

# Thailand's Energy Efficiency Revolving Fund: A Case Study

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This case study sets out the views of the consultants. It does not represent the official views of APEC or any of its member economies. The Commonwealth of Australia does not accept any liability in relation to the contents of this work.

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## EXECUTIVE SUMMARY

Thailand's Energy Efficiency Revolving Fund ("the Fund") commenced operation in January 2003. The Fund was established to stimulate financial sector involvement in energy efficiency projects and to simplify project evaluation and financing procedures. The Fund provides capital at no cost to Thai banks to fund energy efficiency projects, and the banks provide low cost loans to project proponents. Government intervention in the financing process is minimised.

From the perspective of a government, the financing model used in the Fund is very attractive:

- the major risk arises from the possibility of project proponents defaulting on loans – the adverse consequences from defaults fall mainly on the project proponent themselves and partly on the lending bank, while the government carries no risk;
- the major costs are incurred in assessing loan applications, administering loans and promoting the Fund – these costs are carried mainly by the banks and partly by the project proponents (eg the costs of feasibility studies), while the government carries only a small proportion of these costs;
- all loan principal is repaid, so the only additional cost to the Government is the time cost of money in providing the loan principal at zero interest rate for up to 10 years;
- the repaid loan principal may be available for recycling into new loans (though this has not yet been approved); and
- the provision of loan funds to an energy efficiency project can leverage significant additional investment in the project from non-government sources.

The financing model is simple and straightforward and does not rely on any factors unique to the situation in Thailand. Therefore, it could easily be applied in other APEC economies. Applying the model in other economies would require:

- a revolving pool of funds from which to provide loans – funds for the initial pool could be directly allocated from government revenue or raised from a dedicated tax;
- agreement from the finance sector (banks and maybe other financial institutions) to participate in the financing model;
- commitment of a small number of staff from a government agency to establish the financing model and to carry out a small proportion of the work involved in assessing loan applications, administering loans and promoting the financing model.

However, if it is intended to apply the financing model to another APEC economy, it would be advisable to first resolve some of the negative aspects of the model, including:

- the difficulty experienced in providing a loan for a worthwhile project where the applicant lacks adequate collateral; and
- the fact that the financing model does not really address risk, which leads to the possibility that some project proponents are carrying higher or lower risk than their project warrants.

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**Note:** The currency exchange rate used in this Case Study is 40 Thai baht (THB) = 1 US dollar (USD).

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## **1. INTRODUCTION**

Thailand's Energy Efficiency Revolving Fund ("the Fund") commenced operation in January 2003. The Fund was established to stimulate financial sector involvement in energy efficiency projects and to simplify project evaluation and financing procedures. The Fund provides capital at no cost to Thai banks to fund energy efficiency projects, and the banks provide low cost loans to project proponents. Government intervention in the financing process is minimised.

A presentation on the Fund was made to an Energy Efficiency Finance Workshop held in Melbourne in February 2004 under the auspices of the Asia Pacific Economic Cooperation (APEC) Energy Working Group. The presentation generated considerable interest, with participants agreeing that the Fund would be a useful subject for a case study to raise awareness about innovative mechanisms to facilitate the financing of energy efficiency projects. Subsequently, the Australian Government, through the Department of Industry, Tourism and Resources, agreed to fund the preparation of this Case Study.

This Case Study:

- outlines Thailand's Energy Efficiency Revolving Fund;
- provides insights into how the Fund has been implemented and the impact the Fund has made; and
- considers whether there are any best practices and lessons learned that could be shared with the other APEC member economies.

The Case Study is intended to provide an important contribution to informing policy and program formulation within APEC economies. It has been prepared from publicly available information about the Fund and from interviews carried out in Thailand in May 2005 with stakeholders of the Fund.

## **2. POLICY CONTEXT FOR THE FUND**

This section explains the policy drivers which led to the decision to establish the Energy Efficiency Revolving Fund.

### **2.1 Legislation**

The *Energy Conservation Promotion Act* ([ENCON Act](#)), passed in 1992, is the primary legislation guiding Thailand's energy conservation and renewable energy policy. The Act outlines three major areas for energy conservation programs:

- a compulsory program for Designated Facilities<sup>1</sup> which comprise approximately 4,500 large commercial and industrial facilities (buildings and factories);
- a voluntary program that applies to smaller facilities, primarily targeting small and medium-sized enterprises (SMEs), and covers a range of activities such as research, demonstration and development, information campaigns, and other special projects.

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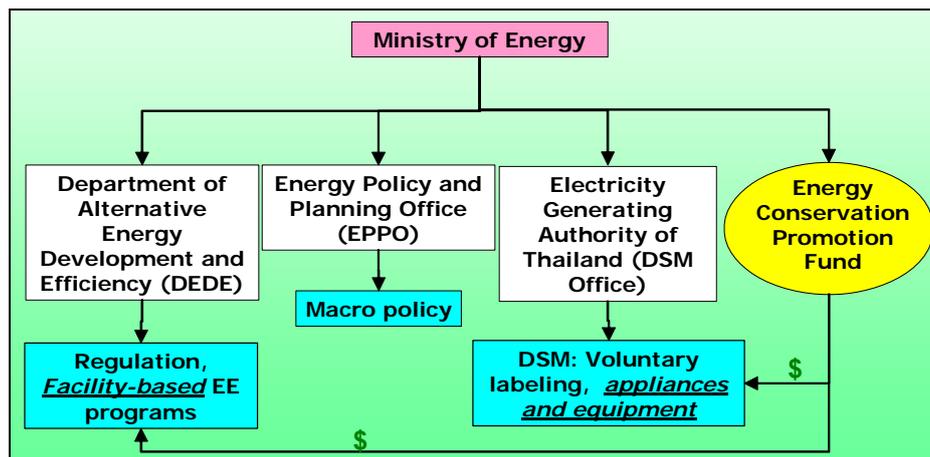
<sup>1</sup> Designated Facilities are defined under the ENCON Act as facilities with electrical demand greater than 1.0 MW or annual energy use of more than 20 TJ/year of electrical energy equivalent.

The ENCON Act also established the Energy Conservation Promotion Fund (ENCON Fund). The ENCON Fund receives revenue from a tax of THB 0.04 (USD 0.001) per litre on all petroleum products sold in Thailand. This provides annual inflows of approximately THB 2 billion (USD 50 million) per year. In June 2005, the ENCON Fund had a balance of more than THB 14 billion (USD 350 million). The allocation of money from the ENCON Fund to activities that support energy efficiency and renewable energy is an important government priority.

## 2.2 Government Agencies

The [Ministry of Energy](#), established in October 2002, oversees all energy functions in Thailand. There are three primary government agencies responsible for energy efficiency activities under the Ministry of Energy:

- the Department of Alternative Energy Development and Efficiency ([DEDE](#)) is the primary government agency responsible for implementing energy efficiency under the ENCON Act;
- the Energy Policy and Planning Office ([EPPO](#)) is responsible for formulating energy policy, as well as strategic policy for energy efficiency and renewable energy;
- the Electricity Generating Authority of Thailand ([EGAT](#)) is a state-owned electricity generating company that has been implementing a demand-side management (DSM) program in Thailand since the mid-1990s.



