



Technical Assistance Report

Project Number: 41326
Policy and Advisory Technical Assistance (PATA)
December 2008

Kingdom of Thailand: Mainstreaming Energy Efficiency Measures in Thai Municipalities (Financed by the Multi-Donor Clean Energy Fund under the Clean Energy Financing Partnership Facility)

CURRENCY EQUIVALENTS

(as of 9 December 2008)

Currency Unit	–	baht (B)
B1.00	=	\$0.0282
\$1.00	=	B35.420

ABBREVIATIONS

ADB	–	Asian Development Bank
EA	–	executing agency
EERF	–	Energy Efficiency Revolving Fund
GDP	–	gross domestic product
PEA	–	Provincial Electricity Authority
TA	–	technical assistance

TECHNICAL ASSISTANCE CLASSIFICATION

Type	–	Policy and advisory technical assistance (PATA)
Targeting Classification	–	General intervention
Sector	–	Energy
Subsector	–	Energy sector development
Themes	–	Environmental sustainability, capacity development
Subthemes	–	Natural resources conservation, institutional development, organizational development

NOTE

In this report, "\$" refers to US dollars.

Vice-President	C. Lawrence Greenwood, Jr., Operations 2
Director General	A. Thapan, Southeast Asia Department (SERD)
Director	J.P. Verbiest, Thailand Resident Mission, SERD
Team leader	J. Lynch, Principal Country Economist, SERD
Team members	S. Hasnie, Senior Energy Specialist, SERD
	O. Jetwattana, Private Sector Economic Officer, SERD
	S. Tumiwa, Senior Energy Specialist, Regional and Sustainable Development Department

I. INTRODUCTION

1. The Government of Thailand has requested technical assistance (TA) from the Asian Development Bank (ADB) to support the Provincial Electricity Authority (PEA) in mainstreaming energy efficiency measures in Thai municipalities. A TA grant in the amount of \$500,000 is included in ADB's assistance program for Thailand in 2008, and the country partnership strategy identifies support for energy efficiency and clean energy initiatives as core areas of cooperation between the Government and ADB.¹ A fact-finding mission was undertaken from 4 to 8 August 2008 to consult with PEA and other key stakeholders on the desired scope and expected results of the TA. Based on initial cost estimates, ADB's climate change steering committee endorsed the mission's request to increase the grant amount of the proposed TA to a total of \$1 million.² This report reflects the findings of the mission and the understanding reached with the Government and PEA on the scope, impact, outcome, outputs, implementation arrangements, cost, financing arrangements, and terms of reference for the TA.³ The TA design and monitoring framework is in Appendix 1.

II. ISSUES

2. Thailand is a net importer of energy. The proportion of Thailand's energy imports as a part of total imports grew to the unprecedented level of 18% in 2007, up from 12.9% in 2001. In 2007, approximately 60% of Thailand's energy demand was met through imported sources at a cost of about \$27 billion. While crude oil accounts for more than 80% of Thailand's energy imports, the fastest growing energy import in recent years has been coal, which is primarily the result of the rapid expansion of independent power producers. A breakdown of Thailand's energy imports is in Appendix 2. The Government is acutely aware that access to secure sources of energy is essential for sustaining economic growth, productivity, and competitiveness.

3. In an effort to improve national energy security, the Ministry of Energy has introduced a number of measures to reduce Thailand's dependency on energy imports and to promote greater energy efficiency. A core objective is to lower the country's energy elasticity—the ratio of energy consumption to gross domestic product (GDP)—from its current high level of 1.4 to 1.⁴ In other words, a 1% increase in GDP generates a 1.4% increase in energy demand. Short-term energy conservation measures and efficiency improvements aim to reduce Thailand's energy elasticity to 0.85 to 1 by 2011. The longer-term energy elasticity target is 0.6 to 1 by 2020.

4. The Government has introduced a range of supply- and demand-side policies and programs to expand domestic energy sources and reduce consumption levels. On the supply-side, the Ministry of Energy has a stated policy objective that renewable energy projects such as wind, solar, biomass, biogas, and micro-hydro will comprise 8% of Thailand's overall generating capacity by 2011. In support of this objective, the Renewable Portfolio Standard of 2003 requires the Electricity Generating Authority of Thailand to ensure that renewable energy sources are at least 5% of new generating capacity during 2008–2010.⁵

¹ The TA is also aligned with ADB's new long-term strategic framework and its emphasis on improving energy efficiency as a means to realize environmentally-sustainable growth for the region. ADB. 2008. *Strategy 2020: Long-Term Strategic Framework of the Asian Development Bank 2008–2020*. Manila.

² The climate change steering committee endorsed the allocation of \$1 million from the Multi-Donor Clean Energy Fund under the Clean Energy Financing Partnership Facility, on a grant basis, to finance the TA.

³ The TA first appeared in the business opportunities section of ADB's website on 3 November 2008.

⁴ By comparison, the energy elasticity is estimated to be 0.8 to 1 for the United States and 0.95 to 1 for Japan.

