WORLD BANK GEF
Post-Implementation Impact Assessment

Thailand Promotion of Electrical Energy Efficiency Project
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<th>Description</th>
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<tr>
<td>A/C</td>
<td>air conditioning</td>
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<tr>
<td>CFL</td>
<td>compact fluorescent lamp</td>
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<tr>
<td>CPB</td>
<td>Consumer Protection Board</td>
</tr>
<tr>
<td>DEDE</td>
<td>Department of Alternative Energy Development and Efficiency, Ministry of Energy</td>
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<td>DIW</td>
<td>Department of Industrial Works</td>
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<tr>
<td>DSM</td>
<td>demand-side management</td>
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<td>DSMO</td>
<td>Demand-Side Management Office</td>
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<td>ECF</td>
<td>Energy Conservation Promotion Fund</td>
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<tr>
<td>EE</td>
<td>energy efficiency</td>
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<tr>
<td>EEI</td>
<td>Excellent Energy International</td>
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<tr>
<td>EER</td>
<td>energy efficiency rating</td>
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<td>EGAT</td>
<td>Electricity Generating Authority of Thailand</td>
</tr>
<tr>
<td>ENCON</td>
<td>Energy Conservation Promotion Act</td>
</tr>
<tr>
<td>EPPO</td>
<td>Energy Policy and Planning Office, Ministry of Energy</td>
</tr>
<tr>
<td>ESCO</td>
<td>energy services company</td>
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<tr>
<td>GEF</td>
<td>Global Environment Facility</td>
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<tr>
<td>GHG</td>
<td>greenhouse gases</td>
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<tr>
<td>GLR</td>
<td>Green Learning Room</td>
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<tr>
<td>GW</td>
<td>gigawatt</td>
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<tr>
<td>GWh</td>
<td>gigawatt-hour (1 million kilowatt-hours)</td>
</tr>
<tr>
<td>HEM</td>
<td>high-efficiency motors</td>
</tr>
<tr>
<td>HPS</td>
<td>high-pressure sodium-vapor (bulbs)</td>
</tr>
<tr>
<td>ICR</td>
<td>Implementation Completion Report</td>
</tr>
</tbody>
</table>
IFCT | Industrial Finance Corporation of Thailand
---|---
IPP | independent power producers
Kt | kiloton
KWh | kilowatt-hour
MEA | Metropolitan Electricity Authority
MEPS | minimum energy performance standards
Mt | megaton
MW | megawatt (1 million watts)
NEPO | National Energy Policy Office
NGO | nongovernmental organization
NOx | nitrogen oxide
PEA | Provincial Electricity Authority
SME | small and medium-size enterprises
SOx | sulfur oxide
TISI | Thailand Industrial Standards Institute
ToU | time of use
TPEEE | Thailand Promotion of Electrical Energy Efficiency
TWh | terawatt-hour

Note: All dollar amounts are U.S. dollars unless otherwise indicated.
EXECUTIVE SUMMARY

Introduction

The World Bank’s Global Environment Facility (GEF) Coordination Team has conducted a series of post-implementation impact assessments in order to better understand the long-term impacts of GEF projects, the sustainability of the impacts, the replicability of the projects, and lessons learned.

Four climate change projects in the energy efficiency thematic area were selected for study in 2004–5: the Poland Efficient Lighting Project, Mexico High Efficiency Lighting Project, Jamaica Demand-Side Management Demonstration Project, and Thailand Promotion of Electricity Energy Efficiency (TPEEE) Project, which is the subject of this report. Marbek Resource Consultants conducted the study in association with Global Change Strategies International. The field mission to Bangkok took place January 17–28, 2005. The TPEEE Project was approved in 1993 and took place from 1993 to 2000. It was cofinanced by a GEF grant of $9.5 million, $5.4 million from the government of Australia, a loan of up to $25 million from the Overseas Economic Cooperation Fund of Japan/Japan Bank for International Cooperation, and funds from the state-owned public electricity utility, the Electricity Generating Authority of Thailand (EGAT). The project, national in scope, consisted of a five-year demand-side management (DSM) plan. It was implemented by the Demand-Side Management Office (DSMO) of EGAT.

Framework and Approach

The study assessed the success, sustainability, and attribution of the following outcomes and impacts:

- **Project Outcomes**: demonstration of technical and financial feasibility of a variety of programs in residential, commercial, and industrial sectors
- **Intermediate Outcomes**: continuation of the DSMO and its programs, changes in
consumer preferences, improvement in capacity and confidence of energy efficiency allies (distributors and retailers), increase in government institutional capacity, improvement in the strength of the energy services sector (energy services companies (ESCOs) and financial organizations), a strengthened manufacturing sector

- **Ultimate Outcomes**: transformation of residential, commercial, and industrial electricity appliance markets; program replication and extension; improved load management

- **Impact**: energy savings, greenhouse gas (GHG) reductions, reductions of air pollutants of local concern, capacity savings, financial benefits

To identify and attribute impacts, studies conducted by the DSMO were used. DSMO data were extrapolated to 2010, and two counterfactual scenarios were designed to represent a lower and upper bound of impacts in the absence of the project. These counter-factual scenarios were used to calculate the incremental impact of the project. Only impacts due to efficient T8 fluorescent lighting and compact fluorescent lamps (CFLs) and to energy-efficient air conditioning (A/C) and refrigerators were assessed.

**Project Outcomes**

In addition to the direct impacts of energy-efficient appliance sales during the program, TPEEE demonstrated the technical and financial feasibility of the technology and the approach and established a model for future programs.

**Intermediate Outcomes**

The DSMO has remained strong. In particular, the EGAT Label #5 (the highest energy efficiency rating of a product) remains highly successful, and the DSMO budget and staffing remain healthy. The DSMO has helped EGAT’s corporate image and has developed and maintained a strong internal evaluation and testing capacity. On the other hand, the rate of increase in DSMO activities has been reduced since 2000, there is a sense of reduced leadership at the DSMO, and there is a poor understanding of the DSMO mandate at EGAT. In addition, EGAT’s privatization impasse has affected DSMO initiatives.

DSMO activities have increased public awareness that energy is a measurable resource. In particular, the energy efficiency labeling campaigns have achieved high recognition and have been highly effective in changing residential appliance purchasing behavior. Behavior change in the commercial and industrial sectors is much less evident.

The DSMO has retained relationships with a number of allies in the private and public sectors. In the public sector, the DSMO has a mixed record of maintaining links. On the positive side, DSMO links to the Ministry of Energy’s departments, such as the Department of Alternative Energy Development and Efficiency and the Energy Policy and Planning
Office, are relatively strong. But there has been a decline in interdepartmental collaboration, and DSMO links to other government agencies have not been strong.

DSMO program achievements have not become a significant factor in EGAT’s power planning process, although the DSMO and the TPEEE Project appear to have had a modest impact on certain areas of government energy policy:

- The Ministry of Energy has realized the importance of energy efficiency and has brought all the important national institutions, including EGAT, into a newly reorganized Ministry structure that is still evolving.
- The programs and the policy instruments of the Ministry of Energy are also evolving quite quickly based on lessons learned and new insights into the role of energy efficiency in economic development.
- The Minister of Energy has recognized and emphasized that EGAT must seek to reduce energy demand.

The DSMO’s earlier ESCO initiatives have served as the spark for many of the current ESCO initiatives in the public and private sectors. The DSMO can also be given some credit for encouraging some specific private-sector ESCOs.

The DSMO retains strong links to the manufacturers it worked closely with, and DSMO activities, particularly related to Label #5, have helped some Thailand manufacturers gain a stronger position in international markets.

**Ultimate Outcomes**

DSMO programs have had a substantial impact on the residential equipment appliance market and it appears that this impact has only strengthened since the project’s close. The most significant impact concerns the labeling program. In the long run, the government’s recent move to minimum energy performance standards (MEPS) may be even more significant.

- **Residential Market**: With respect to lighting, market transformation is under way, though it is not yet complete for CFLs and there is slower progress for low-loss ballasts. For refrigerators, significant market transformation is under way, but it is not yet complete. For air conditioners market transformation is under way, but not yet complete. A significant challenge in the A/C market lies in the number of manufacturers and the difficulties this poses for negotiation and product testing or verification. It is expected that the MEPS for A/C announced in March 2005 will greatly increase the number of energy-efficient units being sold. Sales of Label #5 lights, refrigerators, and A/C units are estimated to have risen substantially in the period to 2004, including:
  - 85 million T8 fluorescent tubes
  - 5 million CFLs
• 12.4 million refrigerators
• 2.8 million A/C units

**Commercial/Institutional Market:** The TPEEE Project’s medium-term impact on commercial energy efficiency has not been nearly as significant as impacts in the residential sector. DSMO and government procurement policies have had some success in commercial and institutional energy-efficient lighting and A/C equipment sales, but a significant potential remains.

• **Industrial:** Although there is currently some activity under way in industrial energy efficiency, very little of this can be traced back to the DSMO or the TPEEE Project.

**Sustainability**

The TPEEE Project has transformed the market for residential appliances such as air conditioning, refrigerators, and lighting. The advent of minimum energy performance standards for these products and other equipment will ensure sustainability of this transformation.

The successes of the project have been sustained by EGAT’s continued funding of the DSMO. At the end of the TPEEE Project, DSMO funding from a dedicated tariff was removed, and EGAT elected to continue funding at equivalent or higher levels through its revenue base. However, the potential for privatization represented a significant threat to the DSMO. Fortunately, the office is in a unit of EGAT that will not be privatized (the transmission division). The operation of a DSM program by a transmission company will be somewhat unique and may require a clear government policy commitment to keep the DSMO running.

DSMO sustainability has also been strengthened by high consumer demand for services. With the program’s high visibility and consumer confidence in DSMO activities (namely, in Label #5), it is in the government’s and EGAT’s interest to maintain the program.

**Impacts**

Over the period studied, sales of EE products resulted in energy savings of approximately 28 terawatt-hours (TWh). Of this, 17.0–23.5 TWh are attributable to TPEEE. This translates to GHG emission reductions of approximately 21 megatons (Mt) carbon dioxide equivalent from 1993 to 2004, of which an estimated 12.6–17.4 Mt are attributable to the TPEEE Project.

In addition to the global benefits of reduced GHG emissions, the electricity savings also reduced emissions of air pollutants that contribute to smog and acidification, including sulfur oxide emission reductions of approximately 9.4 kilotons (Kt) and nitrogen oxide emission reductions of approximately 51 Kt.

The sales of energy-efficient products have also reduced peak demand by over 1,000 megawatts and produced a range of financial benefits.
Lessons Learned

Consumer and investor knowledge and confidence in energy efficiency products is a key objective of an effective DSM program. Consumers and investors are motivated by cost savings. This motivation requires knowledge that is strong enough to allow for long-term energy cost-saving calculations to play an important factor in investment decisions.

DSM programs must have a strong public awareness campaign, in part to build public support for the policies and investments needed to support the programs.

A program should be designed in a way that allows “early wins” that then lead to expanded programs. This may mean targeting residential markets (which are often easier to deal with than commercial or industrial), technologies with relatively low incremental costs (such as fridges, air conditioners, and tube lighting), and programs that do not require collaboration with other departments or agencies (such as distribution utilities).

It is important to align programs with the interests of the key players:

- From the electrical generation/utility’s perspective: DSM can delay costly construction of added baseline capacity and peaking plants. DSM can also bring substantial benefits for the “corporate image” if and where the programs have the necessary outreach, education, and campaign components.
- From the distribution utility perspective: DSM can provide a business opportunity where ESCOs are set up. It also can assist in planning and cost avoidance of system expansion and can improve consumer relations by providing added-value programs.
- From the consumer’s perspective: DSM can provide regular and long-term cost-saving opportunities through reduced power use and lower bills.
- From the manufacturer’s perspective: DSM provides an opportunity for increased competitiveness both in domestic and international markets by creating a critical mass of demand.
- For the government: DSM allows for environmental improvements, fulfillment of international environmental obligations, and a more competitive economy. It can also lead to foreign investment opportunities (such as through the Clean Development Mechanism).

It is important to design a robust and flexible program that can be adapted to changes such as economic shocks, deregulation, and so on. An adaptive management approach is essential.

Voluntary programs are useful as a necessary step toward the development of minimum standards. This is relevant to both low and
high incremental cost products. To sustain energy efficiency achievements, however, mandatory standards may be needed.

DSM programs need strong leadership to get into the mainstream. EGAT’s experience suggests that this leadership is required at the most senior levels.
I
INTRODUCTION

The World Bank’s Global Environment Facility (GEF) Coordination Team has identified the need to assess post-implementation results of projects, especially in terms of longer-term impacts, sustainability, replicability, and lessons learned. In particular, there is a need to focus on lessons learned to better understand the extent of impacts and benefits, and the sustainability of these impacts, in order to determine how Bank-GEF operational programs’ long-term goals are being addressed.

This study was designed to support the Bank’s Monitoring and Evaluation policy (OD 10.70), which recommends that major impact studies be conducted on a selective basis several years after a project is completed to measure changes brought about by the project.

Four climate change projects in the energy efficiency (EE) thematic area were selected for study in 2004–5: the Poland Efficient Lighting Project, Mexico High Efficiency Lighting Project, Jamaica Demand-Side Management Demonstration Project, and Thailand Promotion of Electricity Energy Efficiency (TPEEE) Project. This report deals with the Thailand project. The results contribute lessons not only about the specific project and country but more significantly for the thematic area.

The objectives of this study were to assess the long-term impacts of the TPEEE Project and to draw out lessons for the development of future GEF projects. The key issues addressed included the following:

- Contribution of outcomes to the achievement of expected impacts
- The project’s impacts on the global environment
- The project’s impacts on institutional development
- The project’s impacts on beneficiaries (such as savings or knowledge)
- The project’s impacts on market development in the energy efficiency sector
• The project’s impacts on country organizations, including capacity development
• Lessons learned regarding the sustainability of project impacts
• Replicability of project outcomes achieved and catalytic effect of the project
• Lessons learned regarding achievement and measurement of impacts
• The project’s impacts on mainstreaming global environment concerns in Thailand’s national development and sector policies
• Lessons learned for improving the design and management of future activities, answering the question, How can we do it better?

The study also attempted to separate project-specific impacts from those due to other sources, including any follow-up projects that were implemented in Thailand.

In addition to this Introduction, the report has eight chapters:

• Chapter 2 provides background on the TPEEE Project
• Chapter 3 describes the results framework used to link project activities to ultimate impacts
• Chapter 4 reviews and updates the project’s outputs and outcomes
• Chapter 5 describes the current context for energy efficiency in Thailand, focusing on developments that have occurred between TPEEE Project closure (2000) and 2005
• Chapter 6 examines the impacts of the TPEEE Project on the current context in terms of intermediate outcomes
• Chapter 7 examines ultimate outcomes
• Chapter 8 assesses the impacts of those outcomes
• Chapter 9 presents the study conclusions and provides lessons learned that may be applied in the development of future GEF-supported DSM projects
The Thailand Promotion of Electricity Energy Efficiency Project was approved in 1993 and took place from 1993 to 2000. It was cofinanced by a GEF grant of $9.5 million, $5.4 million from the Government of Australia, a loan of up to $25 million from the Overseas Economic Cooperation Fund of Japan/Japan Bank for International Cooperation, and funds from the state-owned public electricity utility, the Electricity Generating Authority of Thailand (EGAT).

The EGAT funding was made available through a special project-long automatic tariff. The global budget for the project was $189 million, though when it was completed in 2000 only $59.3 million had been spent. The project, national in scope, consisted of a five-year demand-side management (DSM) plan. It was implemented by the Demand-Side Management Office (DSMO) of EGAT.

