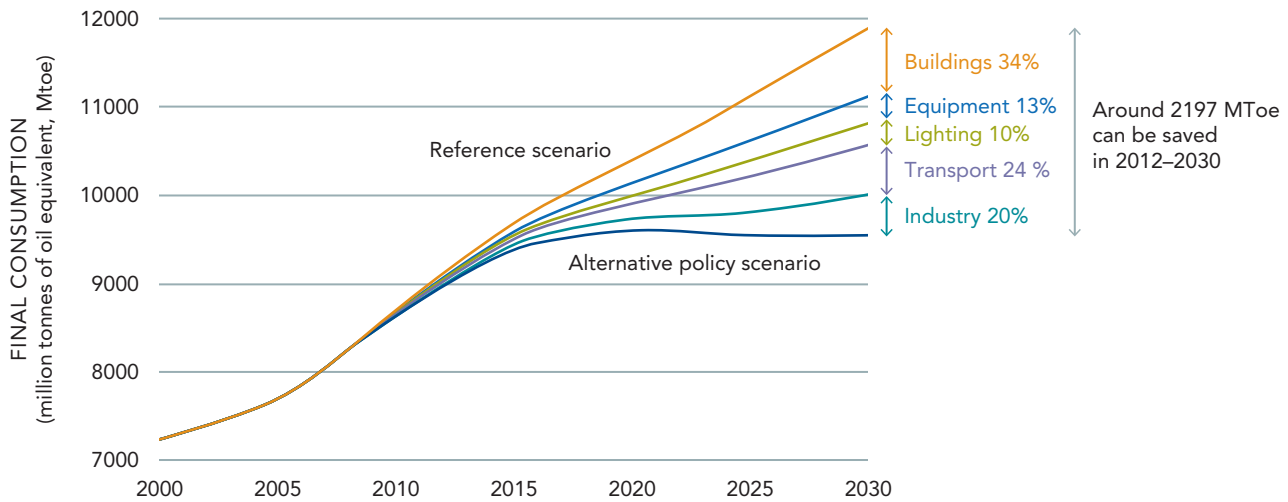
## Energy Efficiency Potential and Closing the Investment Gap

The IEA (2007) estimates the potential for efficiency improvements to be in the range of approximately 20 to 50 percent of global energy consumption. Energy efficiency policies in 11 member countries of the Organization for Economic Co-operation and Development (OECD) (Australia, Denmark, Finland, France, Germany, Italy, Japan, Norway, Sweden, United Kingdom, and the United States) between 1973 and 1998 had saved approximately 49 percent of actual energy use. Jollands *et al.* (IEA 2010) showed that energy efficiency policies and technologies would help save an average of 20 percent of total energy consumption from 2010 to 2030 in five major sectors, namely buildings, equipment, lighting, transport, and industry in countries evaluated (Figure 1). If other sectors are considered, the saving potential would be more than 20 percent. Figure 2 illustrates the range of possibilities and is expressed as the percentage of energy that could be saved over the total final energy consumption from 1975 to 2030. The potential for energy efficiency savings in developing countries and countries with economies in transition could be higher than IEA countries because of their widespread use of inefficient energy technologies.

The energy efficiency gap is a term that is widely used in the literature by international organizations. It refers to the difference between the level of energy efficiency investment that appears to be cost-effective based on engineering-economic analysis and the lower levels actually occurring at the country-level (SERI 1981). The efficiency gap can also be defined as the difference between the actual level of energy efficiency and the higher level that would be cost-effective from an individual's or firm's point of view. The concept of an energy efficiency gap and market barriers to energy efficiency investment have been used since the early 1970s. Lovins (1976) was among the first to develop a definition of



**FIGURE 1 IMPACT OF ENERGY EFFICIENCY POLICY AND TECHNOLOGIES ON WORLD ENERGY CONSUMPTION (2000–2030)**



Source: Developed from data of Jollands et al. (2010)

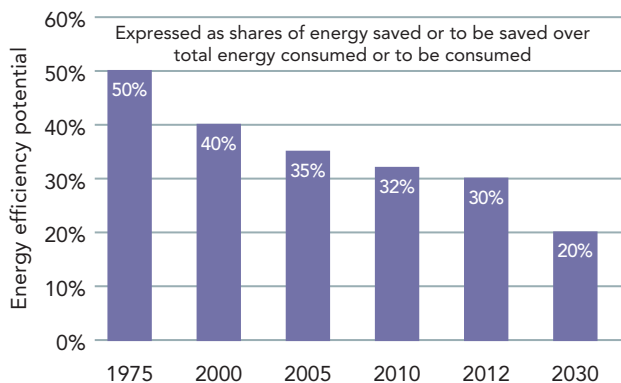
energy efficiency: using less energy to produce greater economic output. This definition, coupled with a review of the apparently highly inefficient use of energy by society, indicates that markets alone cannot produce the most desirable social outcomes in the use of energy without government policy intervention (IEA 2007). Barriers cause market failures and lead to insufficient investment in energy efficiency.