⁵ The structure of Thailand's electricity supply industry known as a single-buyer model where the state-owned enterprise—the Electricity Generating Authority of Thailand—is a major power producer, a single buyer, and the operator of the transmission network. Under this single-buyer arrangement, the Electricity Generating Authority of

5. On the demand side, the Energy Conservation and Promotion Act of 1992 is the principal regulatory framework for energy efficiency programs in Thailand. Under the act, the Energy Efficiency Revolving Fund (EERF) was established in 2003 to stimulate investments in energy efficiency projects.⁶ The EERF provides capital at no cost to participating Thai banks which, in turn, provide low-cost loans for energy efficiency projects. As of mid-2008, the EERF had financed more than 200 energy efficiency projects totaling nearly \$300 million in investments, yielding an estimated \$110 million in energy savings per year. The projects funded by the EERF have predominantly been private factories and, to a lesser extent, buildings, such as hospitals and hotels.

6. While demand-side management for energy conservation is gaining traction in Thailand's industrial, commercial, and residential sectors, efforts to promote energy efficiency measures at the municipal level have been lacking. The EERF, for example, has not financed any municipal energy efficiency projects. Additionally, energy service companies in Thailand primarily market their services to private clients who own industrial and commercial enterprises. While the Clinton Climate Initiative has launched a building retrofit program in partnership with the Bangkok Metropolitan Administration,⁷ mainstreaming energy efficiency measures in secondary cities can yield additional energy and cost savings, improve Thailand's energy security, and reduce greenhouse gas emissions.

7. Because PEA provides electricity services to more than 1,000 cities and towns throughout Thailand, it can play a key role in promoting energy efficiency at the municipal level.⁸ More than 65% of all electricity consumed in Thailand is within PEA's service area. In terms of geographical coverage, PEA distributes electricity to 99% of the country and has more than 900 suboffices throughout 73 provinces. Municipalities across the country are increasingly seeking PEA's advice on retrofitting public buildings to conserve energy and reduce electricity costs.⁹ Because PEA provides significant subsidies for municipal street lighting, it has a strong financial incentive to replace outdated and inefficient lighting systems.¹⁰

8. The potential for municipal building retrofits and street lighting improvements to save energy and yield financial benefits to both municipalities and PEA provides the cornerstone for joint efforts to mainstream energy efficiency measures. Preliminary estimates suggest that a 10% improvement in the energy efficiency of municipal buildings and public street lighting would result in annual electricity cost savings of \$27 million. A 20% gain in energy efficiency would yield annual cost savings of \$53 million. This 10%–20% reduction in electricity consumption at the municipal level is about 6%–13% of the total value of Thailand's annual electricity imports.

Thailand is the only buyer of electricity from multiple suppliers, i.e., the independent private power producers and neighboring countries. The distribution and retailing functions are the exclusive responsibility of two state-owned enterprises—the Metropolitan Electricity Authority and PEA.

⁶ The EERF is managed by the Ministry of Energy's Department of Alternative Energy Development and Efficiency. After nearly 6 years of operation, the size of the EERF has grown to \$126 million.

⁷ The Clinton Climate Initiative is working with energy service companies and banks to design and finance retrofit projects for both municipal and privately owned buildings in the city of Bangkok.

⁸ PEA is a state-owned enterprise under the Ministry of Interior that distributes and sells electricity in a service area that encompasses the entire country with the exception of Bangkok, Nonthaburi, and Samut Prakarn provinces, which are serviced by the Metropolitan Electricity Authority.

⁹ In Thailand, this savings in energy costs directly translates into additional fiscal capacity for municipalities, thereby providing financial resources to cover other municipal expenses.

¹⁰ It is estimated that PEA provides an annual subsidy of \$20 million for electricity used in municipal street lighting.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

9. The TA is designed to improve Thailand's energy security and decrease the rate of greenhouse gas emissions by promoting energy efficiency initiatives in Thai municipalities. A key outcome will be the strengthened capacity of PEA and municipalities to identify, design, finance, and implement energy efficiency measures. The pilot energy efficiency projects to be launched under the TA will include retrofitting municipal buildings and upgrading public street lighting. The TA outputs will include (i) design and implementation of pilot municipal energy efficiency projects, (ii) innovative project financing arrangements; (iii) a plan for expanding and scaling-up of municipal energy efficiency projects throughout Thailand, and (iv) capacity building for PEA and municipalities to replicate and mainstream energy efficiency measures.

B. Methodology and Key Activities

10. The methodology of the TA is based on four key activities that will directly contribute to desired outputs and outcomes. One municipality will be selected from each of PEA's four service regions based on predefined criteria.¹¹ In each of the four participating municipalities, the consultants and counterpart staff from PEA and the local municipality will identify potential pilot energy efficiency projects in two categories: (i) retrofitting municipal buildings; and (ii) upgrading public street lighting.¹² The results and lessons from the demonstration program will, in turn, serve as the basis for replicating municipal energy efficiency projects and for strengthening the capacity of PEA and municipalities to mainstream energy efficiency measures. The four key activities of the TA are described below.

11. **Design and Implement Pilot Municipal Energy Efficiency Projects.** Upon the selection of the four municipalities to participate in the TA, the consulting team and PEA staff will identify potential energy efficiency pilot projects in each municipality. Project selection will be based on initial techno-economic studies that assess the potential for achieving energy savings and financial benefits from implementing energy efficiency measures. The pilot energy efficiency projects will then be subject to detailed design and feasibility assessments that will involve conducting energy audits, recommending specific investments, calculating payback periods, and identifying how management changes and no-cost or low-cost options can reduce energy consumption and yield financial savings. A methodology and indicators for measuring and verifying the benefits of energy efficiency projects will be defined, along with a time-bound implementation plan. The demonstration program's components, costs, benefits, and implementation arrangements will be incorporated into a demonstration program agreement to be signed by PEA officials and the mayors from each participating municipality. The consulting team and PEA will proceed to implement the pilot energy efficiency projects, undertake monitoring and verification, and document the process into a handbook for future replication in other Thai municipalities.