2
PROJECT BACKGROUND

2.1 Project Objectives and Approach

The TPEEE Project was approved by the World Bank in conjunction with the GEF in 1993. The project had two major objectives within the World Bank, which were described in the Implementation Completion Report (ICR):

- To build sufficient institutional capability within Thailand’s electric power sector and the energy-related private sector to deliver cost-effective energy services throughout the economy
- To pursue policies and actions that would lead to the development, manufacture, and adoption of energy-efficient equipment and processes within the country

The main GEF objectives in funding the project were:

- To demonstrate the potential for electricity savings to replace substantial fossil
The project had a four-pronged approach:

- Provide user and manufacturer incentives and consumer education to influence practices and attitudes toward energy-efficient technologies
- Develop efficiency standards and testing capabilities to exercise control and monitor efficiency improvements
- Develop and promulgate building and appliance codes in order to enforce minimum efficiency standards
- Continue pursuing technological improvements and their adaptation to Thai conditions

The objectives and approach of the TPEEE Project were intended to demonstrate the potential for cost-effective energy efficiency savings through utility-based DSM activities, thus saving fossil fuel and reducing GHG emissions.

The original project plan was based on DSM experience in other parts of the world, especially North America, and was intended to test whether these DSM concepts could be successfully applied in developing regions as well. Thailand, with a rapidly growing demand for energy, was deemed an appropriate place to test such a model and its potential for replication in other Asian countries.

### 2.2 Project Activities

The TPEEE Project worked on a wide variety of components and activities (see Table 2.1).

The TPEEE Project was designed with considerable input from Thai DSMO staff at EGAT, who developed a model for implementation that was unique in terms of incentives that were designed to work in the Thai cultural context. A key attribute of the design was reliance on voluntary measures, in particular the voluntary use by manufacturers of labels displaying product energy efficiency ratings. In addition, the program paid for marketing and publicity campaigns, a range of information and communication measures, initial bulk purchasing of energy-efficient products (in the lighting components), and incentives and offerings that could be accessed by target groups, especially in commercial and industrial components. The DSMO placed major emphasis on data collection.

The labeling program was among the measures that acquired the highest profile. This initiative saw manufacturers affix on their products la-
Table 2.1 TPEEE Project (DSMO) Activities

<table>
<thead>
<tr>
<th>Components</th>
<th>Main Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorescent Tube Lamps T12 to T8</td>
<td>Negotiate the manufacture &amp; sale of quality-tested EE T8 tubes</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>Aggressively promote EE tested/labeled units using EGAT Label #5</td>
</tr>
<tr>
<td>Air Conditioners</td>
<td>Aggressively promote EE tested/labeled units using EGAT Label #5</td>
</tr>
<tr>
<td>Compact Fluorescent Lamps (CFL)</td>
<td>Aggressively promote EE tested/labeled units using EGAT Label #5</td>
</tr>
<tr>
<td>Street Lighting</td>
<td>Subsidy to public lighting using high-pressure sodium-vapor bulbs (HPS)</td>
</tr>
<tr>
<td>Green (designated commercial) Buildings</td>
<td>Free energy audits and retrofit investment consultations</td>
</tr>
<tr>
<td>Green Leaf Buildings Hotel Certification</td>
<td>EE audits and certification of hotels</td>
</tr>
<tr>
<td>New Commercial Buildings</td>
<td>Demonstrate viability of EE measures exceeding code for new buildings</td>
</tr>
<tr>
<td>Brown Rice</td>
<td>Promote brown rice (Label #5) due to energy savings from milling</td>
</tr>
<tr>
<td>High-efficiency Motors (HEM)</td>
<td>Promote and demonstrate HEM with financing and set up motor-testing lab</td>
</tr>
<tr>
<td>Low-loss Ballasts</td>
<td>Promote low-loss magnetic ballasts mainly through green buildings/plants</td>
</tr>
<tr>
<td>Pilot Energy Service Companies (ESCOs)</td>
<td>Demonstration of investment grade audits</td>
</tr>
<tr>
<td>Industrial Cost Reduction (retrofits)</td>
<td>Promote audits and advice for retrofits and investment in end-user premises</td>
</tr>
<tr>
<td>EE for Small and Medium-Size Enterprises (SMEs)</td>
<td>Promote and demonstrate EE measures for SMEs with financing</td>
</tr>
<tr>
<td>Load Management</td>
<td>Promote standby generators, time-of-use meters, and interruptible load scheme</td>
</tr>
<tr>
<td>Thermal Storage</td>
<td>Construct and test demonstration facility to assess commercial viability</td>
</tr>
<tr>
<td>Attitude Creation, including Green Learning Rooms (GLRs) in schools</td>
<td>Comprehensive media and school-based campaign on EE and energy conservation</td>
</tr>
</tbody>
</table>

Source: Implementation Completion Report.

belts that indicated an energy efficiency rating (EER) of the tested product on a scale from 1 to 5. EGAT has over the years aggressively publicized Label #5. The labeling program has had visibility and considerable success in the residential appliance component of the TPEEE program. Reference is made throughout this report to Label #5, which refers to this program and the fact that consumers and manufacturers quickly gravitated to Label #5, the highest EER, as a sign of greatest savings to be achieved. Label #5 also became an indicator of a higher-quality product.

To generate results from these activities, the TPEEE Project and the DSMO worked with
a wide variety of partners in the manufacturing sector. Specifically targeted were manufacturers and manufacturers’ associations, wholesalers and retailers of residential electrical appliances, commercial and industrial establishments (including hotels and hotel associations), and enterprises and buildings that were designated by government as requiring energy audits under the Energy Conservation Promotion (ENCON) Act of 1992.

Also involved were several government departments that dealt with energy policy and the administration of the Energy Conservation Promotion Fund (ECF) (sometimes called the ENCOM Fund), the Consumers Protection Board, product testing and certification units, the two large state-owned electrical distribution companies (the Provincial Electrical Authority and the Metropolitan Electrical Authority), the Ministries of Education and Health, the Prime Minister’s Office, the Department of Energy Development and Promotion (as it was then known), specialized energy conservation nongovernmental organizations (NGOs), international and national energy consultants, organizations specializing in independent project monitoring and evaluation, and many others. Each collaborating entity was involved in a specific program and set of activities.

The project was aided considerably in its work by the support and leadership of the Assistant Governor of DSM, Sittiporn Ratanopas, who became the Governor of EGAT in 2002–4. As an indication of his influence, Ratanopas is cited in the recent EGAT DSM report,² one of the few publicly available reports issued by EGAT on the efforts and achievements of the DSMO.

The project also built up considerable human resource capacity, and by the end of the project the DSMO consisted of some 250 staff members in two divisions.
3
ASSESSMENT FRAMEWORK
AND APPROACH

3.1 Impact Assessment Framework

In the absence of a logical framework, the Study Team developed a results-based impact assessment framework to graphically illustrate the linkages between project outcomes and the expected project impacts. (See Figure 3.1.) The framework provided the team with a focus for investigation and provided an explicit and transparent description of how the project impacts may have been realized through linkages, attributions, and consequences, which can be called “impact threads.”

Figure 3.1 highlights the key project outputs in terms of sales, audits, testing, labeling, demonstrations, and education campaigns. These outputs were expected to lead to a series of immediate project outcomes, demonstrating the potential for electricity savings throughout the economy. Those demonstrations would in turn lead to increased institutional capacity in the DSMO and other government agencies, behavioral change among consumers, increased capacity among energy efficiency trade allies, improved policies supporting energy efficiency in the government, and a stronger energy efficiency manufacturing sector.

Ultimately these changes should lead to broad market transformations, including accompanying changes in sales, and to impacts on peak power demand, energy use, GHG emissions and air pollution, and financial benefits. They should also lead to program replication in Thailand and elsewhere.

3.2 Results Framework

Table 3.1 lists the indicators used to assess each of the results in the assessment framework.

3.3 Attribution

We know that EE equipment sales were minuscule before TPEEE started (at least an
Figure 3.1. Impact Assessment Frameworks

**Outputs (100% in control of project)**
- Bulk purchase of CFLs and sales through distributors
- Work with manufacturers to use voluntary labels
- Product testing by TISI
- Work with manufacturers (not related to labelling)
- Public education campaigns
- Perform audits in support of DEEP "designated buildings"
- Demonstration ELCONTROLS energy mgmt. systems
- Workshops, audits, certification for hotels
- Demo and tech assistance for new buildings
- PINESCOs and investment
- Construction of demo facility at EGAT
- HEM promotion, interest free loans
- Workshops, demo projects, financial assistance
- Industrial building audits
- Encourage load management (managed by NEPO)

**Project Outcomes (Immediate results of the project)**
- Increased sales of approved CFLs
- Increased market share of high-efficiency refrigerators
- Increased market share of high efficiency A/C
- Promote switch from T-12 to T-8

**Intermediate outcomes (Influenced by project in medium-term: policies, programs and behaviours)**
- Energy Conservation (public good)
- UO-1 Residential market transformation:
  - Compact fluorescent
  - T-8 tube lamps
  - Refrigerators
  - A/C
- IO-1 Strong DSMO (continued programs, stable funding)
- IO-2 Behaviour change with respect to energy, purchasing
  - Low-loss ballasts
  - T-8 tube lamps
  - Improved EE of commercial buildings
- IO-3 Relationships with allies in the public sector
- IO-4 Policies, regulations, institutions and financial mechanisms supporting EE
  - Improved EE in designated buildings (> 1 MW demand)
  - Improved EE in hotels (Green Leaf)
  - Improved EE in new buildings
  - Increased ESCO activities
  - Thermal storage demo project
- UO-3 Industrial market transformation:
  - Motors
  - Increased use of HEM motors
  - Improved EE in industrial facilities
  - Improved load management in commercial / industrial
- IO-5 Strong energy services sector: ESCOs and financial organisations
- IO-6 Strong EE manufacturing sector
- UO-4 - Program replicated or extended in Thailand & other countries
- IM-1 Energy conservation
- IM-2 Environmental benefits (reduced air pollutants, GHG)
- IM-3 Improved utility load management

**Outputs (100% in control of project)**
- IM-4 - Program replicated or extended in Thailand & other countries
- IM-1 Energy conservation
- IM-2 Environmental benefits (reduced air pollutants, GHG)
- IM-3 Improved utility load management
<table>
<thead>
<tr>
<th>Result Statement</th>
<th>Indicators</th>
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<tr>
<td>Project Outcome: Switch to T8 fluorescent tube lamps</td>
<td>Manufacturers switch production to T8 lamps</td>
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<td></td>
<td>Importers switch to T8 lamps</td>
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<tr>
<td>Project Outcome: Use of low-loss ballast</td>
<td>Use of labels distributed to manufacturers</td>
</tr>
<tr>
<td>Project Outcome: Sales of approved CFLs</td>
<td>Units sold</td>
</tr>
<tr>
<td></td>
<td>Price of CFL lamps</td>
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<tr>
<td>Project Outcome: HPS streetlights</td>
<td>Procurement of lamps</td>
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<td></td>
<td>Installation of lamps</td>
</tr>
<tr>
<td></td>
<td>Price of lamps</td>
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<tr>
<td>Project Outcome: Labeling of refrigerators</td>
<td>Market share of EE models</td>
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<tr>
<td></td>
<td>Take-up rate of use of labels among 5 manufacturing</td>
</tr>
<tr>
<td>Project Outcome: Labeling of air conditioners</td>
<td>Market share of EE models</td>
</tr>
<tr>
<td></td>
<td>Take-up rate of use of labels among 55 manufacturing</td>
</tr>
<tr>
<td>Project Outcome: Test facilities for high-efficiency motors and low-loss ballasts</td>
<td>Viability of testing labs</td>
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<td></td>
<td>Number of tasting labs</td>
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<td></td>
<td>Testing protocols and capabilities</td>
</tr>
<tr>
<td>Project Outcome: Sales of high-efficiency motors</td>
<td>Units sold</td>
</tr>
<tr>
<td></td>
<td>Take-up rate of financial incentives (interest-free loans)</td>
</tr>
<tr>
<td>Project Outcome: Use of brown jasmine rice</td>
<td>Number of brands using labels</td>
</tr>
<tr>
<td>Project Outcome: Load management</td>
<td>Number of commercial &amp; industrial customers participating in program</td>
</tr>
<tr>
<td></td>
<td>Price differentials to induce load shifting behaviour</td>
</tr>
<tr>
<td></td>
<td>Change in tariff structure</td>
</tr>
<tr>
<td>Intermediate Outcome: Strong DSMO</td>
<td>Lessons Learned by EGAT and participating institutions</td>
</tr>
<tr>
<td></td>
<td>Experience gained by staff at EGAT and in other institutions</td>
</tr>
<tr>
<td></td>
<td>Strength of partnerships with manufacturers,ESCOs etc.</td>
</tr>
<tr>
<td></td>
<td>Level of confidence of key players in ability to continue programs or adopt similar programs</td>
</tr>
<tr>
<td>Intermediate Outcome: Behavioral change</td>
<td>Level of consumer awareness of EE products</td>
</tr>
<tr>
<td></td>
<td>Level of consumer confidence in EE products</td>
</tr>
<tr>
<td></td>
<td>Consumer attitudes to price premium</td>
</tr>
<tr>
<td></td>
<td>Availability of products labeled EE</td>
</tr>
<tr>
<td>Intermediate Outcome: Relationships with allies in the public sector</td>
<td>Number and strengths of alliances</td>
</tr>
<tr>
<td>Intermediate Outcome: Policies supporting EE</td>
<td>Change in labeling policies</td>
</tr>
<tr>
<td></td>
<td>Tax incentives</td>
</tr>
<tr>
<td></td>
<td>Regulations</td>
</tr>
<tr>
<td></td>
<td>Availability of subsidy, loan and grant programs</td>
</tr>
<tr>
<td></td>
<td>Availability of promotional activities</td>
</tr>
<tr>
<td></td>
<td>Availability of partnership promotion</td>
</tr>
<tr>
<td>Intermediate Outcome: Strong energy services sector</td>
<td>Number and strengths of ESCOs</td>
</tr>
<tr>
<td>Intermediate Outcome: Strong EE manufacturing sector</td>
<td>Competitiveness of the sector</td>
</tr>
</tbody>
</table>

(continued on next page)
order of magnitude smaller than they were in 2004). But without objective data it is difficult to determine how much of the growth was due to the project and how much to the worldwide market transformation and other factors. Nonetheless, using multiple lines of evidence, it is possible to assess the contribution of TPEEE to various changes in the relevant markets.

The indicators in Table 3.1 provide a means to describe the changes that have occurred since TPEEE. For each of these, we attempted to quantify or describe the change and the way in which TPEEE had a role.

To calculate the impact of TPEEE on energy use and emissions, we needed to know what had happened since the program (and what is projected to happen in the near term), as well as what would have happened in the absence of TPEEE (the counter-factual scenario). The difference between these two cases constitutes the incremental impact of TPEEE. Fortunately, we have reasonably good historical sales data for Thailand. But many assumptions had to be made to project future sales data and to speculate on what would have happened in the absence of the program.

Nevertheless, in the interest of illustrating the quantitative implications of our assessment, we attempted to estimate impacts by constructing three subjective scenarios:

- A With TPEEE scenario that incorporates all the available data on product sales and extrapolates these data to provide a complete time series of sales from the start of TPEEE until 2010 (this year was chosen because it provides a reasonable period of time to allow for the differences between the scenarios to become evident)
- A No TPEEE — High Baseline scenario that sets a high boundary of the range of estimates of sales that would have happened in the absence of TPEEE and hence represents the lower boundary of the range
of estimates of the incremental impact of TPEEE

- A No TPEEE — Low Baseline scenario that sets a low boundary of the range of estimates of sales that would have happened in the absence of TPEEE and hence represents the higher boundary of the range of estimates of the incremental impact of TPEEE

Although these scenarios — particularly the two counter-factual ones—are necessarily based on “educated best guesses” and many assumptions, we expected that by using a wide range of scenarios, as well as conservative assumptions, the results would be reasonably credible.

