

Document of  
The World Bank

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IMPLEMENTATION COMPLETION REPORT  
(TF-50007)

ON TWO

PROPOSED LOANS

IN THE AMOUNT OF US\$2.475 MILLION FROM  
THE MONTREAL PROTOCOL INVESTMENT FUND

AND

SDR 2 MILLION (US\$ 2.5 MILLION EQUIVALENT)  
FROM THE GLOBAL ENVIRONMENT FACILITY TRUST FUND

TO THE

INDUSTRIAL FINANCE CORPORATION OF THAILAND (IFCT)

FOR A

BUILDING CHILLER REPLACEMENT PROJECT

May 22, 2006

**Environment and Social Development Sector Unit  
East Asia and Pacific Region**

## CURRENCY EQUIVALENTS

(Exchange Rate Effective May 1, 2006)

Currency Unit = Baht  
38.33 Baht = US\$1.00

## FISCAL YEAR

October 1 – September 30

## ABBREVIATIONS AND ACRONYMS

ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers	kW hr	Kilowatt hour
Btu	British thermal unit	kW	Kilowatt
C	Carbon	kW/hr	Kilowatt per hour
CAS	Country Assistance Strategy	khr/yr	Kilowatt hour per year
CEC	Energy Conservation Committee	kW/TR	kilowatt per ton of refrigeration
CFC	Chlorofluorocarbons	LIL	Learning and Innovation Loan
CO <sub>2</sub>	Carbon dioxide	MLF	Montreal Protocol Investment Fund
CRF	Chiller Replacement Fund	MP	Montreal Protocol on Substances that Deplete the Ozone Layer
DEDP	Department of Energy Development and Promotion	NEPO	National Energy Policy Office
DIW	Department of Industrial Works	ODP	Ozone Depleting Potential
DSM	Demand-Side Management	ODS	Ozone Depleting Substances
ECF	Energy Conservation Fund	OEPP	Office of Environmental Policy and Planning
EGAT	Electricity Generating Authority of Thailand	OM	Operation Manual
ESCO	Energy service company	PMU	Project Management Unit
ExCom	Executive Committee for the Multilateral Fund	SA	Special Account
GEF	Global Environment Facility	SOE	Statement of Expense
GHG	Greenhouse gases	t	Metric ton =1,000 kg
GWP	Global Warming Potential	tC	Tons of carbon
IFCT	Industrial Finance Corporation of Thailand	TEWI	Total Equivalent Warming Impacts
kg	Kilogram	TR	Ton of refrigeration
ktC	Kiloton carbon		
kgC	Kilogram carbon		

Vice President:	Jeffrey Gutman, Acting EAPVP
Country Manager/Director:	Ian Porter, EACTH
Sector Manager/Director:	Magda Lovei/Maria Teresa Serra
Task Team Leader/Task Manager:	Nat Pinnoi

# KINGDOM OF THAILAND

## Building Chiller Replacement Project

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Project ID: P069028  
Team Leader: Nat Pinnoi

Project Name: Building Chiller Replacement Project  
TL Unit: EASEN

ICR Type: Intensive Learning Model (ILM) of ICR

Report Date: June 27, 2006

## 1. Project Data

*Name:* Building Chiller Replacement Project *L/C/TF* TF-50007  
*Country/Department:* THAILAND *Number:*  
*Sector/subsector:* Other industry (100%) *Region:* East Asia and Pacific Region  
*Theme:* Climate change (P); Pollution management and environmental health (P); Technology diffusion (S)

### KEY DATES

	<i>Original</i>	<i>Revised/Actual</i>
<i>PCD:</i> 06/30/2000	<i>Effective:</i> 10/25/2001	10/25/2001
<i>Appraisal:</i> 05/25/2001	<i>MTR:</i>	
<i>Approval:</i> 06/21/2001	<i>Closing:</i> 09/30/2005	09/30/2005

*Borrower/Implementing Agency:* IFCT/THE INDUSTRIAL FINANCE CORPORATION OF THAILAND (IFCT)  
*Other Partners:*