¹¹ Such criteria will include, but not be limited to, a municipality's demonstrated interest and willingness to participate, its ability to provide counterpart human and financial resources, its level of outstanding receivables with PEA, and the capacity of PEA's local area office to provide implementation support.

¹² Preferred municipal buildings will be central administration buildings; retrofits will focus on improvements to lighting and air conditioning systems, including the installation of switches and voltage regulators coupled with a staff awareness campaign. The upgrading of municipal street lighting will include the replacement of inefficient lighting technologies such as fluorescent lights, incandescent bulbs, and low-pressure mercury vapor lamps in central city areas; a demand-side management component will include the installation of timers and voltage regulators.

12. **Structure Innovative Project Financing Arrangements.** The consulting team will study various financing models appropriate for energy efficiency investments in Thailand, including the possibility of PEA serving as an intermediary for such financing. This analysis will ascertain potential sources of concessional funding, including bilateral agencies and the Ministry of Energy's EERF. After reviewing applicable legal and regulatory provisions that may pertain to the financing structure, the consultants will undertake consultations with PEA, municipalities, and other relevant parties and come to an agreement on the most efficient financing model. Consideration will also be given to the possibility of using grant funds sourced from the TA to reduce the incremental cost of more efficient technologies. Grant funds will be made available on a cost-sharing basis with PEA and the municipalities, and serve to reduce the financial risk of participating in the demonstration program. Once the appropriate financing structure is determined, its specifications will be formally presented to PEA and municipal counterparts, and incorporated into the demonstration program agreement.

13. **Prepare a Plan for Replicating Municipal Energy Efficiency Projects.** Laying the foundation for replicating energy efficiency projects in Thai municipalities across the country is a core objective of the TA. Four regional workshops will be conducted to showcase the achievements and lessons from the pilot energy efficiency projects to municipalities in the four PEA service regions, as well as to government agencies, consultants, academic institutions, and other interested parties. The workshops will also be used to solicit input on replicating and scaling-up municipal building retrofit and street lighting improvement projects throughout the country. A national workshop will be held for mayors and other municipal officials to prepare for a nationwide rollout of the municipal energy efficiency program. Taking into account the feedback received at the various workshops, the consulting team will develop action plans and identify potential funding sources for (i) replicating the municipal building retrofit program and (ii) scaling-up the public street lighting improvement program. Because the upgrading of municipal street lighting throughout the country will yield significant energy savings and reduce the need for PEA to subsidize the cost of inefficient lighting systems, it may be possible to obtain carbon credits through the Clean Development Mechanism.¹³ In this context, the consultants will examine the feasibility of preparing a nationwide public street lighting improvement program and reducing investment costs through the Clean Development Mechanism.

14. **Strengthen the Capacity of the Provincial Electricity Authority and Municipalities to Mainstream Energy Efficiency Measures.** This activity will emphasize a learning-by-doing approach in which the consulting team will work directly with counterparts from PEA and the municipalities to promote hands-on learning. Drawing upon the experiences and lessons from implementing the demonstration programs, the consultants will prepare a business plan for institutionalizing and sustaining PEA's energy efficiency advisory services for municipalities. The business plan will include an analysis of the municipal market for energy efficiency advisory services, an organizational structure for an energy efficiency advisory services unit, an assessment of staffing and skill requirements, a marketing plan, a listing of necessary agreements with clients, a budget for the next 5 years, potential sources of income, and the approvals and permits that may be necessary. In addition, the TA will support the preparation of a communications and outreach program to promote energy conservation initiatives among residential customers, commercial building owners, and to small- and medium-sized enterprises.

¹³ The Clean Development Mechanism is an arrangement under the Kyoto Protocol allowing industrialized countries with a greenhouse gas reduction commitment to invest in projects that reduce emissions in developing countries as an alternative to more expensive emission reductions in their own countries.

C. Cost and Financing

15. The TA is estimated to cost \$1,450,000 equivalent, of which \$1,000,000 will be financed on a grant basis by the Multi-Donor Clean Energy Fund¹⁴ under the Clean Energy Financing Partnership Facility, and administered by ADB. The Government will finance the remaining \$450,000 equivalent in-kind through the provision of counterpart staff, consultancy services, office accommodation, and other support facilities and services. The detailed cost estimates and financing plan are in Appendix 3.

D. Implementation Arrangements

16. PEA will be the executing agency (EA) for the TA. PEA will establish a project management unit to be staffed by a project director and other PEA personnel with expertise in finance, engineering, procurement, law, and public outreach. In each of the four participating municipalities, dedicated teams from PEA's local area offices and from the municipal administrations will be established to assist with data collection and the implementation of the pilot projects. Energy efficiency equipment and technologies will be purchased in accordance with ADB's *Procurement Guidelines* (2007, as amended from time to time), and handed over to the EA and participating municipalities at no cost upon project completion.

17. The TA will be implemented by a team comprising two individual international consultants and a national consulting firm. The international consultants will consist of a team leader, who is an energy efficiency expert, and a project finance specialist. The firm will provide a multidisciplinary team comprising eight specialists. ADB will engage the consultants in accordance with its *Guidelines on the Use of Consultants* (2007, as amended from time to time). The international consultants will be selected on an individual basis and the national consulting firm will be selected using ADB's quality- and cost-based selection method. Outline terms of reference for all of the consultants and specifications for deliverables are in Appendix 4.