3.4 Methodology

The methodology involved the following tasks:

- **Initial document review and initial consultations**: We read the ICR and gathered documents from the World Bank in Washington. We interviewed the former Project Team Leader and reviewed correspondence on follow-up activities since the end of the project.
- **Development of impact assessment framework**: Using initial documentation available, we drafted an initial log frame to represent what we understood as the project activities leading through to impacts.
- **Preparation of study plan**: We prepared a first draft study plan, made contact with EGAT’s DSMO staff, and established a working relationship with the person who became our key contact person at EGAT, a Senior Economist in the Planning Unit of the DSMO.
- **Study plan revision**: On the basis of feedback received from the DSMO, we revised the study plan and identified documentation available in the field, people available for interviews, and the level of assistance that the DSMO and the Bank office in Bangkok would provide.
- **Document search and acquisition and in-depth document review**: With the assistance of the DSMO, a full range of sources was acquired. These were reviewed to assist in building familiarity with the program and to sharpen the questions to be pursued in Thailand.
- **Field work preparation**: We prepared letters of introduction and questions for the interviews, based on the documents and the study plan.
- **Field mission**: The field mission to Thailand took place January 17–28, 2005. Three days were spent at EGAT’s DSMO and seven days in other interviews and meetings. A site visit was made to an air conditioner retailer, Siam Air, and impromptu excursions were made to shops to look at the prevalence of labels on lights and appliances.
- **Interview documentation**: Notes on all interviews and meetings were typed and filed.
• *Report drafting:* A draft report was prepared and submitted for comment by the World Bank and EGAT. This final version incorporates changes in response to those comments.
4

**Project Outputs and Outcomes**

Project outputs and outcomes were assessed through the Beneficiary’s Project Completion Report and the Bank’s Implementation Completion Report. The key outcomes reported are listed in Table 4.1.

<table>
<thead>
<tr>
<th>Components</th>
<th>Outcomes at project completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fluorescent Tube Lamps T12 to T8</td>
<td>All manufacturers switched production to T8; market transformation complete</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>100% of domestically produced fridges and 82% of all fridges sold are Label #5 (EE)</td>
</tr>
<tr>
<td>Air Conditioners</td>
<td>Label #5 (EE) AC units account for nearly 40% of units sold</td>
</tr>
<tr>
<td>Compact Fluorescent Lamps</td>
<td>Large volume of units sold (900,000) at 40% below prevailing market price (that is, subsidized)</td>
</tr>
<tr>
<td>Street Lighting (HPS bulbs)</td>
<td>Lamps procured (275,000) and installed; high cost of local HPS bulbs halts promotion</td>
</tr>
<tr>
<td>Green (designated commercial) Buildings</td>
<td>Conducted more than 250 commercial and industrial building audits; installed more than 120 control systems; complete four demo project sites</td>
</tr>
<tr>
<td>Green Leaf Buildings Hotel Certification</td>
<td>More than 85 audits completed; just under 60 hotels rated—5 were at highest level; results disseminated widely</td>
</tr>
<tr>
<td>New Commercial Buildings</td>
<td>Program on hold due financial crisis and related construction halt since 1997</td>
</tr>
<tr>
<td>Brown Rice</td>
<td>59 brands of brown jasmine rice using Label #5</td>
</tr>
<tr>
<td>High-efficiency Motors</td>
<td>More than 60 demonstration/test motors procured, but only four HEM motors purchased; lab set up</td>
</tr>
</tbody>
</table>

(continued on next page)
Table 4.1 Outcomes of TPEEE Project (continued)

<table>
<thead>
<tr>
<th>Components</th>
<th>Outcomes at project completion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low-loss Ballasts</td>
<td>Distributed more than 545,000 units of Label #5 to 11 manufacturers; no promotion; on hold</td>
</tr>
<tr>
<td>Pilot ESCOs</td>
<td>Four investment grade audits done; negotiations with banks under way</td>
</tr>
<tr>
<td>Industrial Cost Reduction (retrofits)</td>
<td>30 audits conducted; future depends on ESCO viability, uptake of HEMs, funding</td>
</tr>
<tr>
<td>EE for Small and Medium-size Enterprises</td>
<td>14 demo projects conducted; negotiations ongoing with ECF for large-scale financing</td>
</tr>
<tr>
<td>Load Management</td>
<td>Interest among more than 190 customers; program on hold due large power capacity surpluses</td>
</tr>
<tr>
<td>Thermal Storage</td>
<td>Financial viability deemed marginal; on hold</td>
</tr>
<tr>
<td>Attitude Creation, including Green Learning Rooms in schools</td>
<td>Surveys show significant awareness of EE issues; more than 200 GLRs operational nationwide</td>
</tr>
</tbody>
</table>

Source: Implementation Completion Report.

The ICR also reported on the impact of these outcomes, including:

- Energy savings: 3,140 GWh per year
- Peak reduction: 566 MW
- GHG emission reductions: 2.32 megatons (Mt) per year

All these outcomes were reviewed with EGAT’s DSMO staff and updates were acquired. (See Table 4.2.) Evidence acquired formally and informally during this study confirmed that these immediate outcomes were realized by the project. Everyone we spoke with knew of the results of the TPEEE Project and the work of the DSMO, with individuals usually knowing some components in greater detail than others. The best known outcome was the residential appliance labeling program.
Table 4.2 Summary of DSMO Initiated Activities, as of January 2005

<table>
<thead>
<tr>
<th>Sector</th>
<th>Program</th>
<th>Status (these programs and agencies are described in Chapter 5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential</td>
<td>Refrigerators</td>
<td>Ongoing/Label #5 with minimum energy performance standards (MEPS) in two years</td>
</tr>
<tr>
<td>Residential</td>
<td>A/C units</td>
<td>Ongoing/Label #5 with MEPS as of March 2005</td>
</tr>
<tr>
<td>Residential</td>
<td>Compact fluorescent lamps</td>
<td>Ongoing/Label #5 – MEPS standards set</td>
</tr>
<tr>
<td>Residential</td>
<td>Brown rice</td>
<td>Ongoing/Label #5</td>
</tr>
<tr>
<td>Residential/Commercial</td>
<td>T8 fluorescent tubes</td>
<td>Ongoing/Label #5 – MEPS standards set</td>
</tr>
<tr>
<td>Residential</td>
<td>Fans</td>
<td>New program/Label #5 – MEPS standards set</td>
</tr>
<tr>
<td>Residential</td>
<td>Rice cookers</td>
<td>New program /Label #5</td>
</tr>
<tr>
<td>Residential/Commercial</td>
<td>Low-loss ballasts</td>
<td>Transferred to SME-focused EE programs, such as Department of Industrial Works (DIW)</td>
</tr>
<tr>
<td>Commercial</td>
<td>Green leaf hotel certification</td>
<td>Transferred to U.N. Environment Programme, environmental NGOs, and so on</td>
</tr>
<tr>
<td>Commercial</td>
<td>Green buildings–energy audits</td>
<td>Transferred to Department of Alternative Energy Development and Efficiency (DEDE) and non-EGAT ESCO units</td>
</tr>
<tr>
<td>Commercial</td>
<td>SME audits and EE solutions</td>
<td>Transferred to DIW and non-EGAT ESCO units</td>
</tr>
<tr>
<td>Industrial</td>
<td>High efficiency motors</td>
<td>Transferred to EGAT’s ESCO unit and DIW – MEPS standards set</td>
</tr>
<tr>
<td>Industrial</td>
<td>ESCOs</td>
<td>Recently renewed at EGAT</td>
</tr>
<tr>
<td>Industrial</td>
<td>Chillers</td>
<td>Transferred to EGAT’s ESCO unit</td>
</tr>
<tr>
<td>Other/Municipal</td>
<td>Streetlights</td>
<td>Cancelled</td>
</tr>
<tr>
<td>Other/Education</td>
<td>Green Learning Room</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>
This chapter examines the context for energy efficiency in Thailand, with a focus on macro-scale developments that occurred since the project closed in 2000. Specifically, it examines developments in the economy, the electricity sector, government institutions, the DSMO, and energy efficiency and DSM programs.

5.1 Economic Trends

In 1997 Thailand experienced an economic crisis that had a severe impact on the country’s growth and development. This event had a direct impact on the TPEEE Project (greatly reduced activity, as noted in the ICR) and on the uptake of EE technologies in later years. As an indication, interviewees suggested that businesses involved in the EE market (suppliers, retailers, energy service companies) were reduced to 50 percent capacity and have only recovered to 70–80 percent of their levels before 1997.

Following the 1997 economic collapse, electricity demand dropped significantly and, with it, interest in energy efficiency and demand-side management. Since then, demand has increased to near 1997 levels, and EGAT has been more actively seeking solutions to its projected supply shortfall.

5.2 Electricity Sector

The context for electricity supply and demand changed considerably since 1999, due in part to the economic trends just noted and in part to organizational changes. The remainder of this subsection examines developments in supply, demand, and government policies that affect the sector.

5.2.1 Electricity Supply and Distribution

Thailand’s energy supply is currently 25.6 gigawatts (GW), 59 percent of which (15 GW) is generated by EGAT, with most of the remainder generated by the country’s independent power producers (IPPs) augmented by small amounts from sources outside the country. The IPPs provide much of the country’s base load through diesel and natu-
ral gas as well as through lignite coal-fired thermal generating stations. In contrast to many other countries, Thailand’s peak load is generally satisfied through hydroelectric power. Four years ago, following the period of economic collapse, EGAT had a 40 percent surplus generation capacity. Now the reserve margin is only 20 percent, and the government has been seeking ways of developing new generation capacity.

EGAT has 10–15 direct customers—industrial plants with 10 MW or more of peak demand each. The remainder of Thailand’s electricity is supplied through the country’s two distribution utilities: the Metropolitan Electricity Authority (MEA) and the Provincial Electricity Authority (PEA).

The key change in government policy has been the adoption of the 2002 National Energy Strategy. As a result, Thailand’s electricity supply context has changed in a number of ways that affect the country’s energy efficiency directions:

- **Privatization:** The government has declared its intention to privatize EGAT, with the encouragement and support of the Thai business sector, the Asian Development Bank, and the World Bank. At the time of the impact study, the privatization process was behind schedule—a contentious issue both within and outside of EGAT. There are a number of reasons for the delays, including strikes and protest by EGAT workers and a sensitive political environment related to the selling of state assets. At the same time, the utility has concerns regarding its ability to meet demand based on the experiences of privatization in Australia, California, and elsewhere.

- **Tariff changes:** In 2000, the utility moved to implement time of use (ToU) rates. New commercial and industrial customers are required to use ToU; existing customers can choose to switch to ToU but cannot thereafter switch back to time of day rates.

- **Barriers to the construction of new power generation plants:** In the past few years, EGAT attempted to build two thermal plants in the country’s southern areas, but these were shut down by public protest. The protests were primarily based on concerns for air quality, water, tourism, and income loss. In addition, the government has refused to provide construction loan guarantees to EGAT, effectively disabling the utility from building further generation capacity of its own. Under current laws, EGAT can build and own up to four new power plants by the end of 2008. Yet the lack of government loan guarantees and public opinion effectively prevents that. EGAT’s alternative strategy is to buy from IPPs. After 2008, EGAT’s legal option to build expires; from then on, all new power plants will be built by IPPs on a 100 percent competitive basis.

- **Constraints on EGAT activities:** EGAT is subject to a number of constraints. First,
as a state enterprise, EGAT is not permitted to make a profit; second, after 2008 it is not permitted to make investments in new power plants; third, it is not allowed to make upstream investments (such as natural gas for its power plants); finally, it does not control tariff levels.

- **Tax incentives and procurement policies for energy efficiency**: At present, the government does not have a stated energy policy that clearly indicates its priorities with respect to energy efficiency or DSM. However, it appears that the government is focusing on investment incentives for EE without using loans and grants, preferring instead to use tax incentives as the key economic instruments to achieve its EE policy objectives. In recent years the government has adopted a green procurement policy that requires energy efficiency in the purchase of labeled products. For example, all A/C units under about 3 tons must have Label #5.

### 5.2.2 Electricity Demand

Over the past 15 years Thailand’s energy use has risen 40 percent more than GDP. The government has now set a target of a 1 percent increase in energy use for every 1 percent increase in GDP by 2007. This would bring the country in line with the average among members of the Organisation for Economic Co-operation and Development.

Peak seasonal energy demand occurs from March to May. Figure 5.1 provides an overview of Thailand’s daily load characteristics. There are currently three peak times: two peaks at roughly 10 a.m. and 4 p.m. (primarily from industrial and commercial demand) and a third peak at 7 p.m. (primarily from residential demand). During the 4 p.m. peak, residential demand represents 20 percent of the load, commercial is 35 percent, and industrial is 45 percent.

### 5.2.3 Minimum Energy Performance Standards

In the past three years, Thailand has begun the development of minimum energy performance standards for six appliance categories: air conditioners, refrigerators, motors, ballasts, compact fluorescent lights, and fluorescent tubes. For these, the MEPS mainly follow United States Environmental Protection Agency guidelines and also draw on DSMO standards for Label #5. The MEPS are being implemented by the Department of Alternative Energy Development and Efficiency and the Energy Policy and Planning Office (EPPO) of the Ministry of Energy, with the support of the Thailand Industrial Standards Institute (TISI).

The MEPS implementation schedule for air conditioners began in March 2005 and was effective as of May 2005. The standard for A/C is equivalent to what EGAT calls a Level 3 EER (8.6–9.6 Btu/h/W). MEPS for fridges are intended to follow in 2007. It was decided to apply MEPS to A/C units first, as experience indicates that these are the most difficult to
affect through voluntary labels. Thailand has many manufacturers and models of A/C, and the DSMO found it difficult to ensure that all labeled units were in compliance. Therefore a standards approach was deemed necessary.

At the time of this study, there were no detailed plans to implement the five other MEPS.

5.3 Key Government Institutions

The ENCON Act of 1992 (which became effective in 1995) has been a critical piece in the development of EE in Thailand and is considered particularly progressive. It was especially notable for its establishment of the Energy Conservation Promotion Fund.

From 1992 to 2002, and during the life of the TPEEE Project, energy matters were the responsibility of the Prime Minister’s Office. At that time the National Energy Policy Office (NEPO) was located in the Prime Minister’s Office and EGAT, being the responsibility of NEPO, reported directly to the Prime Minister’s Office.

In 2002 the Thai government began implementation of the National Energy Strategy and created the Ministry of Energy, which includes the Energy Policy and Planning Office (known as NEPO during the TPEEE Project) and the Department of Alternative Energy Development and Efficiency (known
as the Department of Energy Development and Promotion during TPEEE). Overseeing these structures is the National Energy Policy Council, which is normally chaired by the Prime Minister.

From 2002 to 2005, the Metropolitan Electricity Authority and the Provincial Electrical Authority — both publicly owned and distributing 35 percent and 63 percent, respectively, of the nation’s electricity — reported to the Interior Minister. In 2005, they began reporting to the Ministry of Energy. Figure 5.2 shows the Ministry of Energy’s overview responsibilities up to 2005; as of 2005, the Ministry was overseeing the activities of EGAT, DEDE, and EPPO as well as MEA and PEA.

By most accounts, this reorganization has helped centralize responsibility for electricity and EE issues within the government, though the organizational structure and responsibilities are still maturing. In broad terms, EPPO handles load management, policy, research, and development, while DEDE is responsible for program implementation.