### STAFF

	<i>Current</i>	<i>At Appraisal</i>
<i>Vice President:</i>	Jeffrey S. Gutman	Jemal-ud-din Kassum
<i>Country Director:</i>	Ian C. Porter	Jayashankar Shivakumar
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## 2. Principal Performance Ratings

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HL=Highly Likely, L=Likely, UN=Unlikely, HUN=Highly Unlikely, HU=Highly Unsatisfactory, H=High, SU=Substantial, M=Modest, N=Negligible)

*Outcome:* S  
*Sustainability:* HL  
*Institutional Development Impact:* H  
*Bank Performance:* S  
*Borrower Performance:* S

*Quality at Entry:* QAG (if available) ICR  
S  
*Project at Risk at Any Time:* No

### 3. Assessment of Development Objective and Design, and of Quality at Entry

#### 3.1 Original Objective:

The original objective was to assist Thailand to (i) improve energy efficiency and reduce greenhouse gas emissions in the building chiller sector, and (ii) reduce consumption of ozone depleting substances (ODS) consistent with its targets under the Montreal Protocol on Substances that Deplete the Ozone Layer (MP). Specifically, the project aimed to establish conditions to facilitate early replacement of energy-inefficient, CFC-using chillers with 30 % more efficient non-CFC chillers, by demonstrating actual energy savings from replacing about 24 old CFC chillers.

The project was also consistent with Global Environment Facility (GEF) Operational Program (OP) #5 which aims to remove barriers to energy efficiency and energy conservation efforts. The project was designed as a Learning and Innovation Loan (LIL), and an overall evaluation on the project was to be made three years after project effectiveness; the Government would apply the lessons learned to implement a larger program targeting replacement of an additional 420 CFC chillers. Together, these 444 chillers would account for about 30 % of the total number of Chillers operating in Thailand.

This demonstration effect was expected to lead to even more widespread use of energy efficient chillers in the chiller market, leading to a significant reduction in emissions of greenhouse gases (GHGs) and use of ODS. A successful pilot would demonstrate the economic viability and feasibility of the non-CFC chiller technology, with the expectation that the government would follow this with a program that would cover a much larger set of chiller users. This was consistent with the Government's other priorities in energy conservation, which aimed to address barriers relating to unfamiliar technology, high upfront investment costs for replacing chillers, and inadequate technical capacity to change and manage the new chillers.

#### 3.2 Revised Objective:

After a one-year extension of the new non-CFC chillers commissioning date from September 30, 2002 to September 30, 2003, 17 CFC chillers had been successfully replaced. More participants could not be persuaded to join the conversion activities proposed by the project due to a number of factors including changes in market conditions that rendered the project's terms and conditions unattractive. Eventually it was decided to close the project ahead of schedule at the level achieved, without any restructuring.

#### 3.3 Original Components:

Component 1: The project included an investment component that aimed to replace 24 building chillers. The estimated costs were USD 4.97 million, financed by loans from the Multilateral Fund (MLF) and the GEF.

Component 2: The project included an Evaluation component that would allow an assessment of the pilot program and the development of a follow-up program. This component was entirely financed by the Government.

The total costs and sources of financing are indicated below.

Component	Estimated Costs (USD M)	GEF fin. (USD M)	MLF fin. (USD M)
1. Replacement of approximately 24 chillers	4.97	2.50	2.47
2. Evaluation of LIL project, development of follow-on program (financed by ECF)	0.26	0.00	-
Total Project Costs	5.235	2.50	2.47
External Financing Required	4.975	2.50	2.47

### *3.4 Revised Components:*

There was no revision of the components of the project during implementation.

### *3.5 Quality at Entry:*

The Quality of Entry is rated as “Satisfactory.” This rating is based on the project’s clearly defined outputs and outcomes, which are consistent with the CAS goals of supporting the Government in protecting the environment and in meeting its obligations under international environmental agreements, in this case the Montreal Protocol (MP), and supporting the UN Framework Convention on Climate Change. The project technical design was able to address the uncertainty of the potential energy savings from replacing the CFC chiller with the non-CFC chiller.

A higher rating could not be justified since the project proved to be complex and administratively burdensome as described in the following paragraphs.