18. It is estimated that the duration of the TA will be 24 months, commencing in March 2009 and ending in February 2011. The first 12 months will be used to design and implement the demonstration program, months 13–20 will entail data collection on the energy and financial savings from the pilot energy efficiency projects, and months 21–24 will be used for conducting workshops, finalizing the action plans for replicating municipal energy efficiency projects, and preparing the final reports. The individual international consultants will mobilize prior to the national consulting firm to coordinate with PEA staff on setting up the project management unit and clarifying its functions, selecting the four participating municipalities, and undertaking initial assessments of the potential energy savings and financial benefits resulting from potential pilot energy efficiency projects.

IV. THE PRESIDENT'S DECISION

19. The President, acting under the authority delegated by the Board, has approved ADB administering technical assistance not exceeding the equivalent of \$1,000,000 to the Government of Thailand to be financed on a grant basis by the Multi-Donor Clean Energy Fund under the Clean Energy Financing Partnership Facility for Mainstreaming Energy Efficiency Measures in Thai Municipalities, and hereby reports this action to the Board.

¹⁴ Contributors: the governments of Australia, Norway, Spain, and Sweden.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
<p>Impact</p> <p>Improvement in Thailand's energy security and a decrease in the rate of greenhouse gas emissions</p>	<p>Energy elasticity target of 0.6 to 1 achieved by 2020, representing a reduction from the current level of 1.4 to 1.</p> <p>A reduction of at least 2% in Thailand's CO₂/GDP indicator by 2020, as benchmarked against the 2006 level of 0.42.</p>	<p>Energy statistics compiled by the Ministry of Energy</p> <p>Country-level compound indicators compiled by the International Energy Agency</p>	<p>Assumptions</p> <p>Institutional and financial support from the Ministry of Energy and PEA</p> <p>Coordination and cooperation between PEA and municipalities</p> <p>Risks</p> <p>Pilot projects are not replicated to achieve significant level of impact</p>
<p>Outcome</p> <p>Strengthened capacity of PEA and Thai municipalities to identify, finance, and implement energy efficiency measures.</p>	<p>An energy efficiency advisory services unit within PEA is established, adequately staffed, and providing assistance to municipalities by 2010</p> <p>At least 20 municipalities implementing energy efficiency measures for public buildings and street lighting by 2012</p>	<p>Annual operating reports prepared by PEA's energy efficiency advisory services unit</p> <p>Field reports prepared by PEA's local offices and progress reports prepared by the participating municipalities</p>	<p>Assumptions</p> <p>Cooperation and commitment of PEA and concerned municipalities to mainstream energy efficiency measures</p> <p>Commitment of PEA to establish, staff, and resource an energy efficiency advisory services unit</p> <p>Risks</p> <p>PEA perceives the benefits of mainstreaming energy efficiency measures to be insufficient to justify the costs of implementation</p>
<p>Outputs</p> <p>1. Pilot energy efficiency projects designed and implemented in 4 municipalities</p> <p>2. Innovative financing arrangements for energy efficiency projects are structured for 4 municipalities</p>	<p>Building retrofits for public buildings in 4 municipalities by month 20, resulting in energy savings of at least 10%</p> <p>Street lighting upgraded in 4 municipalities by month 20, resulting in energy savings of at least 5%</p> <p>Municipalities secure financing for their respective pilot energy efficiency projects by month 12</p>	<p>Pilot project identification and implementation reports prepared under the TA for the participating municipalities</p> <p>Energy savings audit reports prepared under the TA for the participating municipalities</p> <p>Financing plans for pilot energy efficiency projects prepared under the TA</p> <p>Demonstration program agreements signed by mayors and PEA by month 12</p>	<p>Assumptions</p> <p>The Government and PEA are committed to promoting energy efficiency at the municipal level</p> <p>Participating municipalities are committed and have the capacity to implement the pilot energy efficiency projects</p> <p>Commitment from PEA and staff to undertake energy efficiency advisory services and establish a dedicated unit</p>

Design Summary	Performance Targets/Indicators	Data Sources/Reporting Mechanisms	Assumptions and Risks
3. Plan prepared to replicate municipal energy efficiency projects throughout Thailand	<p>Action plans prepared by month 20 to replicate municipal energy efficiency measures throughout Thailand by retrofitting public buildings and upgrading street lighting</p> <p>Project design document prepared by month 20 to access Clean Development Mechanism financing for a nation-wide municipal street lighting improvement program</p>	<p>Handbook for preparing municipal energy efficiency projects completed under the TA by month 20</p> <p>Five dissemination workshops and action plans to scale-up municipal energy efficiency initiatives are completed under the TA by month 24</p> <p>Clean Development Mechanism project design document prepared under the TA by month 24</p>	<p>Proposed energy efficiency measures are financially viable and sources of financing can be secured</p> <p>Pilot energy efficiency projects serve as models for replication in other municipalities</p> <p>Risks</p> <p>TA consultants are unable to identify, structure, and secure sources of financing for the pilot energy efficiency projects</p>
4. Capacity building for PEA and municipalities to mainstream energy efficiency measures	<p>Baselines defined by month 6 for measuring progress in developing the institutional and organizational capacities in PEA and the participating municipalities</p> <p>A business plan to institutionalize and sustain PEA's energy efficiency advisory services for municipalities and for accessing Clean Development Mechanism financing finalized by month 24</p> <p>A communications and outreach program finalized by month 24 for PEA and municipalities to jointly promote energy efficiency initiatives to other municipalities as well as to residential customers, commercial building owners, and small and medium enterprises.</p>	<p>Institutional and organizational capacity baselines for PEA and the participating municipalities developed under the TA by month 6</p> <p>Business plan for PEA's energy efficiency advisory services unit prepared under the TA by month 24</p> <p>Energy efficiency communications and outreach program prepared under the TA by month 24</p>	<p>Incentives for municipalities to participate in demonstration program are inadequate from the perspective of potential energy savings and financial returns</p> <p>Counterpart staff available from PEA and the participating municipalities is not sufficient to support the TA consultants</p>