**Figure 1. Thai Government Agencies Responsible for Energy Efficiency Activities**

Recommendations about the use of money from the ENCON Fund are made by the ENCON Subcommittee which comprises senior officers from DEDE, EPPO and the Ministry of Finance plus two senior university academics.

The subcommittee makes recommendations for decision by the main ENCON Committee which is chaired by a Deputy Prime Minister. The members of the ENCON Committee are:

- Deputy Prime Minister;
- Permanent Secretary of the Ministry of Science and Technology;
- Permanent Secretary of the Ministry of Industry;
- Secretariat of the Office of the Economic and Social Development Board;
- Secretary-General of Thailand Industrial Standards Institute;
- Director General of the Comptroller General's Department;
- Director General of the Department of Alternative Energy Development and Efficiency (DEDE);
- Director General of the Department of Public Works and Town & Country Planning;

- Director General of the Department of Industrial Works;
- Chairman of the Federation of Thai Industries;
- Chairman of the Engineering Institute of Thailand;
- Senior advisors, not more than seven persons, from various organisations, such as representative from the Office of the Attorney General, economist, university professor, etc;
- Energy Policy and Planning Office (Secretariat for the ENCON Committee).

## **2.3 Policy Context**

As the primary implementing agency for energy efficiency under the ENCON Act, DEDE is responsible for ensuring that the approximately 4,500 Designated Facilities nationwide take actions to save energy.

Under the ENCON Act and Ministerial Regulations made under the Act, these Designated Facilities were required to:

- appoint an energy manager;
- submit data on energy use to DEDE every six months;
- submit preliminary and detailed energy audits to DEDE, the costs of which were subsidised; and
- submit targets and plans for increasing energy efficiency to DEDE, prior to receiving a financial subsidy to implement projects to achieve mandatory energy efficiency levels established under Thai law.

In the early years after the implementation of the ENCON Act, much of the energy efficiency work carried out in Designated Facilities was geared toward energy auditing and reporting. Implementation of actual energy efficiency projects was hindered by lack of awareness of energy efficiency opportunities, the low priority given to energy costs in management decision-making<sup>2</sup>, and limited access to capital due to the 1997 economic crisis in Thailand. DEDE also recognised that excessive bureaucracy and paperwork associated with the energy audit and reporting program hindered progress in actually implementing energy efficiency measures<sup>3</sup>.

To overcome these barriers to increased energy efficiency, DEDE introduced [two new programs](#) in late 2002 and early 2003<sup>4</sup>, using funds sourced from the ENCON Fund:

- the Energy Efficiency Revolving Fund which stimulates investment in energy efficiency by involving the Thai finance sector in providing low interest loans for energy efficiency projects; and
- the 30% Subsidy Program that provides two channels of funding for energy efficiency projects:
  - ◆ subsidies for the installation of any one of 11 different Standard Measures (energy efficient equipment “pre-approved” as eligible for subsidies); and
  - ◆ subsidies for the implementation of customised energy efficiency projects, called “Individual Projects”.

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<sup>2</sup> However, this situation subsequently changed because of the rapidly increasing price of energy.

<sup>3</sup> A new Ministerial Regulation which took effect in late April, 2005 simplified the reporting requirements for Designated Facilities under the ENCON Act. Designated Facilities are now only required to submit one relatively short report summarising the energy efficiency measures which will be implemented in the facility. In addition, the subsidies previously available for the costs of energy audits have been withdrawn.

<sup>4</sup> The Danish government provided support in the design and initial implementation of both of these programs as part of its Thai-Danish Energy Efficiency Promotion Project, which ran from January 2001 to September 2004.

### **3. DESIGN OF THE FUND**

This section describes the design of the Energy Efficiency Revolving Fund, and the rationale for particular aspects of the design.

#### **3.1 Size of the Fund**

The initial amount allocated from the ENCON Fund to the Energy Efficiency Revolving Fund is THB 2 billion (USD 50 million).

The size of this initial allocation was determined by an Energy Efficiency Market Assessment study carried out in 2001 and in discussions with the banks. The study estimated the technical and economic potential for energy efficiency projects in industries and buildings and recommended the establishment of an initial fund of THB 1 to 2 billion. DEDE also collected information from the banks about the total value of the loans they could expect to make from the Energy Efficiency Revolving Fund over the initial three year pilot program for the Fund.

When the Fund commenced, DEDE issued to each of six major Thai commercial banks credit lines from the Energy Efficiency Revolving Fund within the range of THB 100 to 400 million (USD 2.5 to 10 million). However, DEDE reserved the right to adjust the credit lines according to the actual requirements for the energy efficiency investments of each bank. In practice, funds are only released from the ENCON Fund to each bank as required to meet loan drawdowns. Therefore, the credit lines only served as targets for the bank's operations.

In June 2005, because the pilot program for the Fund (known as Phase 1) concludes at the end of 2005, DEDE intends to discontinue issuing credit lines to individual banks. Each bank will be able to make requests on a first-come first-serve basis in relation to the funds remaining from the initial allocation from the ENCON Fund (currently about THB 300 million). If a Phase 2 is approved for the Fund, the system will be similar to that in Phase 1 and a credit line will be issued to each bank at the beginning of the Phase 2 period.

#### **3.2 Interest Rates**

Funds for loans under the Energy Efficiency Revolving Fund are provided from the ENCON Fund to the banks at a zero interest rate.

The banks lend this money to proponents of energy efficiency projects (customers) at a fixed interest rate of no more than 4% per annum. Frequently, banks set an interest rate lower than this maximum figure, depending on their relationship with the customer. If the customer is well known to the bank, and has a good banking history and a strong financial position, the interest rate may be as low as 2.7%.

When the incentive scheme of low interest rates between the banks and customers was set in late 2002, three options were considered:

- a variable rate;
- a fixed rate;
- a subsidy (ie interest rate "buy-down") on a commercial rate set by the lending bank.

After extensive discussions with the banks, DEDE proposed the fixed maximum rate of 4%. The banks' view was that a maximum rate of 4% was required to cover management fees and the risk associated with the loans, while still making the loans attractive to customers.

In general, the cost of funds for banks in Thailand varies between 2% and 5% per annum. Since funds for loans under the Energy Efficiency Revolving Fund are provided to the banks at a zero interest rate, this allows the banks to make loans at rates lower than their usual lending rates.

The reference rate for lending by Thai banks is the minimum lending rate (MLR). Each bank sets its own MLR but in practice the MLRs set by individual banks are very similar. Banks may set rates below the MLR for their existing customers with good banking histories and strong financial positions. However, low rates are usually set only for short periods of up to a couple of years and the loan then reverts to a higher interest rate. Banks may also set higher rates for commercial loans made to other classes of customers.

When the maximum rate for loans from the Energy Efficiency Revolving Fund was set in late 2002, the MLR was about 5.75% and it remained relatively stable between then and June 2005. Therefore, compared with the MLR, the maximum rate of 4% for loans from the Fund is advantageous for proponents of energy efficiency projects.

### **3.3 Facilities Eligible for Funding**

When the Energy Efficiency Revolving Fund commenced in January 2003, only owners of Designated Facilities under the ENCON Act were eligible to apply for funding for energy efficiency projects.