It is useful to review briefly the responsibilities of EPPO and DEDE, as well as other organizations involved in EE.
5.3.1 Energy Planning and Policy Office
EPPO has been very active since 2002 as the implementer of “voluntary” programs (including renewable energy, industrial liaison, R&D projects, and promotion of small power production generation) and “supplementary” programs (including human resource development and public awareness). Under a recently revised allocation of responsibilities (which took effect in 2005), EPPO focuses almost exclusively on strategic issues, including policy research and coordination. The Energy Conservation Promotion Fund is a major instrument for EPPO in policy implementation. (See Box.)

5.3.2 Department of Alternative Energy Development and Efficiency
From 1995 to 2004, DEDE only had responsibility for “compulsory programs” (including designated factories and buildings). As of 2005, EPPO took on responsibility for the “strategic administration program” (including policy research and management), while DEDE assumed responsibility for the renewable energy program and energy efficiency program, a new area for DEDE. The EE program includes DSM, labeling, and MEPS. Both programs include R&D, demonstration projects, human resource development, and public relations and awareness. From an organizational perspective, it is expected that this arrangement will simplify the interaction between the DSMO and the ECF, as all energy efficiency — related activities have now been centralized.

DEDE currently operates three divisions:
- Bureau of Energy Regulation and Conservation, which handles “designated
- ...
facilities” (factories and buildings) under the ENCON Act

- Bureau of Energy Efficiency Promotion, which handles nondesignated facilities (including government buildings) and some public awareness activities
- Training division (about 40 staff).

5.3.3 Consumer Protection Board
The Consumer Protection Board (CPB) has a clear role and mandate in enforcing the product labeling aspects of DSM. However, it does not test appliances or assure consumers of product quality. Rather, the CPB relies on the Thailand Industrial Standards Institute and various universities for this. The CPB is situated within the Office of the Prime Minister.

5.3.4 Electrical and Electronics Institute
The mandate of the Electrical and Electronics Institute is to increase Thailand’s exports by enhancing the competitiveness of Thailand’s products. The Institute tests products for use not only within Thailand but internationally, as these EE products are also exported to neighboring countries. The current Executive Director of the organization is a champion of energy efficiency for Thailand’s industrial sector as a strategy for improving Thailand’s competitiveness and promoting exports.

5.4 The DSMO
5.4.1 Structure and Reporting Relationships
EGAT’s DSMO has remained in place since the end of the TPEEE Project. The DSMO maintains a staff of approximately 250 people, slightly larger than when the project was in operation. For the most part it maintains the programs that at the end of the project were seen as successful, as reported in the December 2000 ICR.

The DSMO is now located institutionally within the Transmission Division of EGAT, a unit that is not likely to be privatized.7 It is headed by an Assistant Governor—one of 19 who report to the Deputy Governor of the Transmission Division. The DSMO has two units, each with a Director: a Management and Planning Unit and an Implementation Unit.

- The Management and Planning Unit plans and monitors all aspects of DSMO program implementation and reports according to formats established during the TPEEE Project. New and additional program activities have been incorporated into the reports.
- The Implementation Unit undertakes the residential appliances labeling and testing program, the ECSO development program in the industrial sector, and the Green Learning Room Program.

Under the current leadership, the DSMO is being asked to trim staff and budget and has no identified organization-wide “champion” beyond its own Assistant Governor and staff. This is the case despite the strong and widely held perception that the DSMO Label #5
program is the face of EGAT for most people in Thailand.

It is worth noting that the overall privatization issue and the uncertainty surrounding it appear to have had a significant impact on the DSMO. Several interviewees indicated that a number of programs were frozen as a result of this uncertainty. There is also some uncertainty with respect to the role of the DSMO in relation to the policy structure of EPPO and the implementation responsibilities of DEDE. As a result, the DSMO’s future role in achieving energy efficiency objectives in Thailand is not clear.

Also complicating the outlook for the DSMO are its links, along with overall EGAT links, to the EPPO and the structures for energy planning. The DSMO formerly chaired an interministerial DSM committee, but this has not met in four years. The office is very much on its own at the present time in a fluid policy environment, which is affecting several aspects of DSMO work. In certain cases, other agencies are assuming responsibility for DSMO areas of expertise (such as residential areas), and this causes some tension.

5.4.2 DSMO Capacity
The DSMO has developed competencies in a number of significant areas:

- **Monitoring and Evaluation:** The DSMO has developed the human resources necessary to do detailed monitoring and evaluation of its own programs. In some instances, the office does this on its own, while in others it teams up with outside organizations. The DSMO has developed a particularly strong capacity in quantifying the energy and environmental impacts of its own programs.
  - **Compliance Testing:** The DSMO has continued to test, with third-party labs, compliance in the use of its Label #5 on the full range of labeled products. The office works with Excellent Energy International Co., Ltd. (EEI) to do appliance testing and with the Thailand Industrial Standards Institute on equipment standards. Since 2000, the number of equipment tests has increased as more manufacturers seek the EGAT #5 label. In the past four years, EEI has tested 1,200 sets of A/C and 970 refrigerators. The Consumer Protection Board supports the DSMO program. The CPB receives complaints, while EGAT does random testing.

5.4.3 Financing and Reporting
During the life of the TPEEE Project, EGAT funded the DSMO budget through a fuel tax adjustment tariff. This tariff was removed shortly after October 2000, and thereafter EGAT took on the funding of the DSMO and its programs through its base tariff. The DSMO now has an annual budget ceiling of some 300 million baht (approximately $7.9 million), although the actual amount spent each year in the last four years has been about 60–70 percent of budget, depending
on approval of activity or project budgets. The DSMO budget represents approximately 1 percent of EGAT’s operating budget of 30–40 billion baht (EGAT’s revenues are approximately 250 billion baht).

The current DSMO five-year plan (2006–10) was approved in March 2005.

5.5 EE and DSM Programs

This section reviews efficiency-related activities undertaken by the DSMO and other organizations since closure of the TPEEE Project, with in particular an examination of developments in the residential sector, commercial and institutional sectors, industrial sector, load management and peak shifting, education and awareness-raising, and energy service companies. Note that in certain cases there are overlaps between programs. For example, the fluorescent tube program applies equally to both residential and commercial sectors.

5.5.1 Residential Sector

Overall, EE activity in the residential sector has increased since 2000, primarily through the activities of the DSMO and, to a lesser degree, DEDE.

DSMO

The DSMO has continued the use of its Label #5 on EE appliances used in homes across Thailand, and Label #5 has become a recognizable symbol of EE and EGAT nationwide. Manufacturers have adopted the use of the label through voluntary agreements with EGAT and now sell few (if any) domestically produced appliances that are below the standard of Label #5. EGAT has worked with manufacturers to increase the EE rating of all the appliances since the labeling program began. Label #5 for A/C is EER of 10.6, but this will be moving to 11 in the near future (in consultation with industry). The DSMO has also rescaled the Label #5 threshold for fridges.

From May to July 2002, EGAT launched a campaign offering interest-free loans of 10,000 baht (paid through credit cards; the DSMO paid the interest) for each purchase of an energy-efficient #5 A/C. They subsequently dropped the program due to the low level of uptake. Similarly, the DSMO dropped its magnetic ballast labeling program because it discovered that long-life items such as ballasts are harder for people to adopt due to infrequent changes and the high incremental cost of low-loss ballasts. (A 4-watt ballast initially costs more than three times as much as a standard 10-watt ballast.)

The DSMO has added three new labeling programs since the end of the TPEEE Project in 2000:

- *Domestic electric fans:* The DSMO implemented labeling of domestic electric fans across Thailand. The program was based on a full cost-benefit analysis that estimated impacts based on experience with other labeling programs.
Brown rice promotion: The DSMO also engaged in a program to encourage the use of brown rice, which requires less energy in milling but requires longer cooking times, although the net energy use has not yet been studied. The main driver behind this program is health, and the program was substantially aided by the direct endorsement by the King. EGAT categorizes this initiative within its attitude creation program.

Rice cookers: The DSMO launched a program to label domestic rice cookers (not related to brown rice promotion). This program was only launched recently and has not had time to gain substantial market presence.

DEDE Programs (independent and in collaboration with the DSMO)

Prior to government restructuring in 2002, DEDE programs exclusively targeted commercial and industrial energy users. DEDE’s focus has since shifted to include residential and transportation sectors. DEDE has undertaken the following, either alone or in collaboration with the DSMO and other organizations:

Energy-efficient housing: Under its residential program, DEDE has come up with energy criteria for houses and developed three types of demonstration homes. The office is considering an award program for EE houses and the development of a model EE community. (It is worth noting that, so far, DSMO activities have not addressed the area of home energy efficiency, only appliances.)

Standards and Labeling Working Committee: DEDE also established a working committee for EE standards and labeling consisting of DEDE, EGAT, EPPO, the Consumer Protection Bureau, and TISI. EGAT and DEDE worked together to set up standards and testing procedures. DEDE also developed a promotional and subsidy plan, including publications and brochures for buyers.

Harmonized EE standards: DEDE is currently cooperating with the DSMO on developing harmonized EE standards for appliances, over and above work that has been done on MEPS. DEDE is also considering a tax incentive for appliances.

5.5.2 Commercial and Institutional Sectors

From 2000 to 2005 there was little activity aimed at the commercial and institutional sectors outside of the ESCO work described here.

DSMO

DSMO activities in the commercial sector have not been significant. EGAT continues to do certification of Green Leaf hotels in collaboration with the Hotel Association of Thailand, the United Nations Environment Programme, and a number of environmental NGOs. Green Leaf is as a voluntary certification program with a checklist of activities to reduce environmental impacts pertaining to energy, water, and so on.
In 2002, EGAT provided technical assistance in performing energy audits — designing and retrofitting energy-efficient air conditioning and lighting systems for the head office buildings of Bangkok Bank and the Bank of Thailand as well as the latter’s Surawongse branch office. These pilot projects were intended as a showcase for energy and cost saving for the commercial sector.

DEDE
DEDE is currently revising the building codes (which came into effect in 1995) for new buildings, including an explicit section on energy. The code will include offices, educational institutions, and hospitals. DEDE is also providing training for building owners on how to save energy.

5.5.3 Industrial Sector
The Thailand industrial sector accounts for approximately 45–50 percent of all electricity use. Within this sector, heavy electric motors are responsible for 80 percent of electricity use. Although a number of initiatives have targeted the industrial sector and motors in particular, there has been relatively little EE activity since 1999. Activities of the DSMO, the Department of Industrial Works, DEDE, and the International Finance Corporation of Thailand (IFCT) are described briefly here.

DSMO
DSMO activity in the industrial area dropped significantly after 2000, when the office discontinued its efforts to label high-efficiency motors. The office found that the program was ineffective as it only affected the domestic production of small motors. The DSMO realized that the main efficiency gains were to be had in the imported large motor market, an area unaffected by voluntary labeling. The office opted to drop the program and try to address it through MEPS at a later date (as noted earlier, the government has developed a MEPS for motors but it is not known when it will be put in place). Note that in this period the DSMO also stopped its industrial audit programs.

Department of Industrial Works
In recent years the DIW has increased its interest and involvement in industrial energy efficiency programs. The majority of these efforts focus on reduced fossil fuel use, although there are some initiatives that consider electricity EE. These include:

- Energy Guidelines: The DIW has developed energy guidelines for six light industries, including canning, textiles, cold storage (freezing), plastics, rubber products, and smelters. Although the focus of the work is primarily on fossil fuel cost savings, some consideration is given to electricity energy efficiency. The program employs four DIW staff and will run until 2009.
- Audits: The DIW sends consultants to industries to assist in EE projects (both electricity and fossil fuel use). EPPO/DEDE then funds 30 percent of the retrofit cost,
and the customer must obtain the other 70 percent. This presents a significant challenge, as financing is not easy to get due to banks wanting cost reduction guarantees.

- Staff training: The DIW has done training in energy efficiency for 1,800 of its own staff in the provinces who are promoting DIW guidelines for EE in the SME sector, where there are 60,000 enterprises.

DEDE
During the TPEEE Project, 80 percent of designated commercial and industrial facilities underwent a preliminary or walk-through audit. But DEDE experienced severe difficulties in processing these audits, approving retrofit programs, and implementing actual retrofits (financing proved to be a significant barrier). DEDE staff found that it was difficult to fully enforce the regulation on the energy efficiency investment, especially within the industrial sector (factories claimed that their energy consumption was already efficient, and the law was not specific enough to say otherwise). Since 2003, DEDE has streamlined the system to provide a more results-oriented approach (for example, there is no longer a need for registered consultants to do the walk-through audits, and the parties can now report their audit results electronically).

From 2002 to 2004, DEDE also ran a “30% Subsidy Program.” This was a revised program that had easier access to financial subsidies, a focus on industrial plants (rather than a wider focus on designated commercial facilities), and a better system in place that incorporated lessons learned from earlier program. DEDE funded 390 projects under this program (including 200 industrial facilities) and reduced audit approval time from six months to one month. This experience allowed them to build capacity and confidence that was needed to implement audits and retrofits.

The DEDE-operated ECF has funded 45 projects to date, including 35 industrial and 10 commercial/institutional ones. Projects include chillers, process improvements, controls, cogeneration, biogas, and fuel switching. Most projects use a single technology, with very few integrating more than one technology, in part because few consultants or ESCOs are able to provide integrated design.

International Finance Corporation of Thailand
The IFCT manages the Chiller Replacement Fund, a project originally developed by EGAT in 2002. The program is done in collaboration with the Department of Industrial Works and has a budget of $5 million from the World Bank (with half the funds coming from the GEF and half from the Montreal Protocol Fund, with chlorofluorocarbon emission reductions as the main objective).

To date the IFCT has arranged for the replacement of 20 chillers using World Bank
funding, and 36 more using other funding. The completion date for the program was June 2005.

5.5.4 Load Management and Peak Shifting
The TPEEE Project was originally intended as both an energy efficiency and load management project. As EGAT did not have knowledge of the fundamental differences between these primary objectives and the implications for the organization, the latter area received relatively little attention.

Prior to 1997, the DSMO engaged MEA in a pilot project focused on load management through peak shifting. Following the economic crisis, however, interest in peak reduction fell and the MEA/EGAT project was dropped.

In 2002, the EGAT Governor (Khun Sittiporn, the former head of the DSMO) recognized the important role of load management and started the Peak Cutting Program. Under this, the DSMO encourages large customers with standby generation to use their generators rather than grid power during on-peak periods.

5.5.5 Public Education and Awareness of Energy Efficiency
In general, the level of public awareness of EE has increased in the past five years through continuous campaigns around Label #5 as well as through related initiatives by both the DSMO and EPPO.

DSMO
EGAT has maintained a high level of activity in EE education and awareness raising. These activities include continued advertising of Label #5 and expansion of programs such as the Green Learning Room, operated in conjunction with the Ministry of Education. At present there are 424 classrooms across the nation with specific equipment and resources to teach about electricity production and energy efficiency. EGAT pays for the expansion of the program, at the rate of approximately 10 new GLRs each year at $13,750 per room. National and regional competitions are run to engage students. DSMO staff indicated that students and families in rural areas take an even greater interest than urbanites in GLR.

The goal of GLR is to raise awareness of electricity first (for instance, how it is generated) and environment second. GLR’s focus is on behavior change: unplug appliances, turn off lights, and buy EE products. The program reinforces other aspects of the DSMO’s public campaign: EE labeling and consumer choice. It tries to reach the household level through students with activities that involve their parents, such as household EE audits. The DSMO has seen many secondary effects from GLR — for example, families of children attending GLRs are much more likely to buy Label #5 A/C and appliances.

The GLR program has partnered with the Ministry of Education and one IPP, Rachaburi Power Co. Ltd. GLR won an interna-
tional recognition award in Austria in 2001. In terms of replication, one GLR has been constructed in Cambodia, and Chinese authorities have also expressed interest.