The learning objective was justified but it required high levels of monitoring and supervision. The recourse to two different sources of funds and the innovative use of TF resources for repayable loans led to a very lengthy preparation period. Two loan agreements and two guarantee agreements had to be made for the total financing of less than USD 5 million. The use of two trust funds, GEF and MLF, also complicated the project implementation. For example, the Financial Intermediaries (FI) and enterprises had to separately report their utilization of two funds, and the task team had to manage two budgets and report completion twice. Similar learning objectives could have been incorporated into a simpler instrument, possibly even a technical assistance project.

Noteworthy is that Part B of the project - a direct responsibility of Department of Industrial Works, DIW, and a significant deliverable from the learning aspect- is not included in the Loan Agreements, and is merely described in the Trust Fund Guarantee Agreements (Article III - Other Covenants).

In the emerging economic context of Thailand, a low interest loan instrument of this type from Trust Fund resources did not provide sufficient incentives to the potential clients at the time of project implementation, because the commercial interest rate was already quite low, following the aftermath of the 1997 Financial Crisis. This is one of the factors that led to limited interest, and more than half the loan remained unutilized.

In spite of the project’s robust technical design, the extensive procedural requirements for its implementation may have contributed to it falling short of the project numerical target for non-CFC chiller installation. Additionally, implementation experience suggests that a more cooling system oriented approach may have been warranted in lieu of or in supplement to a chiller-based approach where only chiller was eligible to receive financing from the project when in fact the performance of the chiller unit depends on many complementary equipments and water conditions. This would have broadened the opportunity for utilizing the financial resources of the project and possibly captured even greater energy efficiency outcomes. This could have included, for example, more frequent use of variably speed drive technologies and system optimization

Finally, it would have been useful if the PAD had recorded the overall time span in project preparation which was partly caused by the Financial Crisis, and the resulting changes in the design and project implementation partner. Chronologically, the Project Concept Document was brought forward in August 1998. It focused on the GEF’s Operational Program # 5 aiming at removing barriers to energy efficiency, with an overall proposed outlay of USD 90 million covering a large set of chiller users, and a side benefit of ODS consumption phase-out. The MLF component of this project was approved in November 1998, and the GEF component was also submitted in the same time period, so that actual preparation of most of the project’s investment component and agreement on structure and participation must have been carried out well before the PAD in May 2001, but no record of these developments were found in the project preparation files. The

figure of USD 90 million was eventually replaced by an envelope of USD 25 million. In effect, this project was revived after the 1997 economic crisis, and in retrospect, it would have been useful to include the description of the components and indicators that MP and GEF had approved.

Furthermore, the recorded expenditures did not fully reflect the costs of preparation and supervision of the project. Available records confirmed only the Bank Budget provided for 2001 onwards, even though there were at least three years of related field activities to be accounted for. Unfortunately, some project documents during the early part of project preparation and implementation were stored at the warehouse in Bangkok which was completely destroyed during the warehouse fire in 2005. Moreover, costs borne by the Environment Department for their very active and hands-on support were also not reflected anywhere as these were absorbed as part of MP program management overhead.

#### **4. Achievement of Objective and Outputs**

##### *4.1 Outcome/achievement of objective:*

The Outcome/Achievement of the Objective is rated “Satisfactory.”

The project’s objectives of demonstrating energy efficiency and enabling phase-out of ODS refrigerants did not change over the project implementation, and continued to be in line with the national priorities. The project helped convert seventeen chillers with non-CFC systems which led to energy savings superior to the initial targets, enabling a very competitive return on the investment with lower average unit costs than originally projected. The ODS Phase-out achievements were also met. The calculated annual reduction of ODS supported by the project were not less than 14.45 tons, as targeted. All the CFC chillers replaced did not have any post-completion failures. The average internal rate of return was calculated at 29.9 percent, ranging from an astounding 50.3 % (Grand Hyatt) to 16.42 percent (Amarin Plaza Chiller No. 3). Although the initially targeted number of chillers replacement could not be achieved, the demonstration effect regarding energy savings and reduced consumption of ODS was fully met.