In May 2004, this eligibility criterion was extended to enable owners of any commercial or industrial facility, whether or not it is a Designated Facility, to be eligible to apply for loans from the Fund. In addition, third parties, such as energy service companies (ESCOs), who do not own the facility in which an energy efficiency project is to be implemented, are also eligible to apply for loans. However, as noted in section 5.4 (page 11), most banks are reluctant to make loans to third parties because they usually do not own substantial land, buildings or equipment which can be offered as collateral.

During the first eighteen months operation of the Fund, the take up of loans was relatively slow. The eligibility criterion was extended principally to broaden the target area for the Fund, and particularly to make loan funds available to small and medium enterprises. Following the extension, the take up of loans has increased. In June 2005, 12 loans have been made to non-designated factories, one to a non-designated building, and one to an ESCO.

### **3.4 Projects Eligible for Funding**

Projects which implement “energy conservation” as defined in Sections 7 and 17 of the ENCON Act are eligible for a loan from the Energy Efficiency Revolving Fund.

#### **3.4.1 Projects in Factories**

Under Section 7 of the ENCON Act, energy conservation in *factories* means one of the following measures<sup>5</sup>:

- improvement in combustion efficiency of fuels;
- prevention of energy loss;
- recycling of energy wastes;
- substitution of one type of energy by another type;

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<sup>5</sup> Kingdom of Thailand (1992). *The Energy Conservation Promotion Act B.E. 2535*, sec 7.

- more efficient use of electricity through improvements in power factors, reduction of maximum power demand during the period of the electricity system's peak demand, use of appropriate equipments, and other approaches;
- the use of energy-efficient machinery or equipment as well as the use of operation control systems and materials that contribute to energy conservation;
- other means of energy conservation as stipulated in the Ministerial Regulations.

### **3.4.2 Projects in Buildings**

Under Section 17 of the ENCON Act, energy conservation in *buildings* means one of the following measures<sup>6</sup>:

- reduction of heat from the sunlight that enters the building;
- efficient air-conditioning, including maintaining room temperature at an appropriate level;
- use of energy-efficient construction materials and demonstration of qualities of such materials;
- efficient use of light in the building;
- use and installation of machinery, equipment, and materials that contribute to energy conservation in the building;
- use of operation control systems for machinery and equipment;
- other measures for energy conservation as prescribed in the Ministerial Regulations.

### **3.4.3 Use of Loan Funds**

Loans from the Energy Efficiency Revolving Fund may be used for:

- purchase and installation of equipment;
- engineering design and supervision fees, and any savings guarantee fee payable to an ESCO;
- the cost of works necessary for installing and operating equipment, such as equipment foundations, gas pipelines, etc;
- transportation costs, demolition costs, import taxes and duty and any value added tax (VAT) associated with these costs.

Loans from the Energy Efficiency Revolving Fund may not be used for:

- the cost of purchasing land and site preparation, and other costs that are related to land purchase;
- construction costs that are not directly necessary for the installation of energy efficient equipment, such as construction costs associated with an electrical substation, main transformer, or building.
- costs which DEDE considers are not appropriate.

## **3.5 Energy Efficiency Measures Eligible for Funding**

The energy efficiency measures eligible for a loan from the Energy Efficiency Revolving Fund are those listed in the ENCON Act (see section 3.4 above). Note that, in practice, the measures actually funded include a significant proportion of renewable energy measures (see Figure 6, page 16).

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<sup>6</sup> Kingdom of Thailand (1992). *The Energy Conservation Promotion Act B.E. 2535*, sec 17.

It is also strongly recommended that each individual energy efficiency measure should have a simple payback period no longer than seven years. Some project proponents have questioned this requirement and have suggested that the project as a whole, rather than each individual measure, should have a simple payback period no longer than seven years. However, some banks are reluctant to provide loans for any measures which have payback periods in excess of seven years. In some projects, such measures have been funded by the project proponent rather than with a loan from the Energy Efficiency Revolving Fund.

### **3.6 Maximum Loan Size**

The maximum loan available from the Energy Efficiency Revolving Fund is THB 50 million (USD 1.25 million) per project. This figure was set to target the fund at medium-sized energy efficiency projects, such as replacement of air conditioning chillers in a commercial facility or the installation of energy efficient equipment at an industrial site.

The THB 50 million maximum loan size was set to ensure that money from the Fund will be distributed to a large number of medium-sized projects rather than being taken up by a few large projects. In addition, it was felt that:

- customers with smaller projects would be likely to finance the project themselves, possibly assisted by a grant from the 30% Subsidy Program<sup>7</sup>; and
- customers with larger projects would be able to obtain commercial finance on better terms than are available through the Energy Efficiency Revolving Fund.

While the maximum loan size is specified as THB 50 million per project, there is considerable flexibility in defining what constitutes a project. A project may include several separate energy efficiency measures, or it may comprise only one measure. Because project proponents may apply for more than one loan from the Fund, several more expensive energy efficiency measures can be structured into a number of separate projects which each fit within the THB 50 million ceiling. However, each measure has to be independently implemented to be eligible to qualify as a separate project.

The ability to apply for more than one loan also gives project proponents the opportunity to “learn by doing” by using several loans to carry out several different energy efficiency projects.

A loan of up to THB 50 million is enough to finance medium-sized energy efficiency projects. However, it is insufficient to finance larger projects, such as installing a cogeneration facility at an industrial site, which can cost up to THB 300 million (USD 7.5 million). At present, some larger projects are being financed by a loan from the Energy Efficiency Revolving Fund plus additional finance provided by the lending bank, usually at a higher interest rate. Some banks believe that the maximum loan size from the Fund should be increased to enable the Fund to fully finance larger projects.

### **3.7 Repayments**

The initial allocation from the ENCON Fund to the Energy Efficiency Revolving Fund is for 10 years, meaning that DEDE must repay the total THB 2 billion to the ENCON Fund within 10 years from the commencing date of the Energy Efficiency Revolving Fund.

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<sup>7</sup> However, the total allocation of funds to the 30% Subsidy Program was committed within four months of the commencement of the program in late 2002. To June 2005, there has been no announcement of any additional funding.

Funds used by a participating bank to make a loan to a customer are repayable by DEDE to the ENCON Fund within seven years after the first drawdown of the loan.

Each loan agreement between a participating bank and a project proponent includes a schedule of regular repayments of loan principal and interest by the project proponent to the bank. All repayments by the project proponent must be completed within seven years from the first drawdown. However, project proponents can request a grace period with no repayments during the first year if their project requires some time to be completely implemented.

The bank must repay the principal to DEDE within seven days of receiving a repayment from the project proponent.

### **3.8 Administration**

The banks are responsible for most aspects of the lending process for the Energy Efficiency Revolving Fund, including marketing, economic (and sometimes technical) assessment, credit approval, and, importantly, loan repayment in case of default by a customer. The banks are required to submit regular reports on the status of individual projects so that DEDE can track the use of funds, the level of investment in energy efficiency projects and equipment, and the actual energy and demand savings.

DEDE's role in the administration of the Fund includes:

- ensuring that the projects are primarily energy saving projects, and not simply equipment replacement;
- providing technical assistance to the banks and their potential clients;
- monitoring the performance of the banks to ensure that they meet their targets in terms of number of energy efficiency projects, lending, and repayments; and
- evaluating the performance of the funded projects, so as to measure total energy savings.