**EPPO**
Under the ENCON Act, EPPO had responsibility for education and awareness-raising (though this changed in 2005). To date, efforts have focused on the “Divide by Two” campaign that includes TV spots, with the theme “Save electricity, save money in your pocket.” EPPO has also promoted activities for young people and distributed booklets on energy conservation in government buildings and households. The message to households, running from June 2004, is “Save electricity, double profit.” The objective is to urge people to change their electricity consumption behavior. The project provides an incentive to all households (14 million) if they reduce electricity use by more than 10 percent. These incentives involve an electricity tariff reduction of 20 percent for the units saved, which must be equal to or more that 10 percent of the electricity consumption in the same month the year before. This program is open to all MEA and PEA households.

5.5.6 Energy Service Companies
There are at present 12–15 private sector ESCOs in Thailand. The majority of these are not “conventional” in the North American sense; they are not independent companies that do retrofits involving a variety of technologies and brands or provide financing for costs/investments. Rather, all Thai ESCOs but one are affiliated with a particular supplier (such as Honeywell or Siemens) and only supply that company’s products.

The only independent ESCO is Excellent Energy International, a company that has been in business for about five years and has Energy Purchasing Contracts worth around $20 million. EEI has about 13 full-time employees and two or three subcontractors with whom the company works regularly. EEI’s clients are quite diverse, but most are industrial. The clients include the agriculture sector (palm oil production), the food industry (tapioca), and institutions (hospitals and hotels). EEI does not work with offices, schools, or universities.

EEI’s business model is that the company will do investment-grade energy audits, offer the client a range of payback periods, and agree on a regular payment. EEI proposes a slate of measures, including biomass and cogeneration options (particularly for hospitals with large domestic hot water loads), and will guarantee system performance. EEI then usually takes care of all utility payments under a performance guarantee contract. Work is normally financed either by the client or by EEI. EEI arranges funds through local banks or off-shore groups like the Global Energy Fund (in the United States).

A number of government institutions have sought to promote ESCOs:
- In the past five years, DEDE has been promoting ESCO concepts through seminars, brochures, broadcasts, and so on and through an ESCO network. DEDE has also been developing an ESCO Web site and setting up a database to be a tool for potential clients to do a preliminary search for ESCOs.

- The DSMO’s own ESCO Unit was revived in 2002 in anticipation of privatization. This unit was designed to work mainly in the industrial sector and to be spun off as an independent self-financing unit.

- The Metropolitan Electrical Authority (with some funding from the World Bank) undertook a series of ESCO projects in 2000. MEA’s ESCO activities died down until 2003, when MEA formed an ESCO department with three staff. MEA’s current concern is to spin off the ESCO unit so that it can operate on a “for-profit” basis. The ESCO unit has a plan to work with 11 customers.

- The IFCT provides concessional loans and equity to ESCOs and therefore acts as both a lending institute and an investor. IFCT spreads its ECSO work across several sectors and regions of Thailand and works closely with ESCOs (mainly with Excellent Energy International). The IFCT process is that it identifies a client (such as a hotel), talks to the CEO, and guarantees three things: a payback period of usually not more than four or five years, an internal rate of return of 15–20 percent, and a set (maximum) investment cost. The parties then enter into a contract. IFCT gets the ESCO to do an Investment Grade Audit of the facility and provide a menu of choices for investment. IFCT provides the capital to the client, who hires the ESCO to do the technical work with a performance guarantee. IFCT generally deals with only three EE technologies: chillers, heat pumps, and domestic hot water systems. IFCT’s efforts to enter the ECSO business can be attributed in large part to the EGAT Chiller Replacement Program (done under the DSMO but separately funded by the GEF through the World Bank in 1998) and to encouragement from a French group (FE Clear Energy Group) that usually helps set up ESCOs. IFCT involvement in ESCOs is therefore an indirect result of DSMO activities.
6
Assessment of Intermediate Outcomes

This chapter examines the intermediate outcomes of the project (that is, the elements influenced by the project in the medium term, such as policies, programs, and behaviors). As described in the results framework, there are six intermediate outcomes.

The sustainable outcomes of the TPEEE Project, such as the continuation of the DSMO and the influence on consumers and suppliers, have been achieved in large measure due to design features of the original project. Several design elements have been critical in this regard:

- **The project had a sufficiently long life span.** The project lasted seven years, during which it resulted in significant outcomes in several areas with solid evidence that could be verified. A shorter project would not have allowed the successes to emerge.
- **The DSMO Management and Planning Division was sufficiently skilled and well resourced to do its job well.** The Unit used effective methodologies, and as a result the design of new and successful programs improved during the life of the project.
- **There was ongoing staff training in the Planning and Evaluation Unit.** This increased DSMO staff’s capabilities considerably, enabling excellent reporting internally and to the Board of EGAT.
- **Funding of the TPEEE Project was not dependent on the budget of EGAT.** During the life of the project, the tariff that supported the Project provided the necessary revenue without taxing the revenue base of EGAT or its partners, the MEA and the PEA.
- **There were no costly or ongoing subsidies for EE products.** This saved significant resources and ensured that the project was seen as cost-effective.
- **There was strong empirical evidence of DSMO program impacts.** The evidence was obtained through detailed measurements and evaluations, indicating significant results.
• **Public campaigns developed a great amount of public good will.** They were widely successful and provided an image for EGAT that was aligned with consumer savings through product choice (the Label #5 program).

DSMO staff and observers are clear that without the TPEEE Project the organization would not have developed capacity for research, evaluation, load management, and integrated resource management. As a result, the DSMO would have had limited influence and would probably have dissolved into, at most, a single division within EGAT.

### 6.1 Strong DSMO

Over the past five years the DSMO has remained quite strong, and it has built on many of the successes of the TPEEE Project to become what appears to be a focal point for EE in Thailand. At the same time, there are a number of indications that the DSMO is not as strong as it could be and that it has not yet succeeded in promoting EE in all sectors.

The following summarizes the positive aspects of the current DSMO:

- **The EGAT “Label #5” Program remains strong.** Following the end of the TPEEE Project and with the continuation of EGAT’s DSMO, the residential appliance energy efficiency program has continued unabated. The role of this program has risen appreciably in relationship to other DSM components in the TPEEE Project. The primary feature of the residential focus is the labeling program. Not only has this program been maintained, it has been widened to include other appliances, such as fans and rice cookers. While there are EE standards for Labels #1–4, the highest EE standard is Label #5. But manufacturers and consumers have shunned Labels #1–4 and only apply and buy Label #5. Standards for energy efficiency related to the EGAT labels have also risen during this period.

- **The DSMO budget and staffing remain strong.** Following the end of the TPEEE Project, EGAT shifted funding of the DSMO away from the automatic tariff and toward the general revenue base. Yet the DSMO budget of 300 million baht is not allocated but rather considered a cap (the office still needs to apply for funds on a project-by-project basis), and this hinders its abilities to develop long-term initiatives.

- **The DSMO has helped EGAT’s corporate image.** It appears that DSMO activities, and in particular its Label #5, have done a great deal to improve the general public’s positive perception of EGAT. At a time when EGAT is under scrutiny, largely related to the plans for its privatization, this is a very critical factor, and EGAT management appears to be very aware of its value. On the other side, it also appears that this perception of the DSMO as a public relations tool may be preventing
DSMO load reduction efforts from being considered seriously in integrated power planning (as discussed later).

- **The DSMO has developed and maintains a strong internal evaluation and testing capacity.** This tracks a variety of success factors: GHG emissions reduction, energy reduction, peak coincidence factor, and so on. Much of this capacity was obtained by bringing in qualified consultants who helped train DSMO staff. At the same time, the DSMO has not established a solid third-party evaluation capacity—an independent monitoring and evaluation capacity—to validate results and give credibility to statements on the size of project impact. This is due to both a lack of funds and an apparent cultural resistance to the idea of outside critiques.

Despite the positive points just described, there are indications that the DSMO lacks strength in a number of areas:

- **The rate of increase in DSMO activities has been reduced since 2000.** Since then, the DSMO has reduced the size and volume of EE programs it initiates and administers. From 1993 to 1999, the DSMO started 19 programs, but from 2000 to 2005 only four new programs were initiated: Label #5 for rice cookers, brown rice, and household fans and the Peak Cutting Program. In addition, it cut a number of existing programs (such as Label #5 for motors). This reduced level of new initiatives appears to stem from both the uncertainty associated with privatization and the loss of a strong champion within EGAT.

- **DSMO objectives are not aligned with those of EGAT.** Within senior levels of EGAT, it appears that the DSMO is often seen as being in conflict with EGAT’s primary mandate (producing and selling electricity). When the TPEEE Project started, it was recommended that the DSMO engage in two types of activities: load management and conservation. It appears that the distinction was not well understood, and the DSMO focused on conservation, with few efforts aimed at load management and peak shifting. A number of interviewees felt that the DSMO should have paid more attention to the latter; some even felt that load management and load reshaping should be the primary goals of any DSM program. In general terms, energy conservation is “in the public good” while load management is in “the utility’s good,” so an emphasis on the former meant that the utility saw DSMO activities as primarily good public relations.

### 6.2 Behavior Change

DSMO activities have increased public awareness that energy is a measurable resource. This plus consumer and political awareness of EE may be among the DSMO’s greatest impacts. At the same time, it should be noted that the public does not appear to link energy efficiency to the avoidance of power plants, nor do people make a strong link between
energy use and environmental impacts (such as clean air and GHG reductions).

DSMO energy efficiency labeling campaigns have high recognition; they have been highly effective in changing residential appliance purchasing behavior. It appears that consumer behavior has changed significantly with regards to EE equipment and appliance purchasing. Both the DSMO and EPPO have launched public awareness campaigns, although it appears that DSMO work has achieved higher recognition. Interviewees indicated that DSMO campaigns have high recognition and that the Label #5 has effectively become a “seal of approval” and a sign not only of energy efficiency, but also of quality and durability, as indicated earlier. This success seems to have translated into an improved overall public image of EGAT.

Behavior change in the commercial and industrial sectors is much less evident, and it appears that the DSMO’s impacts in this case are limited to indirect “runoff” from the residential campaigns.

6.3 Relationships with Allies in the Public Sector

In the public sector, the DSMO has a mixed record of maintaining links. The links to the Ministry of Energy’s Departments such as DEDE and EPPO are relatively strong. This is supported by the number of collaborative programs instituted (including the minimum energy performance standards, SME cost reduction, ASEAN Energy Cooperation on Standards and Labeling, and the ESCO Pilot project). The DSMO also retains a strong alliance with the Consumer Protection Board, which continues to act as a public monitoring agent in support of the Label #5 program. The success of DSM appears to have created a certain level of competition among government agencies that in turn has pressured DEDE to put more focus on EE in all sectors.

There has been a decline in broader interdepartmental collaboration, however. For example, the DSM Committee (created to coordinate DSM programs among agencies and the utility) has largely ceased functioning, which appears to have impeded the systematic and consistent collaboration among DSM stakeholders that was envisioned during the TPEEE Project. Other working groups, although still active, have not been able to provide momentum. For example, the rice cooker labeling program fell under the EGAT/DEDE Standards & Labeling working group, which met only once in 2004. As EGAT is constrained by the decisions of the group, this inactivity caused a number of delays. Furthermore, EGAT has no significant contact with the Department of Industrial Works or the Department of Industrial Promotion in the Ministry of Industry, despite their involvement in EE programs, audits on buildings, and focus on motors and equipment.

There are few solid indications of programs where the DSMO and the Metropolitan Elec-
Electricity Authority have collaborated in recent years. Interviewees at MEA indicated that DSM programs (specifically Label #5) had greatly benefited EGAT, while the benefits for MEA were uncertain. At the same time, the DSMO had little involvement in MEA’s activities, even though the office had been brought in years earlier to assist MEA in launching its DSM initiatives. It was noted by one interviewee that this was unusual, given that the distribution utilities have direct access to consumers, who are the DSMO’s primary audience.

6.4 Policies, Regulations, and Institutions Supporting EE

This section examines the impact of the TPEEE Project on policies and regulations of both EGAT and the government of Thailand.

6.4.1 Impacts on EGAT Policies and Planning

DSMO program achievements have not become a significant factor in EGAT’s power planning process. It was the view of a number of interviewees that this would be the “litmus test” for measuring high-level impact. Notably, the demand and load reductions achieved by the DSMO are not significant in development of its Power Development Plan and its Integrated Resource Plan, though they are somewhat considered. At present, it appears that this high-level objective has not been achieved.

First, although EE figures do appear in EGAT’s Power Development Plan, the DSMO figure is not separated from other initiatives, and by most indications even the aggregate figure “gets lost” among other considerations in power planning. (The 2002 load forecast counts on 900 MW of peak reduction from energy efficiency, including DSMO activities and others). The former Governor suggests that the DSM concept (and the DSMO itself) is not yet strong enough to influence supply-side management. It should be noted that within EGAT, the DSMO Assistant Governor is just one voice among 19 Assistant Governors, and it is therefore a challenge to have DSMO figures clearly worked into the Power Development Plan. Similarly, the DSMO is not represented on EGAT’s Load Forecasting Committee or on the Tariff Setting Committee, which is chaired at a political level and made up of MEA, PEA, EGAT, IPPO, and others.

It appears that DSMO figures are limited to the marginal reserve section of the power planning figures by both integrated resource planning exercises. As EGAT’s marginal reserves get smaller each year, given the rapid rise in demand, the DSMO contribution is more significant. However, there is a widespread sense that the attention to the DSM information by the integrated resource planning processes is negligible.

The government of Thailand is in the middle of planning a national low-energy intensive industrial growth policy under the direction of the EPPO. But there are no plans to meet
new demand with an enlargement of DSMO activities. It will be a challenge for the government to have the right mix of policy instruments to achieve its goals without greater investment in EE. One area for clarity is for the DSMO to have specific EE or power reduction targets and to have these targets included in the integrated power planning processes of both EGAT and the country.

It is worth noting the impact of the 2002 government restructuring and the continued potential for privatization on EGAT’s planning. These have had the effect of making long-term planning difficult within EGAT, thus “drowning out” the DSMO impacts.

6.4.2 Impacts on Government Policies
The DSMO and the TPEEE Project appear to have had a significant impact on certain areas of government energy policy. The Ministry of Energy has realized the importance of energy efficiency and has brought all the important national institutions, including EGAT, into a newly reorganized ministry structure that is still evolving. The recent government reorganization marked a positive change concerning the coordination of efforts between EGAT and DEDE. The Directors of DEDE and EGAT were brought together to work out their differences. While the relationship still has difficulties, areas of responsibility and lines of reporting are becoming clearer. DEDE has recently undertaken changed policies—for example, setting standards for building codes—that are based on results of DSMO work. The EPPO was putting new structural initiatives in place at the time of this study.

The programs and the policy instruments of the Ministry of Energy are also evolving quite quickly based on lessons learned and new insights into the role of energy efficiency in economic development. The imposition of national MEPS is a significant policy change at the Ministry of Energy—one of the first visible shifts since the Bank’s DSMO project ended—and it was made possible by the DSMO’s important work with manufacturers over several previous years. EPPO’s policies can be promoted largely due to the success of EGAT’s successful DSMO programs. Also, EPPO’s energy efficiency recommendations to the Minister are seen as appropriate in the national context of emerging energy demand.

The Minister of Energy has recognized and emphasized that EGAT must seek to reduce peak energy demand. There is a clear recognition that the need for new electricity capacity should be reduced and that EGAT should undertake peak cutting.

DSMO staff and other observers believe that very little of this would have happened in the absence of the TPEEE Project or that it would have happened much more slowly.