Investments in global energy efficiency depend on many factors, including the GHG emissions mitigation targets set by the international community, future oil prices, climate change policies of national governments, and breakthroughs in energy efficiency technologies. Many international organizations have attempted to estimate worldwide capital costs for end-use efficient technologies to mitigate GHG emissions. The IEA (2006) projects

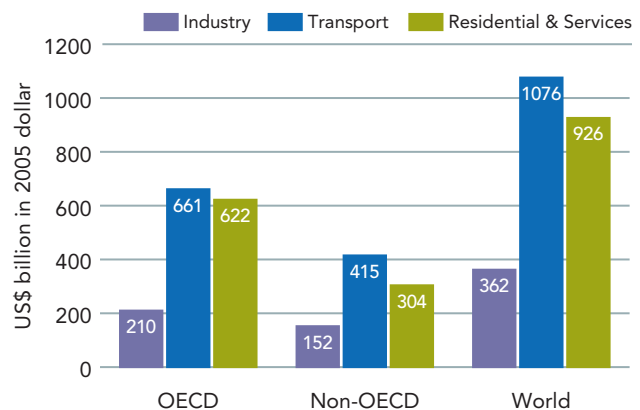
that a total of US\$2,364 billion (Figure 3) additional investment is needed to improve energy efficiency in three major sectors to address the efficiency gap from 2005 to 2030 worldwide. Investment in the transport sector would need to increase by US\$1,076 billion, which is close to half of the total additional end-use energy efficient investments in all sectors in the world.

Investment needed in the residential and service sectors (including agriculture) is approximately US\$926 billion, while the industrial sector needs an extra investment of US\$362 billion. In summary, the IEA analysis states that from 2012 to 2030 the world needs to invest approximately US\$95 billion per year to address the energy efficiency gap in the industrial, transport, residential, and commercial sectors. In developing countries alone the investment need will be US\$35 billion per year in these three areas (Figure 3).

**FIGURE 2 TRENDS IN ENERGY EFFICIENCY SAVING POTENTIAL IN IEA COUNTRIES (1975–2030)**



**FIGURE 3 CAPITAL INVESTMENTS NEEDED TO FILL THE GLOBAL ENERGY EFFICIENCY GAP (2012–2030)**



Source: Developed from data of the IEA (2006)



## Cost-Effective Achievement of Energy Savings and GHG Emission Mitigation

Energy efficiency investment has, for over 20 years, been a GEF priority. By the end of its fourth replenishment (GEF-4) period on June 30, 2010, the GEF had invested approximately US\$9.1 billion in projects in over 150 countries globally. Of this amount, approximately 32 percent was utilized in the climate change focal area, of which 30 percent (US\$872 million) was invested in energy efficiency projects. Using data from the sample of GEF energy efficiency projects (1991-2010), an analysis of project cost-effectiveness and GEBs was conducted. Results show that one dollar of GEF investment in energy efficiency (including enabling and capacity building activities), on average, reduces GHG emissions by 1.89 tonne of CO<sub>2</sub>eq i.e. an average cost of US\$0.53 per tonne of CO<sub>2</sub>eq. This reduction is directly attributable to actual activities such as pilot demonstrations that were financially supported by the GEF. In contrast, one dollar of GEF investment in renewable energy, low-carbon transport, and LULUCF on average reduces emissions by 0.78 tonnes of CO<sub>2</sub>eq (i.e. US\$1.28 per tonne of CO<sub>2</sub>eq).

In addition to significant GHG emission reductions, GEF energy efficiency investments produce numerous additional benefits. These include, for example, facilitating technology transfer and supporting the development and enforcement of policies, standards, and regulations to achieve larger-scale energy efficiency improvements and GHG emission reductions. These additional benefits are not captured in the cost-effectiveness analysis mentioned above, but they do strengthen the value of energy efficiency investments.