Activities with Milestones	Inputs
<p>1.0 Design and Implement Pilot Municipal Energy Efficiency Projects</p> <p>1.1 Select four participating municipalities, one from each of PEA's service regions, based on predefined criteria (months 1–2)</p> <p>1.2 Prepare techno-economic studies to verify the financial incentives for PEA and municipalities to implement energy efficiency measures through pilot projects to retrofit public buildings and to upgrade street lighting (months 2–3)</p> <p>1.3 Prepare detailed and time-bound plans for implementing the pilot energy efficiency projects in each municipality (months 3–9)</p> <p>1.4 Working with PEA and municipalities, undertake detailed design of pilot energy efficiency projects, including conducting energy audits, recommending energy efficiency investments, calculating payback periods, and identifying how management changes and no-cost or low-cost options can reduce energy consumption and yield financial savings (months 3–9)</p> <p>1.5 Develop methodology and indicators for the measurement and verification of energy efficiency gains and financial savings (months 9–12)</p> <p>1.6 Discuss recommendations with mayors and municipal committees, and draft a demonstration program agreement to be signed by the mayors and PEA officials. (month 12)</p> <p>1.7 Implement demonstration projects, undertake monitoring and verification, and document process into a handbook for future demonstration (months 13–20)</p> <p>2.0 Structure Innovative Financing Arrangements</p> <p>2.1 Study various financing models appropriate for financing energy efficiency investments in Thailand, including the possibility of PEA serving as an intermediary for such financing (months 3–9)</p> <p>2.2 Ascertain potential sources of concessional funding, including bilateral agencies and the Ministry of Energy's EERF (months 6–9)</p> <p>2.3 Review applicable regulatory and legal provisions that would affect the financing structure (months 6–9)</p> <p>2.4 Undertake consultations with PEA, municipalities, and other relevant parties and come to an agreement on the most efficient financing model (months 6–9)</p> <p>2.5 Design possible arrangement for grant financing to reduce the incremental costs for more efficient technologies (months 6–9)</p> <p>2.6 Prepare detailed design of financing structure to be presented to PEA and the participating municipalities (months 9–12)</p> <p>2.7 Include consideration on how the Clean Development Mechanism could be used to reduce costs for scaling-up the municipal street lighting program nationwide (months 13–20)</p> <p>3.0 Prepare a Plan for Replicating Municipal Energy Efficiency Project</p> <p>3.1 Hold five workshops (4 regional and 1 national) to present achievements and lessons learned from the demonstration programs to municipalities, government agencies, consultants, academic institutions, and other interested parties (months 20–24)</p> <p>3.2 Prepare action plans to scale-up municipal energy efficiency initiatives by retrofitting municipal buildings and upgrading street lighting, and identify potential means of engaging other development partners (months 20–24)</p> <p>3.3 Prepare a model project design document for accessing Clean Development Mechanism financing by scaling-up the municipal street lighting upgrading program across the country (months 20–24)</p> <p>4.0 Strengthen the Capacity of Provincial Electricity Authority and Municipalities to Mainstream Energy Efficiency Measures</p> <p>4.1 Establish a baseline of the institutional and organizational capacities to be developed within PEA and the four participating municipalities (months 1–6)</p> <p>4.2 Develop a capacity-building component that emphasizes a learning-by-doing approach where the consultants work directly with the relevant counterparts from PEA and the municipality to promote hands-on learning (months 1–24)</p> <p>4.3 Prepare a business plan for institutionalizing and sustaining PEA's energy efficiency advisory services for municipalities by (i) analyzing the municipal market for energy</p>	<p>Financing from the Multi-Donor Clean Energy Fund under the Clean Energy Financing Partnership Facility in the amount of \$1 million to cover:</p> <p>Consulting services (international and national) of 71 person-months—\$700,500 Equipment—\$80,000 Administration—\$110,000 Workshops—\$15,500 Negotiations—\$3,000 Contingencies—\$91,000</p> <p>Government in-kind contributions of:</p> <p>Counterpart staff input of 148 person-months and per diem expenses—\$346,000 Office and transport expenses—\$32,000 Supporting studies and other expenses—\$72,000</p>

Activities with Milestones	Inputs
<p>efficiency advisory services; (ii) preparing financial forecasts and a budget for such services for the next 5 years; (iii) assessing the skills necessary for managing an energy efficiency advisory services unit within PEA; and (iv) drafting the necessary organizational structure, marketing plan, and a listing of agreements with other stakeholders and customers (e.g., long-term maintenance and service contracts) as well as approvals and permits for providing energy efficiency advisory services (months 13–24)</p> <p>4.4 Build the capacity of PEA's energy efficiency advisory services to evaluate and prepare Clean Development Mechanism projects based on a review of methodologies for building retrofit and street lighting projects that have been approved by the Clean Development Mechanism executive board. Based on a feasibility analysis, prepare a clean development mechanism project design document for the proposed scaling-up of a nationwide municipal street lighting upgrading project (months 13–20)</p> <p>4.5 Develop a communications and outreach program that continues to promote energy efficiency initiatives to municipalities as well as to residential customers, commercial building owners, and small and medium-sized enterprises. Recommend specific multimedia materials for implementing the campaign, including brochures at local PEA offices and information leaflets for inclusion in monthly billing statements (months 13–24)</p>	

ADB = Asian Development Bank, CO₂ = carbon dioxide, EERF = Energy Efficiency Revolving Fund, GDP = gross domestic product, PEA = Provincial Electricity Authority, TA = technical assistance.