6.5 Strong Energy Services Sector
The TPEEE Project has had a modest influence on the development of this sector.
The DSMO’s earlier ESCO initiatives served as the spark for many of the current ESCO initiatives in the public and private sector. Initiatives such as those being undertaken by MEA and DEDE are encouraging. Although the Thailand ESCO market is not yet well developed, some interviewees indicated that public and private ESCOs would not exist in Thailand if it were not for the TPEEE Project. ESCO work by the DSMO did help create capacity and sow the seed for later public and private ESCO development. It is assumed that current public ESCO initiatives will be spun off from the institutions that now house them. Time will tell if they will be private enterprises or independent public enterprises, though privatization policies will likely affect ESCO development in Thailand. The Ministry of Energy plans to have ESCOs involved in the retrofit of government buildings. EGAT will be able to take credit for DEDE’s change in policy, with some input into financing decisions on how ESCO activities can be handled in Thailand.

The DSMO can be given some credit for encouraging some specific private sector ESCOs as well. These companies, though few in number, probably would not exist if it weren’t for the TPEEE Project, which helped lay the groundwork for the establishment of ESCOs in Thailand and sparked the interest of some banks, including IFTC and Thai Bank. EEI was one of the groups that participated in the original ESCO pilot, and it appears that EEI was the only ESCO that really worked. The biggest issue here is trust: industry is not sure about ESCOs that promise energy savings. To quote from an interview, “Amongst the biggest barriers now are the recognition and credibility of ESCOs. Banks are on board, everything is ready to go ... they just need the factory owners to believe that it’s the right thing.”

The DSMO’s ESCO activities provided key demonstrations and tools to support ESCOs. First, the DSMO provided promotional value, basically to show that ESCOs work. Second, its Energy Purchase Contract and its monitoring and verification plan were good examples for other ESCO projects of measures and precision quality control. This knowledge and these systems have helped give rise anew to an interest in ESCOs. The current ESCO pilot project may help EGAT to see some business opportunities in this area. If EGAT steps into this business more seriously, it will again make a major difference.

There is an emerging international interest in EGAT’s ESCO activities. This includes recent queries from Japan, where ESCOs are quite strong. In October 2005, an ESCO conference convened in Japan, with an effort to start a regional ESCO association.

Once again, DSMO staff and observers believe that very little activity on ESCOs would have happened in the absence of the TPEE Project.
6.6 Strong EE Manufacturing Sector

The DSMO has had a significant impact on raising the competitiveness of the Thai EE product manufacturing sector. Its efforts made the domestic appliance manufacturing sector more competitive, thus putting it in a better position for strong export market activity.

Thailand’s EE products, such as Label #5 A/Cs, are sold in Sri Lanka and Indonesia, among other markets. Australia now imports many Thai A/C units, and these actually have a higher efficiency than the units produced in Australia. Thailand’s equipment exports are significant: 55 percent of refrigerators; 54 percent of air conditioners, mostly to the Middle East; and 73 percent of fans. As the demand for EE appliances and equipment increases in Asia, Thailand is in a good position to sell such products.

The DSMO retains strong links to the manufacturers it has worked closely with. Interviewees indicated that the positive experience of the TPEEE Project helped nurture these alliances. Interviewees also indicated that EGAT had developed solid human resources on EE and that many of these staff had in turn moved to private sector companies, where their experience helped develop capacity.
7 Assessment Of Ultimate Outcomes

Ultimate outcomes are elements that are influenced by projects in the long term. This includes elements such as market transformation and program replication. Each of these is directly or indirectly affected by the intermediate outcomes described in the previous chapter.

7.1 Residential Market Transformation

DSMO programs had a substantial impact on the residential equipment appliance market, and it appears that this impact has only strengthened since the project’s close.

The Label #5 program has been particularly successful. It has promoted the most energy efficient products, consumers are buying them, and Thai manufacturers have stopped making many less energy-efficient products. In terms of domestic production, assessed through test results, EEI found that the performance of equipment improved significantly in the past five years. However, some lower-quality products are also being imported that compete with Thai products.

As an example of the effectiveness of Label #5, the Consumer Protection Board recently caught a local distributor with an imported product affixing a fraudulent Label #5 sticker and claiming huge cost reductions due energy savings. There have also been cases of false labeling of A/C units.

7.1.1 Lighting

All indications are that the Thailand lighting market has been permanently transformed for fluorescent tube lighting (thin tubes). (In Thailand, fluorescent tubes are used in both residential and commercial markets.) By 2004, 85 million units of T8 fluorescent tubes had been sold in Thailand, and T8 sales accounted for 100 percent of all sales (no other tubes are manufactured or imported into Thailand). It appears that DSMO efforts at labeling and voluntary manufacturer agreements were sufficient to make this change happen.
Market transformation for CFLs has been slower and less than complete, but it has still been widely seen as very successful with the issuance of 4.96 million labels since the beginning of the labeling program for CFLs in June 2003. By 2004, 5.97 million CFLs had been sold in Thailand, whereas only 1.01 million were sold before the introduction of the EE label.

In the case of ballasts, market transformation is at a relatively early stage. EGAT’s labeling program has been somewhat successful, although the long turnover time in equipment and the larger initial purchase costs have necessarily slowed progress in sales. By 2004, the DSMO had distributed 2.85 million labels for high-efficiency ballasts.

### 7.1.2 Refrigerators

Significant market transformation is underway for refrigerators, but it is not yet complete. Labeling became mandatory for all domestically produced refrigerators (single door units in 1998 and double door units in 2002). By 2002, all domestically manufactured fridges sold in Thailand used the #5 label, and this continued through to the latest reports dated November 2004. From the launch of labels for fridges in 1995 to the end of 2004, the DSMO had distributed a total of more than 13.8 million labels for fridges; of these, more than 12.4 million were Label #5 — the highest EE rating. Labeling continues at the rate of more than 2 million labels issued each year.

In the case of fridges, there are still a relatively small number of imported units sold in Thailand. Imported refrigerators do not use the EGAT labeling system and represent a small though significant share of the market. Indications are that these units will be phased out within a few years.

### 7.1.3 Air Conditioners

Market transformation is also underway but not yet complete for air conditioners. Market penetration of Label #5 A/C units continues to increase, although the DSMO faces a significant challenge in dealing with the large number of manufacturers and the difficulty in verifying labels. By November 2004, EGAT had distributed 2.8 million labels for A/Cs, and most residential A/C units sold in Thailand had the #5 label. There are some continuing sales of residential equipment not using Label #5. This often relates to AC units in condos, where the units are supplied and the developers do not pay the related electricity bills.

A big problem with A/C equipment is that for smaller units there are more than 10 manufacturers producing over 200 models. This makes it difficult to negotiate improvements and harder to verify label compliance. However, it is expected that the MEPS for A/C in March 2005 will have greatly increased the number of EE units being sold, although this will depend on the resources available for standards enforcement. Years of DSMO voluntary labeling programs contributed...
to the recent move to mandatory labeling and MEPS, as described at the end of this chapter.

Table 7.1 presents sales data for the main markets that have been transformed by the TPEEE Project.

There is little doubt among various market observers in Thailand that TPEEE played a dominant role in generating these sales, although other factors such as energy prices and reductions in prices for the EE equipment also played a role. Our overall assessment of the attribution of sales to TPEEE is presented in Table 7.2. This assessment is based on the logic of the impact chain presented in Chapter 3, the results of the interviews, and the overall effect of the intermediate outcomes described in Chapter 6.

Table 7.1 Sales Data

<table>
<thead>
<tr>
<th>Lighting</th>
<th>Refrigerators</th>
<th>Air Conditioners</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>T8s</td>
<td>CFLs</td>
</tr>
<tr>
<td>1993</td>
<td>6.35</td>
<td>0.00</td>
</tr>
<tr>
<td>1994</td>
<td>6.48</td>
<td>0.00</td>
</tr>
<tr>
<td>1995</td>
<td>6.61</td>
<td>0.00</td>
</tr>
<tr>
<td>1996</td>
<td>6.74</td>
<td>0.13</td>
</tr>
<tr>
<td>1997</td>
<td>6.87</td>
<td>0.13</td>
</tr>
<tr>
<td>1998</td>
<td>7.01</td>
<td>0.13</td>
</tr>
<tr>
<td>1999</td>
<td>7.15</td>
<td>0.13</td>
</tr>
<tr>
<td>2000</td>
<td>7.29</td>
<td>0.13</td>
</tr>
<tr>
<td>2001</td>
<td>7.44</td>
<td>0.13</td>
</tr>
<tr>
<td>2002</td>
<td>7.59</td>
<td>0.13</td>
</tr>
<tr>
<td>2003</td>
<td>7.74</td>
<td>0.13</td>
</tr>
<tr>
<td>2004</td>
<td>7.90</td>
<td>4.96</td>
</tr>
<tr>
<td>2005</td>
<td>8.05</td>
<td>5.06</td>
</tr>
<tr>
<td>2006</td>
<td>8.21</td>
<td>5.16</td>
</tr>
<tr>
<td>2007</td>
<td>8.38</td>
<td>5.26</td>
</tr>
<tr>
<td>2008</td>
<td>8.55</td>
<td>5.37</td>
</tr>
<tr>
<td>2009</td>
<td>8.72</td>
<td>5.48</td>
</tr>
<tr>
<td>2010</td>
<td>8.89</td>
<td>5.59</td>
</tr>
<tr>
<td>Totals</td>
<td>135.97</td>
<td>37.88</td>
</tr>
</tbody>
</table>

Note: Sales data provided by the DSMO. Fridges and A/C sales are as reported from 1993 to 2004. Lighting sales are based on totals reported by the DSMO for the period, with annual time series estimated by the Study Team. Sales for 2005–10 are based on a 2 percent increase, which is conservative (given recent 5 percent average GDP growth).
Table 7.2 Influence of TPEEE on Sales of EE Equipment

<table>
<thead>
<tr>
<th>Key Factors</th>
<th>Factor’s Influence on Sales</th>
<th>TPEEE Influence on Factor</th>
<th>Composite Attribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electricity Prices</td>
<td>High</td>
<td>Nil</td>
<td>Nil</td>
</tr>
<tr>
<td>EE Prices</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Availability and Marketing</td>
<td>Moderate (as a result of work with manufacturers)</td>
<td>High</td>
<td>Moderate/High</td>
</tr>
<tr>
<td>Consumer Awareness and Interest</td>
<td>Moderate (as a result of labeling)</td>
<td>High</td>
<td>Moderate/High</td>
</tr>
</tbody>
</table>

7.2 Commercial and Institutional

With the exception of the adoption of T8 fluorescent lighting, the TPEEE Project’s medium-term impact on commercial energy efficiency has not been nearly as significant as impacts in the residential sector. The DSMO commercial program focused on a narrow target (hotels, pilot chiller programs), none of which appear to have had a wide-ranging or enduring impact. A number of interviewees indicated that this may be due to the DSMO’s preference for a voluntary approach, which works well in the residential sector but is not as effective in the commercial context.

DSMO and government procurement policies have had some success in commercial and institutional energy-efficient A/C equipment sales. For example, certain commercial air conditioning units have an increased efficiency as a direct result of the DSMO campaign. It can also be said that the DSMO has had an impact on EE A/C installations through the activities of ESCOs that service the commercial sector. As indicated earlier, the ESCO sector is not yet strong but it appears to be growing, and there are signs that the government is planning to use ESCOs as the delivery agent for commercial and institutional EE programs. The DSMO has helped EE equipment suppliers substantially, particularly with supplying government offices where government procurement regulations require Label #5 A/C equipment or an EER under 9.6 for 1–3 ton units.

7.3 Industrial

Although there is currently some activity under way in industrial energy efficiency, very little of this can be traced back to the DSMO or the TPEEE Project. TPEEE had a limited number of initiatives in the industrial sector. Programs such as the high-efficiency motor program did not work as well as hoped and were dropped.

The most influential actor in the industrial sector is DEDE through the designated facilities program and the ECF. However, this program has had limited effectiveness.

The Department of Industrial Works has also played a role in industrial energy efficiency.
However, the DIW seems to be fairly new to EE. The program started in 2003 as a result of lessons learned from the promotion of environmental management systems. In the textile industry, for example, there are options for more energy efficiency with the use of high-efficiency electrical motors, and the technology is available. EGAT, however, is not promoting EE yet with this industry, nor is it working with the DIW.

7.4 Program Replication and Extension

Significant results are being achieved both in Thailand and neighboring countries. Perhaps the most significant impact of DSM activities is the government’s recent move to minimum energy performance standards, the first of which (for A/C) came into effect in March 2005. Although not a replication of the labeling program, the adoption of standards is a logical extension of that program. The DSMO’s Label #5 program was instrumental in getting the government to implement MEPS, and the government could not have achieved mandatory MEPS without doing the earlier voluntary program. Since there is still a lot of opportunity for energy-efficiency improvements in the residential sector and there is a 15 percent increase every year in the number of A/C units sold, the MEPS should have a significant effect in reducing electricity demand.

A ripple effect has occurred from EGAT’s DSM programs to other countries, including Vietnam, Indonesia, China, Laos, Sri Lanka, India, Bangladesh, South Africa, Ethiopia, and Myanmar. The World Bank’s Vietnam DSM program is a 12-year effort now in Phase 2, and it uses a number of lessons learned from Thailand’s experience. The regional office of the International Institute for Energy Conservation provides a direct link among several DSM initiatives in the Southeast Asia region and has noted these ripple effects. Also, the World Bank has been involved in several energy efficiency projects, some involving GEF cofinancing. Furthermore, EGAT is providing considerable confidence to other utilities that they can undertake DSM activities and achieve a variety of results, including peak shaving as well as customer relations and consumer knowledge. As a major player in the region, EGAT’s endorsement provides DSM with significant credibility.

DSMO staff and observers are clear that without TPEEE, there would not have been either the impacts or the recognition (domestically and internationally) that were necessary for program replication or extension.
This chapter examines the overall quantitative impacts of the TPEEE Project and assesses which impacts can be attributed to TPEEE and which would have likely occurred under a business-as-usual scenario. As described in Chapter 3, three scenarios were used: a with TPEEE scenario, based on EGAT figures as of June 2004, including those on sales presented in Table 7.1; a no TPEEE – High Baseline scenario that represents the lower boundary of the estimates of the incremental impact of the program; and a no TPEEE – Low Baseline scenario that represents the higher boundary of the incremental impact.

These scenarios are defined on the basis of the interviews and our assessments of TPEEE’s impact (Table 7.2). The key assumptions of the two counter-factual scenarios are outlined in Table 8.1.

Note that the scenarios do not take into account TPEEE impacts in commercial buildings (such as the Green Leaf program) or industrial motors. In both of these cases, the relative impacts were quite low (representing under 5 percent of the program’s impacts), and they were therefore left out.

8.1 Energy Savings and Emission Reductions

In order to calculate the energy savings, we first calculated the number of reported units sold through the DSMO (largely based on the number of labels issued by EGAT for the various supported units). The total stock in service at any one time is determined by the average lifetime of each unit and the products sold in the preceding years that would still be in service.

The key assumptions were as follows:

- Compact fluorescent lamps: We assumed that the average lifetime of a CFL is 6,000 hours (consistent with assumptions used in the Mexico and Jamaica programs).
Table 8.1 Assumptions behind Baseline Scenarios (No TPEEE Project)

<table>
<thead>
<tr>
<th></th>
<th>High Baseline Sales–Low Impact</th>
<th>Low Baseline Sales–High Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>T8 lamps</td>
<td>Sales delayed five years, then rising by 500,000 units per year until 2010, when sales are nearly that of TPEEE scenario</td>
<td>Sales delayed eight years, then rising by 500,000 units per year until 2010</td>
</tr>
<tr>
<td>CFLs</td>
<td>Assume CFLs would have not have been introduced until 2004, when a “second push” occurred (note that sales of CFLs under TPEEE until 2004 were not significant)</td>
<td>Assume CFLs would have not have been introduced until 2004, when a “second push” occurred; at that point, modest sales would start at 1 million units per year, rising by 500,000 units per year to 2010</td>
</tr>
<tr>
<td>EE Ballasts</td>
<td>Assume that a few ballasts were sold in 1998, slowly rising to TPEEE scenario levels by 2010</td>
<td>Assume that EE ballasts would not be sold until 2000, then slowly rising by 50,000 units per year</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>Assume all fridges would have remained at # 3 level until 1996, after which half of sales would have shifted over to # 4; by 2000, no # 3 fridges are sold; by 2003, there would be a shift over to # 5 fridges until 2010, when the majority of fridges would be # 5</td>
<td>Assume all fridges would have remained at # 3 level until 2000, after which half of sales would have shifted over to # 4; by 2003, there would be a slight shift over to # 5 fridges, but sales would still be dominated by # 4 until 2010</td>
</tr>
<tr>
<td>Air Conditioning</td>
<td>Assume that all A/C units sold to 2000 are # 4 level units; after that, sales are split between #4 and #5</td>
<td>Assume that all A/C units sold to 2000 are half #3 and half # 4 level units; after that, sales are split between #4 and #5</td>
</tr>
</tbody>
</table>

assumed that average utilization is three hours per day.