An energy efficiency professional fixing gas leakage in an industrial facility



A city with lighting



## Co-financing and Mobilizing Private and Public Sector Investment

Since October 1991, the GEF has invested US\$313 million in 49 energy efficiency projects that were completed by June 2010. This GEF investment mobilized a total of approximately US\$2.6 billion in co-financing. The most significant GEF investments were in hardware acquisition (US\$130.7 million), including both tangible asset acquisition and intangible asset acquisition. For example, of the GEF US\$313 million resources, US\$48.7 million (16 percent) was invested in tangible asset acquisitions such as purchasing key parts for energy efficient boilers, while US\$82 million (26 percent) was invested in intangible asset acquisitions such as purchasing a license to produce energy efficient boilers. Furthermore, capital expenditure on technology transfers falls under hardware acquisition since technology transfer relates to asset acquisition. GEF investments in capacity building, not related to asset acquisition (e.g. policy and regulatory development), were the second largest investments, utilizing US\$100 million or 32 percent of GEF resources. The remaining resources were invested in other activities, such as developing markets for energy efficient products. When compared to co-financing partners, the GEF distributed its funds more evenly between asset acquisition and capacity building.

The US\$313 million in GEF resources invested in energy efficiency yielded a co-financing ratio of 1: 8.2 (Table 1). The amount of co-financing varied significantly across sub-areas. Heating projects, for instance, leveraged the largest amount of co-financing, as projects in this category included heating system renovations for which governments, multilateral banks, and other agencies committed significant capital investments. Projects with Energy Service Companies (ESCOs) leveraged the second largest co-financing of all sub-areas, with a ratio



of 8.7, due to increased financial allocation for technical assistance and risk sharing in these projects (Table 1).

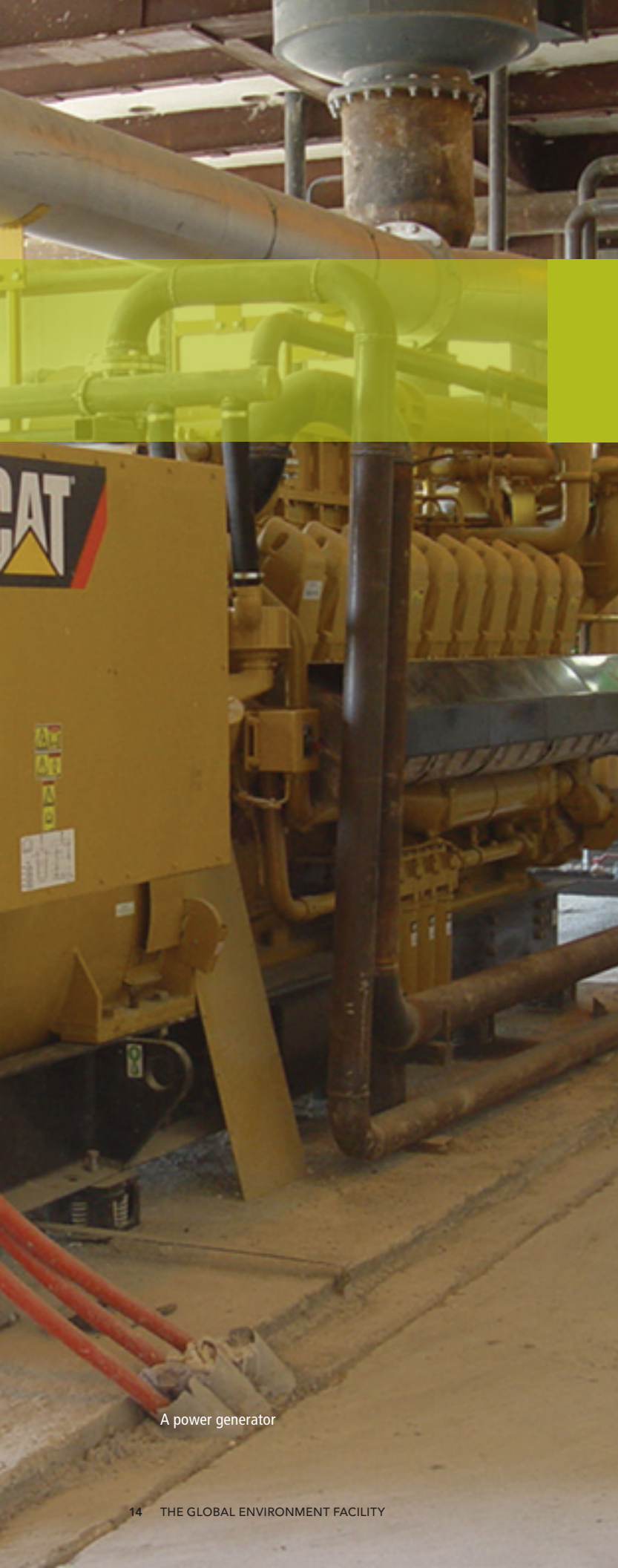
The GEF has catalyzed funds from both the public and private sectors to finance energy efficiency projects. The mobilized co-financing consists of 25 percent from governments of client countries, 31 percent from the private sector, and 47 percent from other sources,

including multilateral banks, financial institutions, and non-governmental organizations (NGOs). Local private sector companies contributed a total of US\$790 million of co-financing to the 49 completed energy efficiency projects included in this analysis. Without such contributions from GEF partners, energy efficiency projects would have not achieved significant progress towards mitigation outcomes.