THAILAND'S ENERGY IMPORTS
(current prices in baht [B])

Energy Type	2001		2007		% Change 2001–2007	As % of Total Imports		As % of Final Energy Consumption	
	B million	% of Total	B million	% of Total		2001	2007	2001	2007
Crude Oil	284,373	80.0	711,185	81.3	150.1	10.3	14.6	37.8	47.3
Petroleum Products	28,522	8.0	47,456	5.4	66.4	1.0	1.0	3.8	3.2
Natural Gas	30,559	8.6	78,901	9.0	158.2	1.1	1.6	4.1	5.3
Coal	7,489	2.1	29,656	3.4	296.0	0.3	0.6	1.0	2.0
Electricity	4,701	1.3	7,414	0.8	57.7	0.2	0.2	0.6	0.5
Total	355,645	100.0	874,612	100.0	145.9	12.9	18.0	47.3	58.2

Source: Thailand Ministry of Energy, Energy Policy, and Planning Office. 2008. *Energy and Economic Statistics*. Bangkok.

COST ESTIMATES AND FINANCING PLAN
(\$'000)

Item	Total Cost
A. Multi-Donor Clean Energy Fund under the Clean Energy Financing Partnership Facility^a	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	237.0
ii. National Consultants	333.6
b. International and Local Travel	111.9
c. Reports and Communications	18.0
2. Equipment ^b	80.0
3. Training, Seminars, and Conferences	
a. Workshop (1 National)	3.5
b. Workshop (4 Regional)	12.0
5. Miscellaneous Administration and Support Costs	110.0
6. Representative for Contract Negotiations	3.0
7. Contingencies	91.0
Subtotal (A)	1,000.0
B. Government Financing	
1. Office Accommodation and Transport	32.0
2. Remuneration and Per Diem of Counterpart Staff	266.0
3. Others ^c	152.0
Subtotal (B)	450.0
Total	1,450.0

^a Contributors: the governments of Australia, Norway, Spain and Sweden. Administered by ADB.

^b Equipment to be purchased will consist of energy-efficient technologies such as lighting (T5 or T8 fluorescent lamps and electronic ballasts) and air-conditioning (high-efficiency systems, timers and controls) for the municipal building retrofit program and high-pressure sodium lamps, timers, and voltage regulators for the public street lighting program. Such purchases will be made on a cost-sharing basis with the Provincial Electricity Authority (PEA) and the participating municipalities, and in accordance with ADB's *Procurement Guidelines* (2007, as amended from time to time). Energy efficiency equipment will be handed over to the Executing Agency and participating municipalities at no cost upon the completion of the project.

^c Includes the purchase of energy efficiency equipment cited above by Government counterparts (i.e., PEA and the participating municipalities).

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. The activities of the TA will take place over a 24-month period and will require 9 person-months of services from two individual international consultants, and about 62 person-months of national consultants' services, which will be sourced through a national consulting firm. The desired qualifications and outline terms of reference for international and national consultants are presented below.

A. International Consultants

2. The two international consultants will be recruited on an individual basis and mobilized approximately 2 months prior to the national consultants. This mobilization plan will ensure that a number of key decisions and preparations are made before the national consultants are fielded. As outlined below, the international consultants will initially coordinate with the Provincial Electricity Authority (PEA) staff to set up the project management unit and clarify its functions, select the four participating municipalities, and undertake initial assessments of the potential energy savings and financial benefits resulting from potential pilot energy efficiency projects.

1. Team Leader and Energy Efficiency Specialist (6 person-months)

3. The team leader will be an energy efficiency specialist with more than 10 years of experience on energy efficiency projects, at least 5 years of which were dedicated to energy-related issues in Asia. Specific and significant experience on Thailand would be highly valued. The consultant must also have demonstrated experience managing large projects involving multidisciplinary teams. An advanced degree in engineering, economics, management, or a related field is required. The team leader's principal tasks and responsibilities are outlined below.

4. In the area of project management, the team leader will:
- (i) Manage the overall contract, supervise all consultants comprising the project team, and ensure that all deliverables are submitted on time and meet quality standards.
 - (ii) Define the role, functions, and staffing requirements for a project management unit within PEA and secure its establishment prior to the mobilization of the national consultants.
 - (iii) Coordinate with PEA staff to select four participating municipalities based on the application of clearly-defined selection criteria.
 - (iv) Prepare detailed and time-bound implementation plans for the energy efficiency pilot projects, including the phase for monitoring progress and measuring results.
 - (v) Establish a baseline of the institutional and organizational capacities to be developed within PEA and within the four participating municipalities.
 - (vi) Ensure that the design of all activities contributes to capacity building through a learning-by-doing approach in which the consultants work directly with counterparts from PEA and the participating municipalities to promote hands-on learning.
5. Activities in the areas of technical input and oversight include the following:
- (i) Conduct preliminary techno-economic studies to ascertain the energy savings and financial incentives for PEA and municipalities to implement pilot energy efficiency projects.
 - (ii) Provide assistance to the project finance specialist to develop an innovative financing method for the pilot energy efficiency projects in each participating municipality.