Due to the slow recovery of the financial crisis in 1997 and competing subsidy programs offered by the government, the aggressive campaign by the Industrial Finance Corporation of Thailand ,IFCT, (IFCT is now Thai Military Bank Public Co. Ltd., TMB, but the earlier acronym is retained for the purposes of this report.) to recruit enterprises including 13 seminars in Bangkok and other cities attended by 340 owners representing 1,000 units of CFC chillers, did not result in achieving the physical target output of about 20-24 CFC chillers, though the 17 CFC chillers represent a target achievement rate of about 71%. From those who were technically qualified, 64 chillers in all were replaced, though only 29 “participated in the program” and only 19 agreed to accept financial support under the project for conversion. By June 2003, due to unsuccessful final negotiation, the final number of participating CFC chillers dropped to 17 units. As noted later, a large number of conversions were occurring outside the scope of the project, i.e. the CFC chillers were replaced using the clients’ own resources.

Both the evaluation of the installed chillers and the follow-up scheme prepared by DIW confirmed the finding that the target energy savings were achieved as well as the reduction of ODS consumption. The evaluation is based on four actual data records collected for the purpose, and reported energy data for the remaining locations. The follow-up schemes are under the Government consideration.

##### *4.2 Outputs by components:*

Component 1: This component aimed at replacing 24 CFC-based chillers. This component is rated “Satisfactory” based on the following:

- a) Although it is difficult to assess the contribution the project had towards the country’s overarching goal of replacing the majority of CFC-based chillers by about 2010, the project clearly help

demonstrate as the benefits of doing so. One could notice that the size of the CFC chiller replacement market in Thailand has been expanding from virtually non-existence before the project to approximately 100 units per year (amounting for 25% of the total new chiller installations) in 2005. Until 2010, this rate of CFC chiller replacement would cover up to two-third of the remaining 700-800 CFC chillers currently in operation in the country

- b) The project clearly demonstrated that it is possible to successfully replace CFC chillers with non-CFC chiller systems with remarkable outcome as follow:. This success has demonstrated significant lessons for the replication efforts.
- The reported average annual energy saving rate was 902,970 kWhr/year, which is quite superior to the designed saving of 874,800 kWhr/year.
  - The average reported cost of replacement at USD 139,714 was much lower than the original design average of USD 207,290. Assuming the target size of CFC chillers at 500 refrigerant tons (RT), this suggests an actual cost per RT which is 34 percent lower than the designed cost per RT (USD 310 per RT compared to USD 415).
  - The overall estimated savings of THB 32.3 million per year (approx. USD 830,000) also suggests that the entire loan amount that was disbursed can be repaid in less than 3 years, making this a very profitable investment

As far as the ODS phase-out is concerned, a draft Project Completion Report was submitted to the Bank's Environment Department in March 2005 as required by the MLF. The report covers all converted chillers, accounting for a phase-out of 14.45 Tons of CFC-11 as per the PAD calculations (50 kg per unit per year for 17 years and 24 units, and no residual adjustment for HFC-123 use). It should be noted there was an inconsistency in the 1998 MLF approved target of 13.2 ODP Tons of CFC and the PAD's target of 20.4 ODP Tons. The MLF PCR prepared for the project reported the ODS phase-out target of 13.19 tons CFC.

Disposal of CFC at units remains an open question. Annex 13 of the PAD assumed that the CFC recovered from old chillers would be inventoried, recycled and reused. Instead, more than 4.5 tons of contaminated CFC is stored with various owners and is not seen as having economic value. There were logistical difficulties for the recovery of CFC-11, which is a low pressure refrigerant, as also the issue of what to do with recovered CFCs. It was also found that the recovered CFC was too contaminated to be reused without re-purifying, and recycling which would be prohibitively expensive for such a small amount. Furthermore, there is no CFC recycling facility in the country due to the high investment cost and insufficient demand. The recycling and reuse of the recovered CFC at an operational level is an issue that is recognized by the government and they are being addressed in the design of the follow-on project. The financing options of the follow-on project are under the Government consideration.

Component 2: Consist of an assessment of the pilot program and the development of a follow-up program. This component is also rated "Satisfactory" for the following reasons.