**TABLE 1 MOBILIZED CO-FINANCING FOR COMPLETED ENERGY EFFICIENCY PROJECTS (1991–2010)**

Sub-areas	GEF Funds (US\$)	Co-finance (US\$)	Co-finance Ratio
Heating	64,942,000	1,368,728,000	21.1
Energy Service Companies	75,529,265	659,635,255	8.7
Energy Supply	10,430,000	64,469,000	6.2
Others	19,131,800	78,034,564	5.1
Industrial Processes	30,182,119	105,605,676	3.5
National Strategy	43,924,000	136,607,000	3.1
Finance	26,550,000	80,360,000	3.0
Appliances & Equipment	11,320,000	33,422,863	3.0
Buildings	12,022,000	20,134,322	1.7
Lighting	19,189,985	27,819,331	1.4
Total	313,221,169	2,574,816,011	8.2

Source: Developed from GEF PMIS (2011)



## Transfer of Environmentally Sound Technologies

Technology transfer plays a critical role in closing the gap in the required level of energy efficiency investments, and is a key global issue for countries combating climate change. The transfer of Environmentally Sound Technologies (ESTs) has been embodied in the UN Framework Convention on Climate Change (UNFCCC 1992). Article 4.5 of the UNFCCC states: *"The developed country Parties and other developed Parties included in Annex II shall take all practicable steps to promote, facilitate and finance, as appropriate, the transfer of, or access to, environmentally sound technologies and know-how to other Parties, particularly developing country Parties, to enable them to implement the provisions of the Convention."*

Since 1991, the GEF has emerged as the largest multilateral funding organization for transfer of ESTs. The GEF has two outstanding characteristics in promoting technology transfer. First, the GEF uses its funds to directly finance projects that have technology transfer components. Second, the GEF has provided resources for Technology Needs Assessments (TNAs) and other enabling and capacity-building activities in more than 100 countries.

Among the ESTs that the GEF has supported over the past years, more than one third are energy efficient technologies, ranging from efficient lighting and appliances to chillers, boilers, motors, and brick kilns. Investments also address building designs and construction materials, district heating systems, power generation and distribution, combined heat and power (co-generation), and industrial energy efficiency. As of June 2010, total GEF funding for EST transfer was approximately US\$1 billion in the climate change focal area.

A power generator





A city with various lighting technologies

All 49 of the energy efficiency projects analyzed have directly or indirectly addressed the challenges and opportunities of technology transfer. Eight of them include hardware technology transfer components. Capital expenditure on technology transfer in these projects forms part of capital expenditure for hardware acquisitions. There have also been a combined total of 49 energy efficiency technology patents transferred from OECD countries to developing countries and countries with economies in transition under these projects. For example, in China's industrial boiler efficiency project the investment in technology transfer supported by the GEF was the largest national investment in combustion

efficiency improvements in China's industrial boiler sector in the mid-1990s. The project transferred a total of nine technology patents from Japan and the U.S. to Chinese boiler manufacturers which successfully built prototypes meeting energy efficiency and environmental performance criteria. Furthermore, eight transferred technologies were used for commercial boiler production and achieved initial sales success. After 15 years, some of the transferred technologies are still in use, yielding a significant increase in fuel efficiency of approximately five percent. The reported global environmental benefit of this project was estimated at mitigating 40 million tonnes of CO<sub>2</sub>eq.





## Advancing National and Local Energy Efficiency Policies and Standards

The GEF has assisted developing countries and countries with economies in transition in removing a large number of regulatory, policy, and market barriers to energy efficiency. Within the 49 GEF energy efficiency projects analyzed, participating governments created 17 energy efficiency policies, standards, and codes. Moreover, these projects promoted the establishment of 21 innovative financial instruments and 29 market-based mechanisms.