- (iii) Develop a database for tracking the electricity consumed by the municipal buildings and public street lighting included in the demonstration programs.
- (iv) Working with PEA and the participating municipalities, undertake detailed design of the pilot energy efficiency projects, including conducting energy audits, recommending alternative management practices, and introducing no-cost or low-cost changes.
- (v) Develop indicators and a methodology for measuring and verifying the energy and financial savings as a result of implementing the pilot energy efficiency projects.
- (vi) Discuss recommendations with mayors and municipal committees and draft an agreement for the demonstration programs.
- (vii) Oversee the implementation of the demonstration programs as well as the monitoring and verification of key results indicators.

6. Responsibilities related to the scaling-up of PEA's energy efficiency advisory services include the following:

- (i) Analyze the overall market for the provision of energy efficiency advisory services to municipalities and propose a market niche for PEA to pursue.
- (ii) Determine the skills necessary for PEA to manage and expand energy efficiency advisory services and propose an appropriate organizational structure for a dedicated energy efficiency advisory services unit.
- (iii) Develop a marketing plan based on targeted business segments and customers at the municipal level.
- (iv) List necessary agreements, developmental approvals, and other types of permits that may be necessary for launching the proposed initiative.
- (v) Develop financial forecasts and a budget for the proposed business over the next 5 years including three business scenarios (low, medium, and high).

7. Tasks to support the mainstreaming of municipal energy efficiency measures include the following:

- (i) Define the structure, key messages, and desired outcomes of the four regional workshops and the national workshop on the municipal energy efficiency demonstration programs.
- (ii) Prepare a handbook that documents the process and lessons from implementing the pilot energy efficiency projects for replication in other Thai municipalities.
- (iii) Develop a strategic action plan for mainstreaming the municipal energy efficiency program that includes the necessary steps, institutional responsibilities, cost estimates, financing sources, timeframe, and expected benefits in terms of energy and financial savings.
- (iv) Develop a strategy and action plan in the form of a project design document to scale-up the public street lighting upgrading program nationwide to access Clean Development Mechanism financing.

2. Project Finance Specialist (3 person-months)

8. The project finance specialist should have at least 10 years of experience in project finance as well as demonstrated knowledge of municipal finance. Significant experience in Asia, and specific experience in Thailand, would be highly valued. The incumbent should also have some knowledge of structuring energy efficiency projects with Clean Development Mechanism credits. A master's degree in business administration or finance is preferred. The incumbent will

- (i) Study various financing models appropriate for the financing of municipal energy efficiency project in Thailand, including the possibility of PEA serving as an intermediary for such financing.
- (ii) Review applicable regulatory and legal provisions that would affect the financial structure of the proposed pilot energy efficiency projects.
- (iii) Undertake consultations with PEA, municipalities, and other relevant parties and come to an agreement on the most efficient financing model.
- (iv) Design possible arrangements for grant financing to reduce the incremental cost of more efficient technologies.
- (v) Design the proposed financing structure for the pilot energy efficiency projects and provide recommendations to PEA and the municipal counterparts.
- (vi) Estimate the potential costs and financial benefits of mainstreaming the municipal energy efficiency program, and identify possible sources of funding.
- (vii) Describe the potential economic impacts and social benefits that would result from implementation of the proposed energy efficiency measures.
- (viii) Contribute to the project design document to access Clean Development Mechanism financing for the rollout of a nationwide street lighting improvement program by estimating the investment costs and assessing financial benefits.
- (ix) Assist the team leader in preparing a business plan for sustaining and scaling up PEA's energy efficiency advisory services.

B. National Consultants

9. A national consulting firm will be recruited to field a multidisciplinary team of eight national consultants. The team will work under the close guidance and supervision of the team leader and the project director of PEA's project management unit. The Asian Development Bank's (ADB) quality- and cost-based selection method will be used to recruit the national consulting firm.

1. Project Coordinator (12 person-months)

10. The project coordinator will be an energy efficiency specialist with at least 10 years of experience on energy-related issues in Thailand. The project coordinator must have demonstrated experience in managing multidisciplinary project teams. It is also required that the incumbent has good English language skills and possesses a master's degree in engineering, economics, finance, or a related field. The project coordinator will:

- (i) Work closely with the team leader to refine the work program and manage the consultants' inputs to ensure the efficient and timely delivery of project outputs.
- (ii) Oversee the conduct of energy audits and feasibility assessments, as well as the preparation of detailed designs for the pilot energy efficiency projects and the associated monitoring and verification programs.
- (iii) Assist in the drafting of demonstration program agreements for each of the four participating municipalities.
- (iv) Provide input into the proposed financing structure for the pilot energy efficiency projects and consider potential financing sources for scaling-up similar projects nationwide.
- (v) Assist in planning and conducting the regional and national workshops and preparing action plans for replicating similar types of energy efficiency projects in other municipalities.
- (vi) Establish a baseline of the institutional and organizational capacities to be developed within PEA and within the four participating municipalities.