Based on interviews with DIW's consultant who is preparing this component, this component consists of two parts:

- a) An evaluation of the CFC chillers replacement: This began one year after the last chiller was installed. It comprised of four actual case studies analyzing the actual data that were retrieved from additional data loggers. The findings confirmed that the target energy savings were achieved as well as the reduction of ODS consumption.
- b) The design of a financial scheme covering 400 more CFC chillers: This included a set of participant incentives including options such as Carbon finance (Kyoto Protocol, Clean Development Mechanism), a review of the financial subsidies, and regulatory and policy recommendation on the recovered and recycling CFCs. Consultation workshops with key stakeholders were organized.

#### *4.3 Net Present Value/Economic rate of return:*

A NPV/ERR analysis is not available in the PAD.

#### *4.4 Financial rate of return:*

A Financial rate of return was not calculated for this LIL at appraisal. A preliminary cash flow analysis was however conducted, with the analysis suggesting that the project was financially very viable: monthly sub-loan repayments set at 95% of projected energy savings (i.e., at no extra cash flow requirement from owners) were expected to enable full repayment of the loans within five years. The final six-monthly progress report prepared for IFCT/TMB suggests that the projects have reported a much better average internal rate of return of 29.9 percent.

#### *4.5 Institutional development impact:*

The Institutional Development Impact is rated “Highly Satisfactory .” Originally, the capacity and the number of staff of the Implementation Unit at IFCT were quite limited. Among the few staff, there was no engineer who would be needed to provide the technical input in appraising the sub-loans as well as monitoring of the CFC chiller replacement process. Since, the inception of the project, IFCT has continued to build the capacity of this implementation unit which could be considered as the leading unit in the banking sector that is capable of handling complex renewable energy and other projects with global environment benefits and multiple sources of financing such as Carbon finance. In addition to financing the replacement of the 17 CFC chillers under the project, IFCT has built on the experience of this project to provide financing for the replacement of about twenty other CFC chillers under the energy efficiency program supported by the Ministry of Energy.

## **5. Major Factors Affecting Implementation and Outcome**

#### *5.1 Factors outside the control of government or implementing agency:*

The East Asian Financial Crisis had significant impacts on the the project at three different levels: delayed project start-up from 1998 to 2001; change of implementing agency from Electricity Generating Authority of Thailand-EGAT to IFCT; and modified lending policy. Regarding the latter, following the Financial Crisis the Bank of Thailand (BOT) prohibited all commercial banks to provide additional loans to any enterprises with any amount outstanding non-performing loans. This seriously limited the pool of potential clients. In addition, non-IFCT clients found it difficult to get loans from IFCT while the collateral remained with other banks. Finally, the interest rates available on the market became extremely competitive to the point that the difference between the rate offered by IFCT and the market rate were not as attractive.

#### *5.2 Factors generally subject to government control:*

There was no policy driver for ensuring a transition to new chillers, from either the ODS or energy efficiency perspective. There was no legislation and/or regulations requiring that chillers be replaced by the non-CFC chillers. Although, DIW was able to work with the Excise Department to raise the excise tax on CFC refrigerant, the impacts have been very limited. But the Ministry of Energy successfully offered several financial subsidy schemes to promote energy efficiency where replacing the old CFC chiller with the new energy efficient non-CFC chiller. These incentives were considered by the private sector more attractive than the ones offered by the Project because of the interest rates were very low with longer repayment period and because there were no requirements to dismantle the old CFC chiller and install a data logger to the new chiller.

#### *5.3 Factors generally subject to implementing agency control:*

Between approval of funding and appraisal, the original borrower (EGAT) dropped out of the project. EGAT was the identified implementing agency in the MLF project, but the PAD did not mention anything about it initially expected role and the reasons why EGAT did not stay involve. The GEF documents and correspondence (Bank Memos to CEO) provided some explanation: that the Government began privatizing

major State Owned Enterprises such as EGAT following the financial crisis, the Government guarantees for GEF grants would be unlikely; therefore, IFCT was considered as an alternative. This process took quite some time to complete.

The borrower's report and IFCT's letter of September 12, 2001 (before project effectiveness) provide additional guidance on this.