Enhanced national energy efficiency policies, codes and standards, and regulations have significant and long lasting impacts on energy efficiency improvements. For example, a GEF lighting project in Mexico led to the development of national quality standards for high-efficiency lighting. In Thailand, after the completion of a GEF project, the Thai Consumer Protection Agency, in collaboration with other organizations, worked to achieve mandatory labeling for refrigerators. In Senegal, the project Sustainable and Participatory Energy Management led to the development of building codes for the entire nation. In the Czech Republic, Slovakia, India, China, Hungary and Vietnam, the projects worked with National Cleaner Production Centers to mainstream energy efficiency into national environment policies and practices.





## Capacity Building Investments Yield Dividends

Capacity building is becoming a major priority in global conventions and the international community. In May 1999, the GEF Council, aware of the growing importance the UNFCCC placed on capacity building, supported the 18-month Capacity Development Initiative (CDI) as a strategic partnership between the GEF and the UNDP for the preparation of a comprehensive approach to developing the capacities needed at the country level to meet the challenges of global environmental action. The CDI was undertaken to:

- (1) conduct a comprehensive assessment of capacity building needs of developing countries and countries with economies in transition;
- (2) take stock of earlier and ongoing efforts to assist national capacity building; and
- (3) prepare a strategy to strengthen the GEF investment portfolio.

The CDI was conducted in a highly consultative manner based on national inputs, regional expertise, contributions by civil society organizations (CSOs) and bilateral/multilateral agencies, and on discussions with the UNFCCC (GEF 2003).

Under the CDI, the GEF worked to strengthen capacity building efforts in developing countries that were already being undertaken with national resources. The GEF clearly recognizes the need to mobilize other resources and to assist countries in identifying complementary sources of financial and technical assistance, either multilateral or bilateral, to meet their capacity building needs. Valuable opportunities to achieve this exist in countries that prepare an action plan for capacity building on the basis of National Capacity

Self-Assessments (NCSAs) and/or in countries for which country programs will be developed.

In this analysis, the effectiveness of NCSAs is assessed using both qualitative and quantitative indicators. These indicators for capacity building cover the following 11 dimensions:

- Awareness and knowledge of generating or delivering global environmental benefits;
- National policy, legal and regulatory frameworks;
- Institutional mandates, coordination, and processes for interaction and cooperation among all stakeholders;
- Information management, monitoring and observation;
- Mobilization of science in support of decision making;
- Financial resources and technology transfer;
- Incentive systems and market instruments;
- Negotiation skills;
- Cooperation and networking within regions;
- Institutional management and performance; and
- Individual skills and motivation in key institutions.

Other elements are related to specific projects. For example, a number of projects provided International Organization for Standardization (ISO) energy management standards training for local professionals. Quantitative indicators for capacity building include the number of people trained and the number of workshops or seminars conducted.

A substantial proportion of GEF funding for energy efficiency projects has supported capacity building in recipient countries. Among the GEF-financed US\$313 million for the 49 energy efficiency projects from 1992 to June 30, 2010, US\$100 million (32 percent) was for building capacity, developing policy, standards, codes, and institutional frameworks. For these projects, GEF mobilized US\$327 million in co-financing from other project stakeholders. The combined funds used for capacity building (US\$427 million) accounted for approximately 15 percent of the total funds (GEF resources and co-financing) for the 49 completed energy efficiency projects.

GEF investments in energy efficiency projects have strengthened the capacities of many developing countries and countries with economies in transition. The capacity building components in the closed 49 GEF energy efficiency projects covered all aforementioned qualitative and quantitative indicators. In particular, the GEF has facilitated knowledge dissemination and capacity building in developing countries in three distinct ways:

- 1) **Implementing regional and global energy efficiency umbrella projects aimed at supporting countries that have similar challenges and needs.** For example, the GEF funded a project to promote energy efficiency in the West African building sector, providing training in energy audit techniques to engineers in Cote d'Ivoire and Senegal. Similarly, the global project implemented in China, the Czech Republic, Hungary, India, Slovakia, and Vietnam has built a network for knowledge- and technology information-sharing across national borders and regions on such topics as energy auditing, project design, implementation planning, and training, which in turn has successfully raised awareness of the economic and environmental benefits of energy efficiency improvements in these countries.
- 2) **Supporting capacity building activities that not only included the participation of local professionals, but also of the general public.** For example, a project in Mongolia, through workshops and social media, raised awareness of energy-efficient household stoves among millions of residents.
- 3) **Implementing projects in different phases allows for valuable lessons and experiences to be transferred between phases.** For example, the second phase of GHG Emissions Reduction in Township and Village Enterprise Industries in China benefited from the technical skills and educational materials that were developed during the first phase of the project.