The decision to have the loans processed by banks, rather than by a special unit within, or established by, DEDE was made early in the design process for the Fund<sup>8</sup>. This decision has turned out to be a wise choice, as the decision to outsource nearly all the responsibility for the administration of the Energy Efficiency Revolving Fund to the banks has expedited investments in energy efficiency projects.

## **4. ESTABLISHMENT OF THE FUND**

This section describes how the Energy Efficiency Revolving Fund was established.

### **4.1 Involving the Thai Finance Sector**

The initial idea for the Energy Efficiency Revolving Fund came from the Thai finance sector itself. The Industrial Finance Corporation of Thailand (IFCT)<sup>9</sup> was a private sector bank which specialised in providing banking services to customers from the industrial sector in Thailand. In 2001, IFCT was participating in a program funded by the World Bank which provided loans to stimulate the replacement of chillers in air conditioning systems with higher energy efficiency models.

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<sup>8</sup> In May 2002, DEDE officials attended a roundtable on energy efficiency financing in the United States. They found that, of the 10 state energy efficiency funds represented, only one state (New York) had the loan funds managed primarily by commercial banks.

<sup>9</sup> Subsequently, IFCT merged with the Thai Military Bank to form the TMB Bank.

Obtaining a loan under the chiller replacement program was complicated and the take up rate for the program was low. However, a senior manager in IFCT recognised the value of involving the finance sector in programs to promote energy efficiency. In mid-2001, he took a proposal to DEDE for a simpler loan program which would involve the finance sector in providing loans for any type of energy efficiency project. This initial proposal evolved and eventually developed into the Energy Efficiency Revolving Fund.

The initial proposal was to involve only IFCT in the financing program. However, DEDE decided that the Energy Efficiency Revolving Fund should involve participation by more than one bank. Therefore, managers from IFCT and DEDE spent some months talking with other banks and persuading them to participate in the Fund. The initial success in involving the Thai finance sector in the Fund is largely due to the early role of these managers in championing the idea of the Fund.

In early 2002, with the support of senior management in DEDE and the ENCON Fund Committee, a budget of THB 2 billion was secured for the Energy Efficiency Revolving Fund.

## **4.2 Establishing a Contract Between DEDE and the Banks**

During 2002, a contract was developed by the Thai Attorney-General's Department to govern the relationship between DEDE and the banks in operating the Energy Efficiency Revolving Fund. This contract took almost 12 months to negotiate because of disagreements about requirements and conditions for loans from the Fund.

A key provision which caused some delay in the negotiations was a requirement that the banks charge a maximum interest rate of only 7.5% when customers were in default on loans made under the Fund. In contrast, banks may charge up to 14.5% interest to customer in default on normal commercial loans. Also, DEDE is able to charge up to 14% interest on any amount which is in arrears on repayments by the banks to DEDE.

This issue was eventually resolved by allowing the banks to terminate any loan made to a customer under the Fund which is in default. The banks can then replace the terminated loan with another loan at a commercial interest rate. However, this provision has never been tested because, up to June 2005, there have been no customer defaults.

## **5. CURRENT OPERATION**

This section describes the current operation of the Energy Efficiency Revolving Fund.

### **5.1 Participation by Banks**

The Energy Efficiency Revolving Fund commenced operation in January 2003, with four participating banks. Currently, there are six banks participating in the Fund:

- Bank Thai;
- Bangkok Bank PCL;
- Sri Ayutthaya Bank;
- TMB Bank (formerly Thai Military Bank and Industry Finance Corporation of Thailand);
- Siam City Bank;
- Siam Commercial Bank.

## 5.2 Lending Process for the Fund

The lending process for the Energy Efficiency Revolving Fund comprises six stages.

The **first stage** involves the identification of an energy efficiency project which may be eligible for a loan from the Fund. The project may be identified directly by the owner of a facility or through an energy audit of the facility carried out by an energy management company or an ESCO.

Once an energy efficiency project has been identified, a detailed feasibility study is carried out by the facility owner, usually assisted by a technical adviser who may be either a staff member or an outside consultant. This study focuses on:

- assessing whether the proposed energy efficiency measures are technically feasible;
- estimating the likely energy savings from the project; and
- determining whether the likely repayment commitments under a loan from the Fund can be met.

If the results of the feasibility study are acceptable, the facility owner makes an application through a participating bank for a loan from the Fund.

Following the extension of the eligibility criterion in May 2004, third parties, such as energy service companies (ESCOs), who do not own the facility in which an energy efficiency project is to be implemented, are also eligible to apply for a loan on their own account. Where applications are made by third parties, there must be an agreement in place between the facility owner and the third party which governs the conditions under which the energy efficiency project will be implemented in the facility<sup>10</sup>.

In the **second stage**, the bank performs a financial analysis of the project. Some banks which have technical staff (eg engineers) may also carry out a technical analysis of the proposed energy efficiency measures. If the analytical results are acceptable, the bank passes on the application to DEDE.

In the **third stage**, DEDE assesses the project and decides whether to approve it according to specified criteria and conditions. The purpose of this assessment is to determine whether the project is eligible for a loan from the Fund and whether the proposed energy saving measures are technically feasible. DEDE then informs the bank whether or not the project has been approved.

In the **fourth stage**, if the project has been approved by DEDE, the bank considers and approves a loan and submits a disbursement and repayment plan to DEDE so that DEDE can organise the disbursement of funds from the ENCON Fund to the bank.

In the **fifth stage**, the borrower uses the loan funds to invest in, and implement, the energy efficiency project.

In the **sixth stage**, the borrower makes repayments of loan principal and interest to the bank and also submits reports to DEDE on the energy savings from the project. Within seven days of receiving a repayment, the bank repays the principal amount to DEDE. DEDE then returns the funds to the ENCON Fund.

The lending process is summarised in Figure 2 (page 11).

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<sup>10</sup> At June 2005, only two loans had been made to a third party because of the banks' reluctance to make loans to parties that do not own substantial land, buildings or equipment which can be offered as collateral.

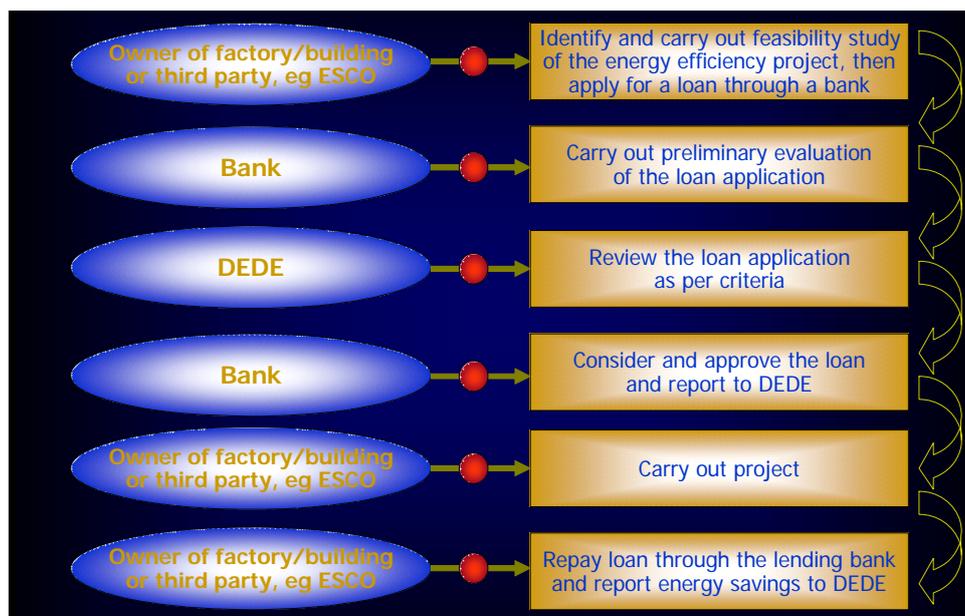


Figure 2. Lending Process for the Energy Efficiency Revolving Fund

### 5.3 Attracting Applications for Funding

The responsibility for education, publicity and promotion in relation to the Energy Efficiency Revolving Fund is split between DEDE and the banks.