1. The project was designed for implementation through EGAT; IFCT expressed concerns that the Bank was using instruments (such as payment to the supplier only when the new non-CFC chiller is installed and successfully commissioned when a down payment is normally provided) which were not very consistent with private borrowing practices. IFCT felt that the Bank was unfamiliar with these matters in designing the project. Some of these concerns appear quite legitimate by themselves, but were difficult to understand in the chronological context: it had been identified as a financial intermediary as early as 1999, and this project was appraised as a Financial Intermediary operation in May 2000, but IFCT frequently refers to the absence of technical capacity, an inadequate fee structure, inflexible instruments, and the challenge of using Bank procedure with micro enterprises. The project negotiations did not indicate that these legitimate issues were resolved adequately.
2. Initially it appeared that a zero percent interest rate was contemplated when EGAT was involved. The rate was subsequently raised to 4.5% as a management fee when IFCT stepped in. While still competitive compared to market rates of 7-8% (normally large enterprises in good standing can negotiate for a better rate), it did make the project less attractive, and created some confusion. Competition from EGAT, which was providing loans for the same purpose with fewer conditions added to the confusion.
3. IFCT also cited the project schedule itself as a major challenge. All participating enterprises were to be identified and chillers commissioned within the first 12 months after effectiveness while the repayment was allowed over four years, and the loan was to be paid back within five years of project effectiveness. This schedule meant that enterprises had to be identified and locked in within the first three months after effectiveness (to allow for manufacturing, shipping and installation on a new non-CFC units over the remaining nine months), and there was no occasion to substitute/replace participants if some dropped out for whatever reasons. Furthermore, the number of viable enterprises just after the crisis was low. More time was allowed by the Bank by allowing an additional year, but this did not help to meet the target.
4. It is necessary to examine whether the selection criteria for beneficiaries were too rigid to allow for adequate operation of a learning project. As examples, IFCT pointed to the rigid power consumption criteria differential between old and new chillers, inadequate clarity on capacity expansion, and the transfer of costs for monitoring equipment (data logger) and dismantling the old chillers (both essential to the project's success) to the project enterprises. It is also indicated that the design definitions did not account for possible inefficiently high baseline energy consumption (based on chiller design) that did not result in energy savings after conversion.
5. The reluctance of suppliers to participate in a program with a complex set of requirements, namely, performance guarantee, detail proposal submission, and bank guarantee was cited. The lack of flexibility in project design was often cited: a requirement for several individual projects documents for owners of multiple chillers, complex project guarantee requirements, etc. As examples, several project owners have undertaken additional chiller conversions without attempting to use the project window. The only participating supplier (Trane) provided an assessment that the additional financial cost of participating in the project (buying and installing data loggers, reporting, destruction of old chillers) adds around 15 percent to project costs.

#### *5.4 Costs and financing:*

On November 11, 2004 the Government of Thailand requested the Bank to cancel the undisbursed balances to the loans totaling USD 2,579,858.78, which amount was allocated as USD 1,303,805.71 to the GEF and USD 1,276,053.07 to the MLF.

## **6. Sustainability**

### *6.1 Rationale for sustainability rating:*

A rating of "Highly Likely" is assigned to this aspect. The government's commitment to project objectives is clear, and the evaluation component is focused on examining whether this will be replicated. The Government is committed to phasing out of ODS, and it is well understood that there will not be ready availability of CFCs beyond 2009. The financial attractiveness of the energy efficiency gains, as well as the highly economical costs of chillers at levels lower than anticipated, provides the ideal environment and incentive for replicating the benefits of the project. Additionally, the Ministry of Energy is providing financial incentives in terms of low interest loans totaling USD 50 million to finance energy efficiency activities including replacing old CFC chillers with new energy efficient non-CFC chillers.

It has been demonstrated that the non-CFC chiller replacement market which was virtually nonexistence before the project has been created by replacing 17 CFC chillers. This market now is flourishing as the private enterprises have been replacing their old CFC chillers with the new non-CFC and energy efficient chillers without any subsidies from the government. As reported by one supplier, annually, more than 50 non-CFC chillers are being installed by private fund replacing the old CFC chillers.

### *6.2 Transition arrangement to regular operations:*

Not applicable to the project. The challenge will be to thoroughly and properly disseminate the lessons.