Energy efficiency auditing

## Project Preparation and Planning Lead to Successful Outcomes

As a mechanism for effectively managing projects, the GEF project cycle ensures that all relevant policies and conditions are taken into account during project design and implementation. Similarly, the GEF project approval cycle defines the stages that a project must go through in order to be approved by the GEF Council in order to receive allocation and/or commitment of funding.

GEF project cycle data reveals that a proportion of GEF projects were not implemented even after being approved for funding. As of June 30, 2010, the GEF had approved 227 project identification forms (PIFs) in the area of energy efficiency. Of these, 49 were completed, 85 were being implemented, 28 were approved but had not yet started implementation, and 65 were moving slowly. Project cancellation was the result of inadequate effort and interest during the project preparation stage. Additionally, factors contributing to slow moving projects included insufficient co-financing, inaccurate estimates of cost-effectiveness, poor project conditions, or limited Implementing Agency support.

An analysis of the slow moving projects offers valuable lessons for avoiding project cancellations in the future. Evidence shows that most of the cancellations took place before GEF CEO endorsement. This implies that inputs and efforts from project developers need to be strengthened at the early stages of project preparation, including preparation of project identification forms and concept papers.



## Energy Efficiency Project Case Study

*Closing the Gap: GEF Experiences in Global Energy Efficiency* presents one GEF completed project as a case study: Energy Efficient Industrial Boilers in China. The project was designed in the early 1990s, implemented from 1994 to 2004, closed in 2005, and post-evaluated in 2010. Figure 4 shows the project timeline.

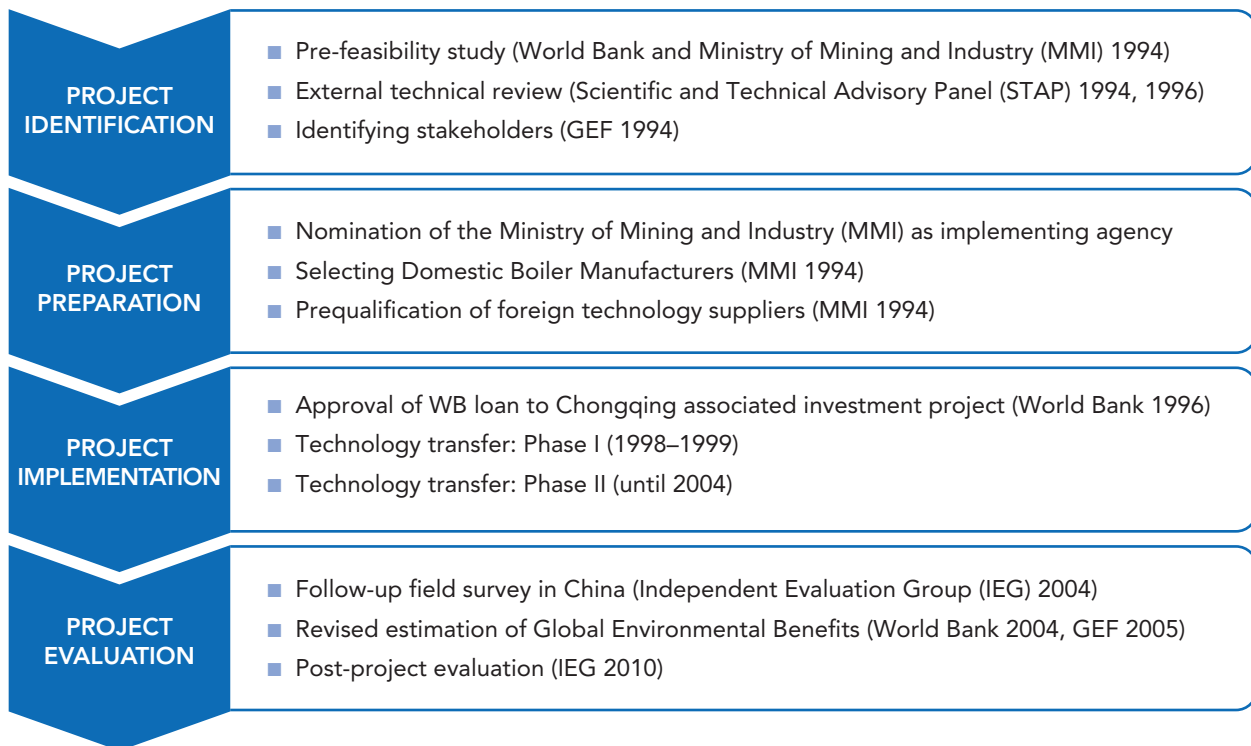
Project finance (US\$121.1 million) consisted of the enterprises' own funds, commercial loans, World Bank finance, and a GEF grant of US\$31.85 million covering the incremental costs of the more efficient technology. The total project funds may appear minor when compared with the total capital costs that were needed to upgrade all industrial boilers in China. However, this project assisted the Chinese government in its development of energy policy and boiler standards and regulations, which greatly facilitated the adoption of new energy efficient boiler technologies and investments for industrial users.