DEDE has no budget specifically allocated to promoting the Fund and its promotional activities in relation to the Fund are relatively low key. From time to time, DEDE runs seminars about the Fund for prospective client from the industrial and commercial sectors. The participating banks are invited to take part in these seminars. In addition, information about the Fund is included in some general advertising about energy efficiency opportunities carried out by DEDE, including some paid radio advertising.

For several months after the Fund commenced, all the participating banks were proactive in promoting the Fund to their existing customers, mainly through seminars. Some banks have remained proactive and continue to run seminars, use their network of branch managers to promote the Fund, and sometimes undertake visits to customers to promote the Fund. These banks view promoting the Fund as a way of expanding their customer base. However, other banks are reactive and wait for existing customers to come to them with loan applications. These banks are not interested in promoting the Fund as a way of expanding their customer base.

### 5.4 Financial Assessment of Loan Applications

The participating banks use their regular lending criteria to carry out the financial assessment of applications for loans from the Energy Efficiency Revolving Fund. Loan applications are assessed by the banks mainly on the basis of the project proponent's balance sheet and assets rather than on the cash flows and savings from the energy efficiency project itself. Therefore, the loans are "asset-based" rather than "project-based" lending.

The banks are principally concerned with two issues in assessing loan applications:

- the capacity of the applicant to make repayments of loan principal and interest in accordance with an agreed repayment schedule; and
- the value and quality of the collateral offered by the applicant.

Capacity to repay the loan is normally assessed through the bank's knowledge of the financial position of the applicant and the applicant's history with the bank. Some banks are willing to make loans from the Fund to new customers and actively promote the Fund to new customers. Other banks are reluctant to make loans to applicants who are not existing customers of the bank.

As collateral for a loan from the Fund, the banks usually require a mortgage over land, a building or equipment owned by the applicant. The mortgaged item is usually linked to the facility in which the energy efficiency project is to be implemented. This raises a problem if the loan applicant is a third party such as an ESCO. Third parties do not own the facility and usually also do not own substantial land, buildings or equipment which can be offered as collateral. Some small and medium enterprises may also be in a similar position to ESCOs. Most banks are reluctant to make loans to parties who lack adequate collateral. This could be overcome by another party providing loan guarantees or by the banks moving to project-based rather than asset-based lending.

Once a loan is approved, the actual interest rate and period of the loan depend upon the agreement reached between the bank and the borrower. However, in accordance with the Fund criteria, the interest rate ceiling is 4% and the loan term cannot exceed seven years.

## **5.5 Technical Assessment of Loan Applications**

Technical assessment of loan applications may be made either by the lending bank, if the bank has technical people (engineers) on staff, or by DEDE if the bank has no technical staff. DEDE has retained a group of technical consultants from the Energy Research Institute at Chulalongkorn University to carry out technical assessments.

Because the project proponent has usually already carried out a feasibility study of the project, detailed technical assessment of loan applications is not required. The assessment concentrates on:

- determining whether the proposed energy efficiency measures fall within the definitions in sections 7 and 11 of the ENCON Act;
- assessing whether the proposed energy efficiency measures are feasible; and
- checking whether the estimates of energy savings are reasonable.

Sometimes, it is necessary for the technical consultants to seek advice from other experts about the feasibility of energy efficiency measures, particularly if a measure involves new technology. Further information may be sought from project proponents if there is insufficient information to validate the estimates of energy savings.

## **5.6 Reporting Requirements**

Participating banks are required to make monthly reports to DEDE, with six monthly and annual compilations of the monthly reports. These reports include, for each loan:

- the total amount of the loan;
- the total of repayments already made by the borrower;
- information about the next repayment due;
- projections of future drawdowns and repayments.

Some banks believe that these reporting requirements are unnecessarily onerous and should be reduced. DEDE mainly uses the monthly reports to assess the timing and amount of money transferred to customers to make sure that the banks do not hold the money for a long period. There

is a requirement that money disbursed from the ENCON Fund to a lending bank should not be held by the bank for more than two months.

Each participating bank has individual targets in relation to the quantity of money they lend under the Energy Efficiency Revolving Fund. DEDE also uses the monthly reports to monitor each bank's progress against their targets. However, DEDE does not impose any penalties if these targets are not met.

DEDE has established a tracking database using Microsoft Access to enable continuous monitoring of the implementation of the Energy Efficiency Revolving Fund. DEDE uses the database to monitor the lending banks' performance, analyse the needs of the customers, and track the progress of individual projects.

## **5.7 Staffing Requirements**

The DEDE program manager for the Energy Efficiency Revolving Fund, maintains that the major attribute required to manage and operate the Fund is coordination ability rather than technical knowledge. Considerable coordination is required between DEDE, the participating banks, the project proponents, the ENCON Fund subcommittee and the Ministry of Finance.

In June 2005, DEDE had the equivalent of about 4.5 full-time people managing and operating the Fund. All of the staff dedicated to the Fund administration, with the exception of the program manager, are under contract to DEDE, rather than permanent staff.

DEDE staff dedicated to the administration of the Energy Efficiency Revolving Fund comprise:

- the program manager for the Fund (part-time);
- a coordinator to manage the administration of the Fund;
- a marketing/promotion officer;
- one full-time and two half-time technical consultants.

In addition, permanent staff in the DEDE accounting department are involved in disbursing funds and receiving repayments; this commitment is equivalent to about two full-time people.

Initially, it was thought that DEDE would also require a lawyer dedicated full-time to work on the Fund. However, after the initial contracts were prepared by the DEDE legal department, the requirement for further legal advice has proven to be minimal.

The staff required by the banks depends on the level of their activity in making loans under the Fund. However, the most active banks probably have staffing requirements similar to that of DEDE.

## **5.8 Monitoring the Performance of the Fund**

DEDE uses a range of Key Performance Indicators (KPI) to monitor the performance of the Energy Efficiency Revolving Fund. These KPIs include:

- marketing of the Fund;
  - ◆ number of inquiries received by DEDE;
  - ◆ how inquirers heard about the Fund;
- number of days taken by DEDE to approve projects for loan applications;
- estimated and actual energy savings per project;
- performance of each participating bank;

- ◆ number of loans approved;
- ◆ total value of loans approved;
- progress of funded projects:
  - ◆ loan approval;
  - ◆ commitment of funding;
  - ◆ installation of the energy efficiency measures;
  - ◆ commissioning of the energy efficiency measures;
  - ◆ continuing operation of the energy efficiency measures.