- **T8 lamps**: We assumed that use of T8 lamps saved, on average, 23 kilowatt-hours (kWh) per year. This is based on DSMO analysis that estimated savings of 1,957 GWh from sales of 85 million T8s. It is assumed that the average lifetime is five years.

- **EE ballasts**: We assumed that each ballast saves, on average, 19 kWh per year. This is based on DSMO analysis that estimates savings of 54 GWh from sales of 2.5 million EE ballasts. It is assumed that the lifetime of each ballast is 10 years.

- **Refrigerators**: We assumed a baseline (business-as-usual) energy consumption of 492 kWh per year (from World Bank 1992 baseline report). For Label #3 fridges, we assumed that annual energy use is 485 kWh per year (average of range provided by the DSMO of 534–437 kWh per year). For Label #4 fridge, we assumed annual energy use of 400 kWh (average of range given by the DSMO of 364–437 kWh/yr). For Label #5 fridge, we assumed energy use of 330 kWh/yr. Assume that lifetime is 20 years.

- **Air conditioners**: We assumed that the baseline A/C units have an EER of 7.4 Btuh/W. Label #4 A/Cs are assumed to have an efficiency of 10.1 (average of range designated by the DSMO), while Label #5 units are assumed to have an EER of 10.6. Annual usage is assumed as 560 hours.
• **Transmission and distribution losses**: This factor identifies the amount of energy lost between generation and the lighting fixture, providing a basis for calculating the amount of energy savings at the generating station. For the purposes of this study, we used 18.6 percent.

Table 8.2 provides the annual energy savings under each scenario for the three major TPEEE focus areas: lighting (including CFLs, T8s, and EE ballasts), refrigerators, and air conditioning units. Table 8.3 provides the total savings under each scenario, and Figure 8.1 provides these data in graphic form.

Based on these estimates, energy savings from all programs (including lighting, fridges, and A/C) amounted to approximately 28 terawatt-hours (TWh) in the period 1993–2004 and will save an additional 61 TWh to 2010. Of this total, 17.0–23.5 TWh are attributable to TPEEE in 1993–2004 and an additional 19.8–37.4 TWh in 2005–10.

### 8.1.1 GHG Emission Reductions

Table 8.4 provides the GHG emission reductions with TPEEE (actual) and those that could have been expected under conservative and aggressive scenarios, while Figure 8.2 provides these in graphic form. Based on these estimates, the use of EE lighting, fridges, and A/C resulted in GHG emission reductions of approximately 20.9 megatons in the period 1993–2004 and additional reductions of 45.2 Mt to 2010. Of this total, 12.6–17.4 Mt are attributable to TPEEE in 1993–2004 and an additional 14.7–27.6 Mt in the period to 2010.

### 8.1.2 Local Environmental Benefits

In addition to the global benefits of reduced GHGs, the electricity savings have also lowered emissions of air pollutants that contribute to smog and acidification. Emission factors for NOx and SOx were obtained from the DSIO Planning and Evaluation Unit, as follows:9

- **SOx**: 0.331 t/GWh
- **NOx**: 1.808 t/GWh.

Based on these figures, the use of EE lighting, fridges, and A/C resulted in SOx emission reductions of approximately 9.4 kilotons (Kt) from 1993 to 2004, with 5.6–7.8 Kt attributable to TPEEE. It is estimated that use of the EE equipment will result in an additional 20 Kt of SOx reductions to 2010. Of this total, 6.6–12.4 Kt are attributable to TPEEE in the period to 2010.

The use of EE lighting, fridges, and A/C resulted in NOx emission reductions of approximately 51 Kt in the period 1993–2004 and an additional 110 Kt to 2010. Of this total, 30.8–52.3 Kt are attributable to TPEEE in 1993–2004 and an additional 35.9–67.6 Kt in the period to 2010.
Table 8.2 Annual Energy Savings and Attribution to TPEEE under Conservative and Aggressive Scenarios (GWh)

<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>With TPEEE</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lighting</td>
<td>179</td>
<td>362</td>
<td>549</td>
<td>741</td>
<td>937</td>
<td>967</td>
<td>997</td>
<td>1,028</td>
<td>1,057</td>
<td>1,087</td>
<td>1,287</td>
<td>1,555</td>
<td>1,830</td>
<td>2,111</td>
<td>2,399</td>
<td>2,522</td>
<td>2,584</td>
<td>2,646</td>
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<tr>
<td>Refrigerators</td>
<td>—</td>
<td>—</td>
<td>61</td>
<td>222</td>
<td>453</td>
<td>626</td>
<td>819</td>
<td>1,080</td>
<td>1,420</td>
<td>1,773</td>
<td>2,181</td>
<td>2,586</td>
<td>3,000</td>
<td>3,423</td>
<td>3,854</td>
<td>4,293</td>
<td>4,741</td>
<td>5,198</td>
</tr>
<tr>
<td>A/C</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>66</td>
<td>142</td>
<td>251</td>
<td>344</td>
<td>456</td>
<td>647</td>
<td>899</td>
<td>1,362</td>
<td>1,888</td>
<td>2,424</td>
<td>2,972</td>
<td>3,530</td>
<td>4,099</td>
<td>4,680</td>
<td>5,273</td>
</tr>
<tr>
<td>Energy Savings</td>
<td>179</td>
<td>362</td>
<td>610</td>
<td>1,030</td>
<td>1,532</td>
<td>1,843</td>
<td>2,160</td>
<td>2,564</td>
<td>3,123</td>
<td>3,758</td>
<td>4,829</td>
<td>6,030</td>
<td>7,255</td>
<td>8,506</td>
<td>9,782</td>
<td>10,915</td>
<td>12,005</td>
<td>13,117</td>
</tr>
</tbody>
</table>

**Energy Savings – High Baseline – Low Impact (conservative estimate of the savings due to TPEEE)**

|                  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Lighting         | —    | —    | —    | —    | —    | —    | 29   | 74   | 134  | 209  | 300  | 376  | 480  | 591  | 706  | 828  | 985  | 1,135| 1,300|
| Refrigerators    | —    | —    | 4    | 13   | 86   | 135  | 189  | 337  | 529  | 728  | 985  | 1,266| 1,553| 1,846| 2,190| 2,542| 2,947| 3,361|
| A/C              | —    | —    | —    | 58   | 122  | 214  | 293  | 388  | 563  | 795  | 1,221| 1,706| 2,212| 2,730| 3,258| 3,807| 4,377| 4,959|
| Energy Savings   | —    | —    | 4    | 70   | 208  | 378  | 557  | 859  | 1,301| 1,823| 2,581| 3,452| 4,355| 5,282| 6,276| 7,334| 8,459| 9,620|

**Energy Savings – Attribution to TPEEE (under High Baseline—Low Impact Scenario)**

|                  |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |
| Lighting         | 179  | 362  | 549  | 741  | 937  | 967  | 997  | 1,028| 1,057| 1,087| 1,287| 1,555| 1,830| 2,111| 2,399| 2,522| 2,584| 2,646|
| Refrigerators    | —    | —    | 56   | 210  | 367  | 491  | 630  | 743  | 891  | 1,044| 1,196| 1,321| 1,448| 1,577| 1,664| 1,751| 1,794| 1,838|
| A/C              | —    | —    | —    | 9    | 20   | 36   | 51   | 68   | 84   | 104  | 141  | 182  | 212  | 242  | 272  | 293  | 303  | 313  |
| Attribution to   | 179  | 362  | 605  | 959  | 1,324| 1,465| 1,603| 1,705| 1,823| 1,936| 2,248| 2,578| 2,899| 3,224| 3,507| 3,581| 3,546| 3,497|
| TPEEE (Conservative) |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |      |

(continued on next page)
Table 8.2 Annual Energy Savings and Attribution to TPEEE under Conservative and Aggressive Scenarios (GWh) (continued)

<table>
<thead>
<tr>
<th>Energy Savings – Low Baseline – High Impact (aggressive estimate of the savings due to TPEEE)</th>
<th>Lighting</th>
<th>Refrigerators</th>
<th>A/C</th>
<th>Energy Savings without TPEEE (Aggressive)</th>
<th>Attribution to TPEEE (Aggressive)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>—</td>
<td>—</td>
<td>4</td>
<td>13</td>
<td>23</td>
</tr>
<tr>
<td>A/C</td>
<td>—</td>
<td>—</td>
<td>29</td>
<td>61</td>
<td>107</td>
</tr>
<tr>
<td>Energy Savings without TPEEE (Aggressive)</td>
<td>4</td>
<td>42</td>
<td>84</td>
<td>137</td>
<td>185</td>
</tr>
<tr>
<td>Attribution to TPEEE (Aggressive)</td>
<td>179</td>
<td>362</td>
<td>549</td>
<td>741</td>
<td>937</td>
</tr>
<tr>
<td>Refrigerators</td>
<td>—</td>
<td>—</td>
<td>56</td>
<td>210</td>
<td>430</td>
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<tr>
<td>A/C</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>38</td>
<td>81</td>
</tr>
<tr>
<td>Attribution to TPEEE (Aggressive)</td>
<td>179</td>
<td>362</td>
<td>605</td>
<td>988</td>
<td>1,448</td>
</tr>
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</table>
Table 8.3 Annual and Cumulative Impact of TPEEE Against Baseline (GWh)

<table>
<thead>
<tr>
<th>Year</th>
<th>Energy Savings with TPEEE (actual)</th>
<th>Energy Savings w/o TPEEE</th>
<th>Incremental savings due to TPEEE</th>
<th>Energy Savings w/o TPEEE</th>
<th>Incremental savings due to TPEEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1993</td>
<td>179</td>
<td>—</td>
<td>179</td>
<td>—</td>
<td>179</td>
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<tr>
<td>1994</td>
<td>362</td>
<td>—</td>
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<td>1995</td>
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<td>1,448</td>
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<td>2,578</td>
<td>1,693</td>
<td>4,337</td>
</tr>
<tr>
<td>2005</td>
<td>7,255</td>
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<td>2,899</td>
<td>2,301</td>
<td>4,954</td>
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<tr>
<td>2007</td>
<td>9,782</td>
<td>6,276</td>
<td>3,507</td>
<td>3,598</td>
<td>6,184</td>
</tr>
<tr>
<td>2008</td>
<td>10,915</td>
<td>7,334</td>
<td>3,581</td>
<td>4,286</td>
<td>6,629</td>
</tr>
<tr>
<td>2009</td>
<td>12,005</td>
<td>8,459</td>
<td>3,546</td>
<td>4,975</td>
<td>7,030</td>
</tr>
<tr>
<td>2010</td>
<td>13,117</td>
<td>9,620</td>
<td>3,497</td>
<td>5,690</td>
<td>7,427</td>
</tr>
<tr>
<td>Total</td>
<td>89,601</td>
<td>52,560</td>
<td>37,041</td>
<td>28,493</td>
<td>61,107</td>
</tr>
</tbody>
</table>

Figure 8.1
Energy Savings Attributable to TPEEE (GWh)
Table 8.4 Annual and Cumulative GHG Reductions of TPEEE Against Baseline (Mt)

<table>
<thead>
<tr>
<th>Year</th>
<th>High Baseline</th>
<th>Low Baseline</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>GHG Reductions under TPEEE</td>
<td>GHG Reductions w/o TPEEE</td>
</tr>
<tr>
<td>1993</td>
<td>133</td>
<td>—</td>
</tr>
<tr>
<td>1994</td>
<td>268</td>
<td>—</td>
</tr>
<tr>
<td>1995</td>
<td>451</td>
<td>3</td>
</tr>
<tr>
<td>1996</td>
<td>761</td>
<td>52</td>
</tr>
<tr>
<td>1997</td>
<td>1,132</td>
<td>153</td>
</tr>
<tr>
<td>1998</td>
<td>1,362</td>
<td>280</td>
</tr>
<tr>
<td>1999</td>
<td>1,596</td>
<td>411</td>
</tr>
<tr>
<td>2000</td>
<td>1,895</td>
<td>635</td>
</tr>
<tr>
<td>2001</td>
<td>2,308</td>
<td>961</td>
</tr>
<tr>
<td>2002</td>
<td>2,777</td>
<td>1,347</td>
</tr>
<tr>
<td>2003</td>
<td>3,569</td>
<td>1,907</td>
</tr>
<tr>
<td>2004</td>
<td>4,456</td>
<td>2,551</td>
</tr>
<tr>
<td>2005</td>
<td>5,361</td>
<td>3,219</td>
</tr>
<tr>
<td>2006</td>
<td>6,286</td>
<td>3,903</td>
</tr>
<tr>
<td>2007</td>
<td>7,229</td>
<td>4,638</td>
</tr>
<tr>
<td>2008</td>
<td>8,066</td>
<td>5,420</td>
</tr>
<tr>
<td>2009</td>
<td>8,872</td>
<td>6,251</td>
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<tr>
<td>2010</td>
<td>9,693</td>
<td>7,109</td>
</tr>
<tr>
<td>Total</td>
<td>66,215</td>
<td>38,840</td>
</tr>
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</table>

Figure 8.2
GHG Reductions from TPEEE Project (Mt)

[Graph showing GHG reductions from 1993 to 2010 with lines for different scenarios and years.]
8.2 Capacity Savings and Financial Benefits

8.2.1 Capacity Savings
In order to estimate capacity savings, EGAT conducted load research and developed factors for each category of appliance, ranging from 8.4 percent in residential A/C units to 85 percent in commercial A/C units, from 13.7 percent in residential lighting to 71.2 percent in commercial lighting, and at 22 percent for refrigerators.

Table 8.5 outlines the total cumulative annual savings as of December 2004.

8.2.2 Financial Impacts
The ICR estimated that as of 2000, the project resulted in a total resource cost-benefit ratio of 1.7, including savings of over $144 million but not counting the value of the GHG reductions. The Study Team was unable to obtain more recent cost information to update these estimates, but the expanding benefits would suggest that both the value of the net savings and the ratio would have increased significantly.

Table 8.5 DSMO Impacts, 1993 to December 31, 2004 Based on afternoon peak (2:00 p.m.)

<table>
<thead>
<tr>
<th></th>
<th>Peak Demand Reduction (MW)</th>
<th>Annual Energy Consumption Reduction (GWh/yr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lighting</td>
<td>420.5</td>
<td>2,087.4</td>
</tr>
<tr>
<td>Refrigerator</td>
<td>209.5</td>
<td>2,129.8</td>
</tr>
<tr>
<td>A/C</td>
<td>420.4</td>
<td>1,598.8</td>
</tr>
<tr>
<td>Motor</td>
<td>0.2</td>
<td>1.2</td>
</tr>
<tr>
<td>Commercial Building</td>
<td>2.6</td>
<td>10.3</td>
</tr>
<tr>
<td>Total</td>
<td>1,053.2</td>
<td>5,827.5</td>
</tr>
</tbody>
</table>
CONCLUSIONS AND LESSONS LEARNED

Without the WB/GEF initiative, the Thailand Promotion of Electrical Energy Efficiency Project, DSM would either not have happened in Thailand or it would have come in much more slowly.