The major environmental benefits of the project are the reduction of GHG emissions as well as local pollutants, such as SO<sub>2</sub>. In total, tangible project benefits were 432,000 tonnes of steam production per hour (tph) of boiler production in nine beneficiary boiler manufacturers over a 20-year span. Most recent calculations by the Independent Evaluation Group (IEG) of the World Bank took this into account, suggesting that the project will likely achieve a total of 40 million tonnes of CO<sub>2</sub>eq reduction by 2019 (IEG 2010).





**FIGURE 4 ENERGY EFFICIENT INDUSTRIAL BOILERS IN CHINA PROJECT TIMELINE (1994–2010)**









## Conclusions

While significant effort has been made globally over the past 20 years in energy efficiency investments, there still exists great potential of reducing over 20 percent of energy consumption worldwide. To achieve this potential, US\$35 billion of capital per year is needed to invest in energy efficiency in developing countries and countries with economies in transition.

Over the past 20 years, the GEF utilized US\$313 million in grants while directly mobilizing US\$2.6 billion from various stakeholders in global energy efficiency investments. The ratio of the GEF funds versus mobilized co-financing is 1:8.2. Of the co-financing for energy efficiency projects, 24.7 percent comes from the governments of recipient countries, 30.7 percent from the private sector, and 44.6 percent from other sources, including multilateral banks, financial institutions, NGOs, and the private sector. Local private sector companies contributed a total of US\$789.5 million in co-financing in the 49 completed energy efficiency projects. The total amount of GEF funds and mobilized co-financing resources is equivalent to approximately US\$145.6 million per annum, which is approximately 0.42 percent of US\$35 billion per annum. Although this figure is modest, GEF project impact on national energy policy, institutional development, capacity building, and technology transfer and innovation in developing countries and countries with economies in transition is significant, long-lasting, and beyond estimation.

GEF energy efficiency projects are cost-effective in mitigating GHG emissions. One dollar GEF investment in energy efficiency yields a direct reduction in GHG emissions of 1.89 tonne of CO<sub>2</sub>eq, a mitigation cost of US\$ 0.53 per tonne of CO<sub>2</sub>eq. This abatement cost is the lowest among those of all GEF sub-focal areas.



For example, one dollar GEF investment in renewable energy, low-carbon transport, and LULUCF yields a reduction in GHG emissions of 0.78 tonne of CO<sub>2</sub>e<sub>q</sub> on average.

GEF investments have catalyzed the transfer of climate friendly and ESTs from developed countries to developing countries and countries with economies in transition. All projects analyzed have directly or indirectly addressed technology transfer, with eight having formal technology transfer components. A total of 49 technology patents have been transferred from OECD countries to developing countries and countries with economies in transition. These projects have helped remove a large number of regulatory and market barriers to energy efficiency in developing countries and countries with economies in transition. Governments participating in the projects studied have created 17

energy efficiency policies, standards and codes, 21 innovative financial instruments, and 29 market-based mechanisms for energy efficiency development.

The GEF has dedicated a substantial portion of its funds in energy efficiency to support capacity building in recipient countries. Among the US\$313 million GEF funds for the projects implemented from October 1991 to June 30, 2010, US\$100 million (32 percent) were used for capacity building, policy, standards, codes, and institutional development.

The GEF and co-financing funds for capacity building, policy, standards, codes, and institutional development reached US\$427 million, accounting for 15 percent of the total funds (GEF resources and co-financing) in energy efficiency. With the support of these funds, more than 1.3 million professionals have received capacity training.



“Closing the Gap: GEF Experiences in Global Energy Efficiency” tells a comprehensive story on how and where this improvement takes place. The analysis also contributes to the following lessons learned:

- Involving and engaging governmental agencies at all levels is critical in identifying key stakeholders and obtaining their commitments to the projects;
- National enforcement and oversight capabilities should be strengthened when it comes to energy efficiency improvements;
- It is essential to ensure that sufficient finance is being provided from local organizations, including resources from lenders and the beneficiary enterprises themselves;
- Clear and consistent energy policies are needed for achieving sustainable impacts after the project is complete;
- Before introducing new technologies, market-driven analysis should be conducted to evaluate the costs and benefits of such technologies;
- Overly complicated procedures for project implementation should be avoided;
- In the least developed countries, the GEF should mobilize more funding from other project stakeholders to invest in capacity building; and
- The GEF will continue working in these areas in the future to further improve global energy efficiency.