## 6. PERFORMANCE AND RESULTS

This section describes the performance and results of the Energy Efficiency Revolving Fund.

### 6.1 Funded Projects

Figure 3 shows the projects funded by the Energy Efficiency Revolving Fund to June 2005.

Note that there are five and a half times as many projects funded in factories as there are in buildings. There are also no projects funded in office buildings. This may be because most office buildings are tenanted and building owners are reluctant to implement energy efficiency measures when they are not responsible for paying the energy bills.

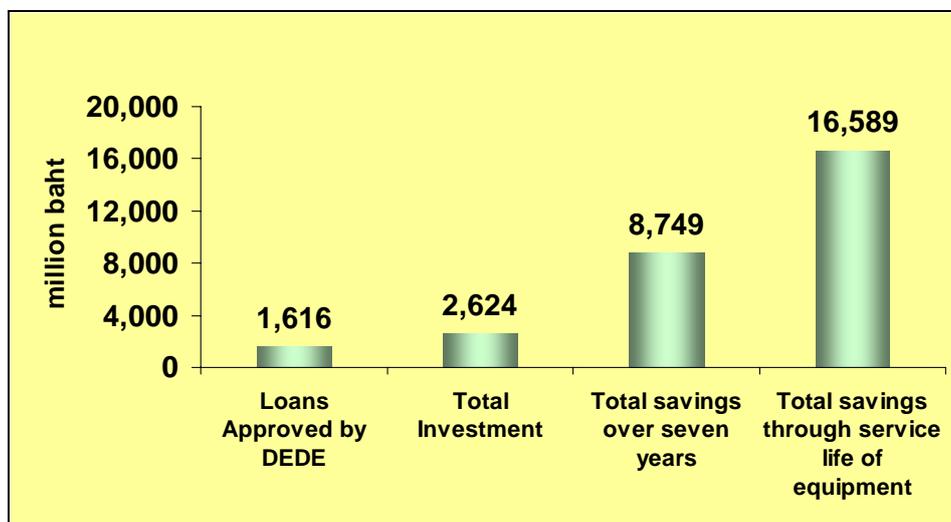
<b>BUILDINGS</b>	
<b>Hotels</b>	<b>6</b>
<b>Hospitals</b>	<b>4</b>
<b>Total</b>	<b>10</b>
<b>FACTORIES</b>	
<b>Food and drink</b>	<b>20</b>
<b>Chemical</b>	<b>16</b>
<b>Textile</b>	<b>9</b>
<b>Others</b>	<b>6</b>
<b>Non-metallic</b>	<b>4</b>
<b>Paper</b>	<b>1</b>
<b>Total</b>	<b>56</b>
<b>Grand Total</b>	<b>66</b>

**Figure 3. Projects that Received Loans from the Energy Efficiency Revolving Fund to June 2005**

Since the start of the Fund, only one or two loan applications have been rejected by DEDE and/or the banks. Because project proponents carry out detailed feasibility studies before making loan applications, the banks receive only high quality applications.

## 6.2 Investments and Savings

Figure 4 shows the total investments in energy efficiency projects leveraged by loans from the Fund and the projected total financial savings which will be achieved over the life of the equipment installed in the projects.



**Figure 4. Investments and Projected Financial Savings in Projects that Received Loans from the Energy Efficiency Revolving Fund to June 2005**

Figure 4 shows two interesting points. The first point is that each dollar of lending results in more than 10 dollars in lifetime energy cost savings. The second point is that every dollar lent from the Fund leverages approximately 60 cents in commercial bank lending; an additional investment of THB 1,008 million (USD 25 million) from other sources was leveraged by the investment of THB 1,616 million (USD 40 million) from the Fund.

Figure 5 shows the projected financial and energy savings by fuel type which will be achieved over the lifetimes of the energy efficiency measures used in the funded projects<sup>11</sup>.

<b>Electricity</b>	<b>2,396.85 million</b>	<b>kWh</b>
<b>Petroleum fuels</b>	<b>1,115.51 million</b>	<b>litres</b>
<b>Electricity</b>	<b>5,992.14 million</b>	<b>baht</b>
<b>Petroleum fuels</b>	<b>10,597.35 million</b>	<b>baht</b>
<b>Total</b>	<b>16,589.49 million</b>	<b>baht</b>

**Figure 5. Projected Energy and Financial Savings over the Total Service Life of the Equipment in Projects that Received Loans from the Energy Efficiency Revolving Fund to June 2005**

<sup>11</sup> DEDE uses different values for the lifetimes of energy efficiency measures, depending on the type of measure. Standard values are 7, 10, 12, 15, 20 and 25 years. For example, DEDE uses 7 years for insulation, 12 years for a voltage regulator, and 25 years for a cogeneration system.

### 6.3 Energy Efficiency Measures Implemented

Figure 6 shows the energy efficiency measures implemented in funded projects, the projected financial savings per annum for each measure, and the simple payback period.

	Measures	Investment (million baht)	Total savings per annum (million baht)	Average Payback (years)
1	Energy management and control	66.14	24.39	2.71
2	Insulation	6.92	7.84	0.88
3	Process improvement	168.35	66.48	2.53
4	High efficiency equipment	400.06	392.40	1.02
5	Renewable energy	751.80	424.84	1.77
6	Improvement of machinery	35.69	19.90	1.79
7	Air conditioning	92.29	33.19	2.78
8	Electrical system	4.01	1.00	4.01
9	Lighting	2.30	0.91	2.53
10	Cogeneration	1,055.77	265.42	3.98
11	Boiler	38.80	31.00	1.25
	<b>Total</b>	<b>2,622.13</b>	<b>1,267.37</b>	<b>2.07</b>

**Figure 6. Energy Efficiency Measures Implemented in Projects that Received Loans from the Energy Efficiency Revolving Fund to June 2005**

About 40% of the investment is in cogeneration and 29% is in renewable energy projects<sup>12</sup>. Cogeneration has a comparatively long payback period (3.98 years), whereas that for renewable energy projects is relatively short (1.77 years), presumably because the renewable fuels are either waste material or available very cheaply. The lowest payback period is for projects involving installation of insulation (0.88 years), whereas less than 0.1% of the total investment is in these projects. The next lowest payback period is for projects involving installation of high efficiency equipment (1.02 years) and 15% of the total investment is in these projects. In contrast, the longest payback period is in projects involving upgrades to electrical systems (4.01 years), with less than 0.1% of the total investment in these projects.

Note that all the payback periods are well within the seven years recommended for energy efficiency measures in projects supported by the Energy Efficiency Revolving Fund.

## 7. FUTURE DEVELOPMENT OF THE FUND

When the Energy Efficiency Revolving Fund commenced in January 2003, the ENCON Committee gave approval for a pilot program lasting three years. This section describes changes which may be made to the Fund after the pilot program (known as Phase 1) is completed in December 2005.

<sup>12</sup> Renewable energy projects include: electricity generation using biomass fuels; biogas production from tapioca starch, wastewater from palm oil processing and pig manure; modifying oil-fired boilers to use rice husks or wood chips as a fuel; and new boilers fuelled with sawdust.