- (vii) Ensure that the national consultants transfer knowledge and skills to staff from PEA and the participating municipalities during all stages of TA implementation.
- (viii) Contribute to the preparation of a business plan for institutionalizing and sustaining PEA's energy efficiency advisory services.
- (ix) Develop a communications and outreach program for PEA's energy efficiency advisory services to promote energy efficiency initiatives to residential customers, commercial building owners, and small- and medium-sized enterprises.

2. Energy Efficiency Engineers (2 positions for a total of 24 person-months)

11. Two energy efficiency engineers will be required to identify, design, and implement the pilot energy efficiency projects in four participating municipalities. The incumbents must have an engineering degree and experience carrying out energy audits. The engineers will:

- (i) Coordinate with PEA staff and municipal engineers to collect and analyze electricity consumption and cost data for the proposed pilot energy efficiency projects.
- (ii) Conduct comprehensive energy audits of municipal buildings and public street lighting in each of the four participating municipalities.
- (iii) Calculate the associated payback periods and financial benefits of the pilot energy efficiency projects.
- (iv) Identify indicators and prepare a methodology for monitoring and measuring the benefits of implementing the pilot energy efficiency projects.
- (v) Assist the PEA and municipal engineers in overseeing the implementation of the pilot energy efficiency projects.
- (vi) Assist the PEA and municipal engineers in monitoring the results and impacts of the implemented changes, and document the process in a handbook for future replication in other municipalities.
- (vii) Provide input into an action plan for replicating municipal energy efficiency projects nationwide, with emphasis on project selection criteria, implementation arrangements, and monitoring procedures.
- (viii) Contribute to the preparation of a project design document to potentially access carbon credits through the Clean Development Mechanism for a nationwide street lighting improvement program.

3. Project Finance Specialist (8 person-months)

12. The project finance specialist will work closely with the international consultants to determine appropriate financing sources and structures for the pilot energy efficiency projects. This analysis will include the calculation of expected payback periods and financial benefits associated with different investment options, and serve as an input into the development of an efficient financing model for the pilot energy efficiency projects. The project finance specialist will coordinate with PEA and municipal staff to measure the financial savings associated with the introduction of energy efficiency measures. The incumbent will also assist in identifying potential sources of financing for replicating the municipal energy efficiency projects and in conducting the necessary financial analysis for preparing the business plan for PEA's energy efficiency advisory services. The project finance specialist should be familiar with local government finance in Thailand and hold a master's degree in business administration or finance.

4. Legal Advisor (4 person-months)

13. The legal advisor must be a Thai lawyer who will assist the project finance specialist to prepare an appropriate financing structure for the pilot energy efficiency projects. Specific

consideration will be given to applicable legal and regulatory provisions that would shape how such projects can be financed. The legal advisor will assist in the drafting of the demonstration agreements for each participating municipality. Taking into account plans for replicating municipal energy efficiency projects, the legal advisor will also document issues that pertain to the use of different funding sources under consideration.

5. Procurement Specialist (6 person-months)

14. The procurement specialist will be responsible for coordinating with PEA and municipal staff to prepare procurement packages for the pilot energy efficiency projects. The incumbent will review the bids, award the tenders, and ensure the provision (and possible installation) of items in accordance with the procurement contract. Familiarity with the procurement policies and procedures of ADB, PEA, and the participating municipalities is desirable. In the context of replicating the pilot energy efficiency projects, the procurement specialist will investigate the potential cost savings of adopting a bulk procurement strategy.

6. Clean Development Mechanism Specialist (4 person-months)

15. The Clean Development Mechanism specialist should be familiar with the preparation of project design documents for submission to the Clean Development Mechanism executive board for consideration and approval. The specialist will work with PEA staff and the team to gather relevant data and information and to prepare a Clean Development Mechanism project design document. The proposed project will be the scaling-up of public street lighting improvements nationwide.

7. Workshop Coordinator (4 person-months)

16. The workshop coordinator will plan five workshops (four regional and one national) to present the achievements and lessons learned from the demonstration programs to other municipalities, government agencies, consultants, academic institutions, and other interested parties. The workshops will also be used to solicit input on replicating and scaling-up municipal building retrofit and street lighting improvement projects throughout the country. The workshop coordinator will liaise with the project team and counterparts from PEA and the participating municipalities to prepare the workshop agendas and materials for distribution, reserve venues, handle logistical arrangements, issue invitations, and draft summary proceedings.

C. Reporting Requirements

17. All consultants will prepare an inception report within 3 weeks of mobilization, which will include a detailed work plan and schedule of deliverables agreed upon with ADB and the executing agency (EA). Key deliverables include, but are not limited to, the following: (i) energy audit reports; (ii) feasibility assessments and detailed designs for the pilot energy efficiency projects; (iii) financing arrangements for the pilot energy efficiency projects; (iv) implementation and monitoring plans for the pilot energy efficiency projects; (v) demonstration program agreements; (vi) a handbook for municipal energy efficiency projects; (vii) action plans for scaling-up building retrofit and street lighting improvement projects in other Thai municipalities; (viii) business plan for PEA's energy efficiency advisory services; (ix) Clean Development Mechanism project design document for nationwide street light improvement project; and (x) a communications and outreach plan for promoting energy efficiency initiatives to residential customers, commercial building owners, and to small- and medium-sized enterprises. Interim reports and the draft final report will be submitted within the deadlines specified in the work plan. The final report will incorporate feedback from the EA, the four participating municipalities, other relevant stakeholders, and ADB.