FOR THE COMPLETE VERSION OF THIS ANALYSIS, PLEASE VISIT  
<http://www.springer.com/978-1-4471-4515-8>.

## REFERENCES

- GEF (2003) Strategic approach to enhance capacity building, GEF information paper, December 2003  
<http://web.undp.org/mainstreaming/docs/ncsa/ncsa-reports/GEF%20Strategic%20Approach%20to%20Enhance%20Capacity%20Building.pdf>. Accessed on 5 April 2012
- GEF (2011) GEF Project Management Information System, Washington, D.C. Accessed in October 2011
- Independent Evaluation Group (IEG) (2010) Phase II: The Challenge of Low-Carbon Development: Climate Change and the World Bank Group, ISBN-13:978-0-8213-8653-8, e-ISBN-13:978-0-8213-8654-5, DOI: 1596/978-0-8213-8653-8. Independent Evaluation Group (as part of the World Bank Group) Washington, D.C.
- International Energy Agency (IEA) (2006), World Energy Outlook, ISBN: 92-64-10989-7. Paris, France
- International Energy Agency (IEA) (2007) Mind the Gap: Quantifying Principal-Agent Problems in Energy Efficiency ISBN: 978-92-64-03884-4. Paris France
- International Energy Agency (IEA) (2012) Energy Efficiency: Policies and Measures Database <http://www.iea.org/textbase/pm/?mode=pm>. Accessed on 19 April 2012
- Jollands N., Waide P., Ellis M., Onoda T., Laustsen J., Tanaka K., T'Serclaes P., Barnsley I., Bradley R., Meier A. (2010) The 25 IEA energy efficiency policy recommendations to the G8 Gleneagles Plan of Action. Energy Policy, Volume 38, Issue 11, November 2010, pp. 6409–6418
- Lovins (1976) Energy Strategy: The Road Not Taken? Foreign Affairs. 55(1): 65–96
- Solar Energy Research Institute (SERI) (1981) A New Prosperity: Building a Sustainable Energy Future. Andover, MA: Brick House Publishing
- United Nations Framework Convention on Climate Change (UNFCCC) (1992) *Convention on Climate Change*, UNEP/IUC, Geneva Executive Center, Geneva











## PHOTOGRAPHY

GEF: 19, 21

GEF Photo Contest: inside cover

Los Angeles Department of Water and Power: 6, 8, 10, 11, 16, 20, 27

UNDP: 14, 17

World Bank Photo Library: 4, 10, 22-23, 24, 28

*All other images are from Shutterstock*

## PRODUCTION CREDITS

Text: Dr. Ming Yang, Dr. Robert K. Dixon,  
and Mr. Andre Laperriere

Review and Edits: Dr. Robert K. Dixon, Mr. David E. Roger,  
and Dr. Chizuru Aoki

Production Date: August 2013

Design: Patricia Hord.Graphik Design

Printer: Professional Graphics Printing Co.

ISBN: 978-1-939339-48-5

## ABOUT THE GEF

The GEF unites 183 countries in partnership with international institutions, civil society organizations (CSOs) and the private sector to address global environmental issues, while supporting national sustainable development initiatives. Today the GEF is the largest public funder of projects to improve the global environment. An independently operating financial organization, the GEF provides grants for projects related to biodiversity, climate change, international waters, land degradation, the ozone layer and persistent organic pollutants.

Since 1991, the GEF has achieved a strong track record with developing countries and countries with economies in transition, providing \$10.5 billion in grants and leveraging \$51 billion in co-financing for over 2,700 projects in over 165 countries. Through its Small Grants Programme (SGP), the GEF has also provided more than 14,000 small grants directly to civil society and community-based organizations, totaling \$634 million.

The GEF partnership includes 10 agencies: the U.N. Development Programme (UNDP); the U.N. Environment Programme (UNEP); the World Bank; the U.N. Food and Agriculture Organization (FAO); the U.N. Industrial Development Organization (UNIDO); the African Development Bank (AfDB); the Asian Development Bank (ADB); the European Bank for Reconstruction and Development (EBRD); the Inter-American Development Bank (IDB); and the International Fund for Agricultural Development (IFAD). The Scientific and Technical Advisory Panel (STAP) provides technical and scientific advice on GEF policies and projects.

[www.theGEF.org](http://www.theGEF.org)



**GLOBAL ENVIRONMENT FACILITY**  
INVESTING IN OUR PLANET