## **7. Bank and Borrower Performance**

### **Bank**

#### *7.1 Lending:*

A rating of "satisfactory" is assigned to this assessment. It is important to record that the Bank's project was essentially put together in spite of the 1997 East Asia Financial Crisis, and that the project was sustained in spite of these delays, when it could easily have been cancelled and the funding returned. However, the absence of adequate records makes it difficult to comment fully on preparation work associated with lending (before the formal appraisal process). The first available preparation aide memoire was of an extended pre-appraisal mission carried out in May and June 2000, and a single mission aide memoire was forwarded to IFCT and DIW in April 2002 for three missions carried out between June 2001 and January 2002 (coinciding with other missions in October, November and December (twice) 2001, and January 2002). It is not clear why these records were thus grouped.

Technically the project was well-conceived, but it had overestimated the willingness of the participants to come forward, in spite of the low interest rate that was meant to attract them. The financial attractiveness of the offer was eroded with the rapidly falling interest rates from late 2001 onwards.

The project was implemented as a Financial Intermediary operation, and a Financial Management Evaluation of IFCT was carried out under OP/BP 10.02 in April 2000. This involved a review of the credit analysis, approval and monitoring procedures under IFCT's credit policies. IFCT's management of credit risk was found to be prudent, and the FMS report confirmed that "IFCT's credit approval application and customer risk analysis, and loan management and monitoring procedures are regarded as comprehensive and consistent with the procedures prescribed as international standards." A project financial management manual was also put together to guide implementation. However, at the time, no assessment was made of IFCT's capacity to

address environmental issues emerging from project implementation and technical/engineering issues of the cooling system.

The use of two Trust Funds, normally reserved for grant operations, to provide loans remains difficult to justify; in retrospect, either one would have been able to finance the entire loan and would have provided adequate energy savings information.

Furthermore, full preparation costs need to be reflected. The recorded budgetary resources did not include the costs incurred during 1997-98 to prepare the MLF/GEF proposals, and also to sustain the project idea through 2001. Even the lending budgets had been consistently under-utilized (or costs charged elsewhere).

#### 7.2 Supervision:

The supervision budget also reflects the challenges of managing two budgets for a small, well-focused project.

<b>Thailand Building Chiller Replacement Chiller Project</b>						
<b>Bank Budget (USD )</b>						
	<b>GEF (P069027)</b>		<b>MLF (P069028)</b>		<b>Total</b>	
	Plan	Actual	Plan	Actual	Plan	Actual
<b>LEN</b>						
FY-01	50,000.00	47,673.69	48,913.00	13,971.84	98,913.00	61,645.53
FY-02	22,920.60	13,891.05	31,956.80	3,545.12	54,877.40	17,436.17
FY-03	0.00	1,374.94	36,000.00	24,089.90	36,000.00	25,464.84
<b>SPN</b>						
FY-03	20,000.00	9,814.65	0.00	9,382.74	20,000.00	19,197.39
FY-04	20,000.00	17,153.27	15,000.00	16,693.27	35,000.00	33,846.54
FY-05	20,000.00	16,005.48	6,000.00	18,113.32	26,000.00	34,118.80
Total					<b>270,790.40</b>	<b>191,709.27</b>

Overall budget costs of course demonstrate the highly economical use of Bangkok-based resources to manage the project. Expenditure was highest in FY-05, a good part of it reflecting completion reporting costs.

Audits: Three audit reports were available on record for the years ending December 2002 and 2003. A Financial Status Report was available for 2004, and the annual audit was received by June 30, 2005. The audits were conducted by KPMG Bangkok, and did not record any discrepancies.

Supervision communications are sporadic, though PSR records were complete. There was no record of any supervision missions until December 2003, by which time project implementation had effectively been completed. There was a final BTO for June 2004 recommending early closure of the project.

Even though this project was supervised locally from Bangkok where IFCT and the team were in constant communication to facilitate smooth project implementation and there seem to be no project implementation shortcomings that could be blamed on supervision quality, however, the absence of detailed records makes it difficult to record whether there was adequate supervision.