## **7.1 Recycling of Repayments**

In June 2005, more than THB 2 million (USD 50,000) of repayments on loans from the Energy Efficiency Revolving Fund had been received by DEDE. The original design of the Fund anticipated that monies received from loan repayments would be recycled (or “revolved”) into new loans. At present, this does not occur and all repayments by the banks are returned to the ENCON Fund. Because the original THB 2 billion (USD 50 million) allocation from the ENCON Fund to the Energy Efficiency Revolving Fund has not yet been totally committed to loans, none of the repaid monies have been required for new loans.

Once the original allocation has been totally committed to loans, the ENCON subcommittee will have to decide whether to recommend the recycling of repaid monies into new loans (i.e. whether the Fund will become a true “revolving” fund). The subcommittee may also consider whether to recommend an increase in the allocation from the ENCON Fund to the Energy Efficiency Revolving Fund.

## **7.2 Increase in Maximum Loan Size**

As noted in section 3.4 (page 6), the maximum loan available from the Fund of THB 50 million (USD 1.25 million) is sufficient to finance medium-sized energy efficiency projects but is insufficient to finance larger projects. Some participating banks believe that the maximum loan size should be increased.

In June 2005, DEDE was considering whether to recommend increasing the maximum loan size to enable the Fund to fully finance larger projects, such as installing a cogeneration facility at an industrial site, which can cost up to THB 300 million (USD 7.5 million).

## **7.3 Further Extension of Eligibility for Loans**

As noted in section 3.3 (page 5), in May 2004, the eligibility criterion for the Fund was extended. This extension enables owners of any commercial or industrial facility, whether or not it is a Designated Facility, to be eligible to apply for loans from the Fund. In addition, third parties, such as ESCOs, are also eligible to apply for loans.

If a Phase 2 is approved for the Fund, DEDE will consider whether to further extend the eligibility criterion to enable manufacturers of energy efficient equipment to apply for loans from the Fund.

## **7.4 Possible Implementation of Loan Guarantees**

As noted in section 5.4 (page 11), the participating banks usually require a mortgage over land, a building or equipment owned by the applicant as collateral for a loan under the Energy Efficiency Revolving Fund. Most banks are reluctant to make loans to parties who lack adequate collateral.

Difficulties in providing a loan for a worthwhile project where the applicant lacks adequate collateral could be overcome if a third party was able to provide a guarantee for the loan. All the participating banks would welcome the provision of guarantees for loans from the Fund.

During 2003 and 2004, DEDE carried out a study supported by the Global Environment Facility (GEF) of the World Bank to investigate the advantages and disadvantages of the GEF establishing a partial guarantee facility for loans provided through the Energy Efficiency Revolving Fund. The final report actually recommended a detailed design for the Fund and its operation. However, it was decided to wait until after the pilot program phase of the Fund to determine whether to apply to the GEF Council for funding to establish the guarantee facility.

One possible source of guarantees for loans from the Fund is the Small Industry Credit Guarantee Corporation (SICGC) which is a state-owned financial institution in Thailand. The main objective of SICGC is to strengthen the confidence of financial institutions in providing credit to small industrial enterprises. SICGC provides partial credit guarantees to commercial banks for loans to small enterprises whose permanent assets must not exceed THB 200 million (USD 50 million). The enterprises can use their land and facilities as collateral. If a small enterprise applying for a loan from the Energy Efficiency Revolving Fund does not have enough collateral for a lending bank, it might be able to get a partial guarantee for the loan from the SICGC.

TMB Bank has also been investigating the possibility of a French government agency providing guarantees for loans from the Fund.

## **7.5 Improved Promotion of the Fund**

As noted in Section 5.3 (page 11), the responsibility for education, publicity and promotion in relation to the Energy Efficiency Revolving Fund is split between DEDE and the banks. However, DEDE has no budget specifically allocated to promoting the Fund and its promotional activities in relation to the Fund are relatively low key.

Traditionally, DEDE has been an extremely technical agency, and it is still dominated by engineers. DEDE has been trying to improve its promotional efforts, in part with technical assistance provided by the Danish Government under the Thai-Danish Energy Efficiency Promotion Program, which ended in September 2004. In June 2005, DEDE was considering how to increase its promotional activity in relation to the Fund after the conclusion of the pilot program phase.

## **8. LESSONS LEARNT IN PHASE 1 OF THE FUND**

This section describes the lessons learnt in operating the Energy Efficiency Revolving Fund to June 2005 and the ways in which this learning has been used to improve the operation of the Fund.

The Fund was established to overcome specific barriers to energy efficiency which included:

- lack of awareness of energy-efficiency opportunities;
- the low priority given to energy costs in management decision-making<sup>13</sup>;
- limited access to capital due to the 1997 economic crisis in Thailand; and
- excessive bureaucracy and paperwork associated with the energy audit and reporting requirements under the ENCON Act.

The establishment of the Fund tackled these barriers by:

- supplementing mandatory obligations with voluntary programs;
- shifting primary responsibility for implementation away from DEDE;
- allocating risk away from the Government; and
- simplifying procedures and expediting program implementation.

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<sup>13</sup> However, this situation subsequently changed because of the rapidly increasing price of energy.

## **8.1 Supplementing Mandatory Obligations with Voluntary Programs**

Thailand's 1992 *Energy Conservation Promotion Act* imposed on owners of Designated Facilities a range of mandatory obligations in relation to energy efficiency (see section 2.3, page 3).

In the early years after the implementation of the ENCON Act, much of the energy efficiency work carried out in Designated Facilities was geared toward energy auditing and reporting. While facilities were required to submit targets and plans for increasing energy efficiency, few energy savings measures were actually implemented.

In part, this low level of implementation was a result of the compulsory nature of the obligations. Because they were compulsory, facility owners tended to do the minimum possible. Because the penalties for non-compliance included in Division 9 of the ENCON Act were not enforced, it was relatively easy for facility owners to get away with doing very little.

In introducing the 30% Subsidy Program and the Energy Efficiency Revolving Fund in late 2002 and early 2003, DEDE attempted to change the paradigm in relation to energy efficiency. The main purpose of these two new programs was to change the emphasis from minimum compliance with compulsory obligations to maximum implementation of voluntary measures. The new programs focus the funding incentive on developing and implementing concrete energy efficiency projects.

While it is too early to draw a definitive conclusion, DEDE expects to have a much higher level of interest among the targeted large commercial and industrial end users because there are no mandatory prerequisites or strings attached to the energy efficiency subsidies. In June 2005, it appears as though both the 30% Subsidy Program and the Energy Efficiency Revolving Fund have succeeded in stimulating an increased level of implementation of energy saving measures in factories and buildings in Thailand.

## **8.2 Shifting Responsibility for Implementation Away from DEDE**

A central principle of the new programs is that DEDE should set the guidelines and then let outside parties be responsible for program implementation. In doing this, DEDE shifted responsibility for implementation of the programs away from the government to the private sector.

In the case of the Energy Efficiency Revolving Fund, the participating banks are responsible for assessing and approving loans made under the Fund and they also assume some of the credit risk in case of loan default. In addition, DEDE has hired contractors to carry out most of the day-to-day administration of the Fund on behalf of DEDE.

The Danish Government provided technical assistance during the design of the new programs and, from 2001 to 2004, a team of experts funded by Danish International Development Assistance was based at DEDE to provide ongoing assistance. In addition, the Global Environment Facility provided technical consulting assistance to DEDE in the design of the Energy Efficiency Revolving Fund, the development of a training program for industry and banks, and the possible development of a credit guarantee facility.