Peter du Pont
former director of Thailand Office of International Institute for Energy Conservation

Thailand’s DSMO program is considered by many to be one of the most successful DSM programs in the world. Through cooperation with manufacturers and an aggressive marketing campaign, the program achieved a number of early wins that allowed it to expand rapidly and focus on increasingly difficult targets. The key features of the program were:

• A focus on cooperation and education rather than subsidies
• Broad focus with programs in the residential, commercial, and industrial sectors
• Use of voluntary labeling
• Aggressive marketing campaigns to bring about behavioral change

In the residential sector, the program achieved substantial gains, including a complete market transformation of tube lighting and refrigerators. The program also had strong success in the areas of CFLs and air conditioners. Perhaps the most significant long-term impact (though not quantified) is evidenced by the Thai government’s recent move to minimum energy performance standards; many observers indicated that this would not have been possible without the DSMO’s long-term voluntary labeling program. When the DSMO began, EE appliances were expensive, hard to find, and had very small sales volumes. Today they are visible in most retail outlets selling lamps and appliances for the residential mar-
In the commercial sector, the program had only a modest impact. Although the lighting market has been transformed and programs such as the Green Leaf initiative and pilot ESCO project were reasonably successful, their impact on the entire sector was not substantial. Nonetheless, it appears that the DSMO laid the groundwork for future expansion of commercial EE initiatives (many of which will likely take place through organizations outside the DSMO). The main example is the ESCO program; depending on market restructuring and the players that emerge, the lessons learned from DSMO programs may prove to be seminal.

In the industrial sector, the TPEEE Project and the DSMO had very little impact. The sector proved to be very difficult to gain access to for a variety of reasons, including equipment importing (difficult to get to makers of large motors, which dominate industrial energy consumption) and decision making (equipment purchasers are not the ones who “pay the bills,” unlike in the residential sector). Nonetheless, if at a future date the MEPS are imposed on motors, then the DSMO’s indirect impact will have been substantial.

Two factors had a significant impact on TPEEE/DSMO: the economic crisis of 1997 and the planned privatization of EGAT. Both have presented unique challenges, and it is fair to say that many similar programs might not have survived either circumstance. The DSMO has enjoyed strong public support and strong leadership (at critical times), which allowed it to survive.

In addition to the direct impacts of the residential, commercial, industrial, and educational initiatives of the program, energy efficiency has become an important policy objective of the government within its economic development goals and strategies.

9.1 Replication and Extension

The TPEEE (DSMO) Project has proved that the features just described have substantial replication value. Countries in the region have shown great respect for Thailand’s DSM/EE programs. EGAT is providing the experiential basis for other utilities to undertake DSM activities and achieve results related to peak shaving, customer relations, and consumer knowledge.

A ripple effect has occurred from EGAT’s DMS programs to programs in Vietnam, Indonesia, China, Laos, Sri Lanka, Australia, India, Bangladesh, South Africa, Ethiopia, and Myanmar. And organizations such as the Regional Office of the International Institute for Energy Conservation provide a direct link among several DSM initiatives in the Southeast Asia region.

Foreign utilities see EGAT as an example of why a utility may be interested in embrac-
9.2 Sustainability

The TPEEE Project has established market transformation for residential appliances such as air conditioning, refrigerators, and lighting. The advent of minimum energy performance standards for these and other equipment will ensure sustainability of savings.

The successes of the project have been sustained by EGAT’s continued funding of the DSMO. At the end of the TPEEE Project, the DSMO’s funding from the dedicated tariff was removed, and EGAT elected to continue funding at equivalent (or higher levels) through EGAT’s revenue base.

The potential for privatization represented a significant threat to the DSMO. In response, the DSMO has been located in a unit of EGAT that will not be privatized (the transmission division). The operation of a DSM program by a transmission company will be somewhat unique and may require a clear government policy commitment to keep the DSMO running.

DSMO sustainability has been strengthened by high consumer demand for its services. With the program’s high visibility and consumer confidence in DSMO activities (namely, Label #5), it is in the government’s and EGAT’s interest to maintain the program.

9.3 Ultimate Outcomes

DSMO programs have had a substantial impact on the residential equipment appliance market and it appears that this impact has only strengthened since the project’s close.

9.3.1 Residential Market

With respect to lighting, market transformation is under way, though it is not yet complete for CFLs and there is slower progress for low-loss ballasts. For refrigerators, significant market transformation is under way, but it is not yet complete. For air conditioners market transformation is under way but not yet complete. A significant challenge in the A/C market lies in the number of manufacturers, and the difficulties this poses in terms of both negotiation and product testing/verification. It is expected that the MEPS for A/C in March 2005 will greatly increase the number of EE units being sold.

Sales of Label #5 lights, refrigerators, and A/C units are estimated to have risen substantially in the period to 2004, including:

- 85 million T8 fluorescent tubes
- 5 million CFLs
- 12.4 million refrigerators
- 2.8 million A/C units
9.3.2 Commercial/Institutional Market
With the exception of lighting (included in the above figures), the TPEEE Project’s medium-term impact on commercial energy efficiency has not been nearly as significant in the residential sector. DSMO and government procurement policies have had some success in commercial and institutional energy-efficient lighting and A/C equipment sales, but a significant potential remains.

9.3.3 Industrial
Although there is currently some activity under way in industrial energy efficiency, very little of this can be traced back to the DSMO or the TPEEE Project.

9.4 Impacts
Over the period, sales of EE products resulted in reductions of approximately 21 Mt of GHG emissions from 1993 to 2004. Of this it is estimated that 12.6—17.4 Mt are directly attributable to the TPEEE Project. EE products also reduced peak demand by over 1,000 MW and produced a range of financial benefits.

9.5 Lessons Learned

9.5.1 Consumer Awareness
Consumer and investor knowledge and confidence in energy efficiency products is a key objective for an effective DSM program. Consumers and investors are motivated by cost savings. This motivation requires knowledge that is strong enough to allow for long-term energy cost-savings calculations to play an important factor in investment decisions.

DSM programs must have a strong public awareness campaign, in part to build public support for the policies and investments needed to support the programs.

9.5.2 Capacity Building
In order to build capacity, it may be helpful to begin with programs that do not require extensive cooperation with other agencies to be successful. DSMO programs proved to be less effective when they depended on the cooperation of other agencies (such as DEDE or NEPO/EPPO).

9.5.3 Program Design
A program should be designed in a way that allows “early wins” that then lead to expanded programs. This may mean targeting residential markets (they are often easier to deal with than commercial or industrial markets), technologies with relatively low incremental costs (such as fridges, air conditioners, and tube lighting), and programs that do not require collaboration with other departments or agencies (such as distribution utilities).

It is important to understand that DSM consists of both conservation and load management. Each presents unique benefits to those involved in the program, and it is critical that all players build their involvement in the program through self-interest:
• From the electrical generation/utility’s perspective: DSM can delay costly construction of added baseline capacity and peaking plants. DSM can also bring substantial benefits for “corporate image” if and where the programs have the necessary outreach, education, and campaign components.

• From the distribution utility’s perspective: DSM can provide a business opportunity where ESCOs are set up. It also can assist in planning and cost avoidance of system expansion and can improve consumer relations by providing added-value programs.

• From the consumer’s perspective: DSM can provide regular and long-term cost-saving opportunities through reduced power use and lower bills.

• From the manufacturer’s perspective: DSM provides an opportunity for increased competitiveness both in domestic and international markets by creating a critical mass of demand.

• For the government: DSM allows for environmental improvements, fulfillment of international environmental obligations, and a more competitive economy. It can also lead to foreign investment opportunities (such as through the Clean Development Mechanism).

“Expect the worst” in designing a DSM program. In designing the program, it is important to consider what could happen if the economy collapses, the government falls, the power sector gets deregulated, a scandal hits the utility, and so on. Given the highly political nature of the power sector, such events appear to be likely over the long term. It is important to design a robust and flexible program that can be adapted to such changes.

In order to achieve the greatest benefits, DSM programs need to target specific products and technologies to gain early momentum. For example:

• Where the incremental cost for the EE version of the technology is relatively low

• Where the DSM program has a high degree of control by the implementing agency and where the implementation is not relying on other departments or agencies to overcome barriers

• Where the technology is manufactured locally and in sufficiently high volumes to allow for product turnover

9.5.4 Commercial Markets
ESCO development requires long timelines. The ESCO model must be developed to suit the local or national business culture. It helps to experiment with different ESCO models (financial, technical) and then to build on lessons learned in the particular jurisdiction and economic environment.

9.5.5 Sustainability
Voluntary programs are useful as a necessary step toward the development of minimum standards. This is relevant to both low and
high incremental cost products. To sustain energy efficiency achievements, however, mandatory standards may be required.

DSM programs need strong leadership to get into the mainstream. EGAT’s experience suggests that this leadership is required at the level of the Governor or Chief Executive Officer, at the level of Assistant Governor, and at the departmental level. The top-level leadership must be provided internally as well as externally. Internally, the leadership provides assurance of funding and use of DSM information in organizational design and staffing and in power planning. Externally, the leadership must extend to the political level, the relevant Minister or Ministers, and to the chiefs of relevant departments in those ministries. The most important contribution of leadership in DSM is to recognize that one of the most significant indicators of a DSM program’s success is the integration of DSM results into the utility load forecasting and power development plan.

Thorough planning (that is, cost/benefit analysis) of a new DSM initiative should be done prior to program launch. This helps to set targets that can be tracked as the program is under way and when it is completed. This will facilitate an easier determination of the successes of the program. Along with internal planning, it is important to have an external, third-party monitor and an evaluation process/agency involved on a regular basis. This leads to credible data and confidence in the reported results of the programs.
Appendix A: Interviewees

Demand-Side Management Office, Electrical Generating Authority of Thailand — www.egat.or.th/dsm and pr.egat.co.th
Khun Pitarn Chaichinda, Assistant Director, DSM Implementation
Khun Sarawuth Chandharath, Assistant Director, Management and Planning Division
Khun Apichart Dilogsopon, Assistant Governor, DSMO
Khun Pornuma Harabutra, Economist, Management and Planning Division
Khun Anake Phanthumitre, Chief, Planning and Evaluation, Management and Planning Division
Khun Napaporn Phumaraphand, Senior Economist, Management and Planning Division
Khun Suphan Puapong, Director, DSM Management and Planning Division
Khun Thana Putarungsi, Director DSM Implementation Division
Khun Nophdol Salisdouk, Chief, Technology Department
Khun Sudarat Sasunee, Chief, Attitude Creation Department
Khun Sittiporn, ex-Governor, EGAT, ex-Assistant Governor, DSM
Khun Srinual Suksod, Chief, Appliances Efficiency and Chief, Labelling Program
Khun Bundit Umpornsrisupap, ESCO Project, Implementation Division
Khun Trong-art Wongwatanyou, ESCO Project unit, Implementation Division

Khun Wathanyu Amatayakul, Plan and Policy Analyst
Khun Chavalit Pichalai, Director of Energy Systems Analysis Bureau

Department of Alternative Energy Development and Efficiency — www.dede.go.th
Khun Mana Nitikul, Executive Director, Bureau of EE Promotion
Dr. Prasert Sinsukprasert, Bureau of Energy Regulation and Conservation
Khun Pornchai Ungpinitpong, Electrical Engineer
Khun Sirinthorn Vongsoasup, Chief, Energy Efficiency Promotion

Department of Industrial Works — www.diw.go.th
Khun Helen Arromadee, Senior expert
Khun Supakit Boonsiri, Electrical Engineer
Khun Issra Shoatburakarn, Director-General
Khun Supachai Siriwattanacharoenchai, Director, Safety Technology Bureau

Metropolitan Electricity Authority — www.mea.or.th
Khun Nives Aroonrat, Assistant Governor, MEA
Khun Anusak Mitrabhuckdi
Khun Napadol Prasertkanchana, ESCO Project
Khun Sutida Sindhvananda, Secretary, Financial Management Division
Khun Bandhit Tawanwong, Director of Load Analysis and DSM Division
Khun Anna Thornthip, Financial Management Division

Office of Consumer Protection Board, Office of the Prime Minister — www.ocpb.go.th
(representing the Secretary General of the CPB, Khun Rasamee Vistaveth)
Khun Pairuj Kanungsup, staff member
Khun Chuensuke Methakulawat, Secretary

Ministry of Natural Resources and Environment — www.monre.go.th
Khun Ampan Pintukanok, Director, Office of International Cooperation, GEF Focal Point

Electrical and Electronics Institute — www.thaieei.com
Khun Thanasak Chaiyavech, Director, Operation and Standards
Khun Charuek Hengrasmee, President

Khun Anat Prapasawad, Business Development Department

Danish Energy Management — www.dem.dk
Peter du Pont, Chief Executive Officer, Thailand

Excellent Energy International Company — www.eei.co.th
Khun Arthit Vechakij, Managing Director

International Institute for Energy Conservation, Asia Regional Office — www.iiec.org
Felix Gooneratne, Asia Director
Sommai Phon-Amnuaisuk, Senior Project Manager

Siam Inter Air Company
Khun Boonchoo Wongkitrungruang, Director
Appendix A

Trane Thailand/AIRCO Limited
Khun Mahitorn Vipattipumiprathet, Senior Marketing Manager

Individuals
Jas Singh, former Project Team Leader and coauthor of Implementation Completion Report, World Bank
APPENDIX B: BIBLIOGRAPHY


Electrical Generating Authority of Thailand, 2000. IMEA Quarterly Reviews of DSMO, Barakat and Chamberlin, United States, and Hagler-Bailly, United States.


APPENDIX C: DATA ANALYSIS

Available online at www.worldbank.org/gef
NOTES

1. Note that the term TPEEE Project is used in this report to denote the GEF-supported initiative. However, in Thailand the GEF-supported project was not seen as a distinct initiative, but rather part of the national utility’s larger demand side management activities, housed under the Demand Side Management Office (DSMO). Therefore, the term TPEEE Project is used here to distinguish the GEF-supported project from ongoing DSMO activities.

2. Electrical Generating Authority of Thailand (EGAT) 2004; see also pr.egat.co.th/prweb/new/demandSideManagement.htm.

3. See also Singh and Mulholland 2000. This document focuses on lessons learned during the program at the point of project completion and discusses the program’s future prospects.

4. See pr.egat.co.th/prweb/new/generation.htm for details.

5. In 2004 the government privatized the Petroleum Authority of Thailand (PTT) through sale of public shares. These shares were purchased within seconds and the public was not given a chance to bid. As a result, the public became distrustful of privatization plans at EGAT, suspecting that “insiders” were aiming to acquire EGAT’s subsidiaries. Also in 2004, on the intended eve of privatization, newspapers reported share trading related to a component of EGAT, which immediately raised public concerns. This resulted in a halt to the intended sale of shares.

6. Time of day rates started in 1990 and were compulsory for larger and medium enterprises, using more than 355,000 kWh per hour. The rate consists of a demand charge for peak and partial peak periods (8:30 am–9:30 pm daily). Time of use rates started in 1997 with peak and non-peak periods and rates. Peak period is essentially 9 am–10 pm Monday to Friday. The rate includes both demand and energy charges (amount used and when it is used). These rates are com-
pulsory for new large enterprises and for medium enterprises consuming more than 250,000kWh/m.

7. This location was arranged under the Governorship of Khun Sittiporn who resigned in 2004. Khun Sittiporn had earlier been the Deputy Governor of the DSMO. Although the DSMO might normally be in a unit on its own, it is somewhat “sheltered” or protected in its current structural location within the current climate of pending privatization (as discussed later).