## **8.3 Allocating Risk Away from the Government**

The Thai Government carries none of the risk associated with loans made under the Energy Efficiency Revolving Fund. Under the contracts between DEDE and the participating banks, the lending bank carries the risk if a project proponent defaults on a loan.

In fact, the risk carried by the banks is relatively small. They receive funds from DEDE at a zero interest rate and can make loans to project proponents at up to 4% per annum. If a project proponent defaults, the lending bank faces a 14% interest rate on any late payments to DEDE.

However, the banks will never allow themselves to make late payments to DEDE. Instead, if a bank has not received repayments from a project proponent, it will simply use other funds to repay DEDE. The bank will be able to access these other funds at a very competitive interest rate. The bank is also able to terminate the defaulted loan and establish a new loan at a commercial rate to replace the terminated loan. In addition, the bank is able to use all its normal procedures, including accessing the project proponent's collateral, to recover funds owed under the defaulted loan.

In contrast, the risk carried by project proponents is relatively high. If a project proponent defaults on a loan made under the Energy Efficiency Revolving Fund, they face an interest rate of up to 7.5% per annum payable to the lending bank, plus the bank will use all its normal procedures, including accessing the project proponent's collateral, to recover funds owed under the defaulted loan. This is the reason why project proponents carry out detailed feasibility studies of potential energy efficiency projects before they apply to a bank for a loan. As noted in section 6.1 (page 14), because project proponents carry out these feasibility studies, the banks receive only high quality loan applications.

It could be argued that the Energy Efficiency Revolving Fund does not really address risk at all. The Fund is not designed to facilitate the banks charging variable interest rates to price the risk of loans made from the Fund. Because loan applications are assessed by the banks mainly on the basis of the project proponent's balance sheet and assets rather than on the cash flows and savings from the energy efficiency project itself, the Fund is missing an opportunity to use interest rate pricing to allocate risk across projects. Therefore, it is possible that some project proponents are carrying higher or lower risk than their project warrants.

## **8.4 Simplifying Procedures and Expediting Project Implementation**

A major goal of the new programs has been to simplify procedures, reduce paperwork, and focus on achieving energy savings through the implementation of energy efficiency projects. For example, loans under the Energy Efficiency Revolving Fund are regularly approved by DEDE within seven days, and sometimes over a shorter period if no additional information is required from the lending bank and/or the project proponent. However, some participating banks maintain that the actual disbursement of funds by DEDE can take up to three months. On occasions, this has caused difficulties with project proponents having to wait to proceed with implementing energy saving measures until the lending bank receives the funds from DEDE.

## **9. CONCLUSION: APPLICABILITY AND TRANSFERABILITY**

This section draws conclusions about the applicability and transferability of the financing model used in Thailand's Energy Efficiency Revolving Fund to other APEC economies.

From the perspective of a government, the financing model used in the Fund is very attractive:

- the major risk arises from the possibility of project proponents defaulting on loans – the adverse consequences from defaults fall mainly on the project proponent themselves and partly on the lending bank, while the government carries no risk;
- the major costs are incurred in assessing loan applications, administering loans and promoting the Fund – these costs are carried mainly by the banks and partly by the project proponents (eg the costs of feasibility studies), while the government carries only a small proportion of these costs;
- all loan principal is repaid, so the only additional cost to the Government is the time cost of money in providing the loan principal at zero interest rate for up to 10 years;

- the repaid loan principal may be available for recycling into new loans (though this has not yet been approved); and
- the provision of loan funds to an energy efficiency project can leverage significant additional investment in the project from non-government sources.

The financing model is simple and straightforward and does not rely on any factors unique to the situation in Thailand. Therefore, it could easily be applied in other APEC economies. Applying the model in other economies would require:

- a revolving pool of funds from which to provide loans – the initial pool could be raised from a dedicated tax or directly allocated from government revenue;
- agreement from the finance sector (banks and maybe other financial institutions) to participate in the financing model;
- commitment of a small number of staff from a government agency to establish the financing model and to carry out a small proportion of the work involved in assessing loan applications, administering loans and promoting the financing model.

However, if it is intended to apply the financing model to another APEC economy, it would be advisable to resolve some of the negative aspects of the model, including:

- the difficulty experienced in providing a loan for a worthwhile project where the applicant lacks adequate collateral; and
- the fact that the financing model does not really address risk, which leads to the possibility that some project proponents are carrying higher or lower risk than their project warrants.

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## APPENDIX A: STAKEHOLDERS INTERVIEWED IN THAILAND IN MAY 2005

<b>GOVERNMENT AGENCIES</b>	
Department of Alternative Energy Development and Efficiency (DEDE) Ministry of Energy	Dr Prasert Sinsukprasert Program Manager
Energy Policy and Planning Office (EPPO) Ministry of Energy	Mr Sanuansak Keyuraphan Senior Consultant
<b>UNIVERSITY</b>	
Energy Research Institute Chulalongkorn University (Under contract to DEDE)	Mr Chaiwat Pollap Project Engineer  Mr Alongkorn Sooksai Assistant Project Engineer
<b>BANKS</b>	
Bangkok Bank	Ms Niramarn Laisathit Senior Vice President  Ms Weerana Soungpo
Bank Thai	Mr Prayoon Shiowattana Executive Vice President Project Development and Technical Appraisal  Ms Wirongrong Sukying Executive Vice President Business Development  Ms Pornpilai Burasai Vice President Business Development
TMB Bank	Mr Anat Prapasawad Business Development Department  Mr Vivat Khositsakul Technical Expert Business Development Department
<b>ENERGY END USERS</b>	
Index Interfurn Co Ltd (Furniture manufacture)	Mr Yingyos Udommahuntisuk Executive Director
Srithai Superware Co Ltd (Plastic and melamine products manufacture)	Mr Prin Bholnivas Chief Financial Officer  Mr Narongporn Pashekrepapon Deputy Finance Manager  Mr Jirachai Nuntapanish Technical Manager
Vibhavadi Consultant Co Ltd (Under contract to Vibhavadi Hospital)	Mr Sarayut Kunnarong Engineer

## APPENDIX B: EXAMPLES OF PROJECTS FUNDED BY THE ENERGY EFFICIENCY REVOLVING FUND

### Nunyang Textile Industry Co Ltd

#### High efficiency equipment – Dyeing machine



The new dyeing machine can dye at low and high temperatures. Steam passes through heat exchangers with condensate return and an accurate control system. The machine reduces chemical consumption per kilogram of product

**Asian Superior Foods Co Ltd**

2.76 MW Gas Turbine Co-generation



**Installation of 2.76 MW Gas Turbine Cogeneration Power Plant  
with 200 million baht investment, savings of 49 million baht  
per year and payback period of 4.08 year**

**Bua Sommai Co Ltd (Rice Mill)**  
**6MW Power Generation Using Rice Husks**



Uses rice husks, which are a by-product of the rice mill, to generate electricity as well as to reduce the volume of waste

**Merlin Phuket Co Ltd (Hotel)**

Two New Chillers each 150 tons refrigeration



Reduces power consumption of the air conditioning system  
and reduces maintenance costs

**Vibhavadi Hospital**

Energy Management and Control System



Measures, monitors and analyses electricity consumption for  
planning of maintenance and demand control