The first mission noted three main issues: some need to take appropriate safety steps in view of the changed refrigerant, the somewhat higher than expected attrition rate of projects not qualifying, and the start of the Government (assessment) component. By December 2003, the aide memoire records a note from a "previous

mission” to the effect that IFCT has already indicated its inability to recruit more than the 17 already engaged beneficiaries because of the “changing economic situations and competition from more flexible programs offered by Department of Alternative Energy Development and Efficiency, DEDE”. At that stage, IFCT was informed that, at a minimum, it needed to provide energy data from at least 7 more non-CFC chiller sites that have carried out replacements without seeking project assistance.

### *7.3 Overall Bank performance:*

Overall Bank performance is rated “Satisfactory” because the project outcomes on energy efficiency and ODS phase-out, and the learning and innovation objective were achieved despite the shortfall of the number of CFC chillers being replaced (17 out of the target of 20-24 chillers). The project implementation had overcome many challenges including the adverse impact of the 1997 Financial Crisis, twice administration burden of two sources of fund, complex technical requirements, and strong skepticism from the enterprises on the projected energy savings.

### **Borrower**

#### *7.4 Preparation:*

No rating can be provided. As mentioned earlier, adequate records of project preparation are not available to assign a rating in this section.

#### *7.5 Government implementation performance:*

This is rated as “Satisfactory”. The Government’s key role in implementation performance is in ensuring an appropriate regulatory framework is in place. An overall policy framework for ODS is in place, but issuance of other policy instruments in the future for completing conversion activities would be critical, especially, the management of recovered CFC. The government was actively participating in the project supervisions. The government also ensured that technical requirements such as the dismantling of the old CFC chillers and the destruction of the CFC compressors were complied with.

#### *7.6 Implementing Agency:*

The project followed “accepted commercial practice” for procurement of chillers by private buyers. IFCT informed the companies of the interested suppliers, and required them to select and propose a single supplier. As it transpired, all the successful replacements were carried out by only one supplier (Trane); some enterprises did choose other suppliers, but these projects were not carried through completion and were not financed by IFCT. Another supplier interviewed for the ICR exercise indicated that it had been contacted by IFCT in the early stages, but communications were lost as the project proceeded.

#### *7.7 Overall Borrower performance:*

Overall rating is “Satisfactory”.

## **8. Lessons Learned**

Key lessons learned are listed below.

*Flexible Project Design* Despite well thought through technical consideration, projects of this nature being implemented in a very dynamic macroeconomic environment (e.g., economic recovery, falling interest rates, and increase in private savings) should have a more flexible design to adjust to the implementation environment. In addition, the project needed to have been able to remain competitive in the existing policy framework: even during implementation, the Royal Thai Government supported initiatives which could be said to be competing directly for the LIL’s target group (such as EGAT’s grant scheme and DEDE’s programs, both focused on chillers and providing financing on more competitive terms). This implies that even for some LILs a mid-term review would have been a useful instrument to assess overall project effectiveness.

*Unified Funding Sources* Two sources of fund (GEF and MLF) were mobilized to finance this project. The added complexity of the administration of both funds was not adequately addressed at the designed stage which led to additional complication in project implementation and monitoring. Therefore, a single funding source or better blend funds should be considered when a follow on project is designed.

*Provision of the Right Information to the Right Audience* With active chiller replacement market, the evidence overwhelmingly suggests that the barriers to CFC chiller replacement have been overcome to the point that the private enterprises are able to finance the replacement using private fund, i.e., incentive is not needed. The information on (i) proven energy savings; (ii) high rate of return to the investment (ROI) on CFC chiller replacement; (iii) the reduced amount of CFC import quota; and (iv) the information on the continue reduction of global CFC production should be disseminated by the government to the top management of target enterprises that still have CFC chillers in operations to induce faster rate of replacement.

*Clear Policy and Incentive Mechanism* The project experience has shown that unclear policy and competing financial subsidies could lead to the suboptimal outcome. With the proven high internal rate of return, the government may not need to provide additional incentive to replace the remaining CFC chillers provided that the private sector has the complete information and clear message from the government. It is crucial that the government clearly declares its subsidy policy. Otherwise, the private sector will wait to get the best deal from the government.

*Refrigerant Management of the Recovered CFC* With a growing replacement chiller market, higher volume of the CFC would be recovered. However, the recover and recycle facility does not exist in Thailand. Therefore, it is likely that the recovered CFC without properly recycled, would not be able to be recharged to the remaining stock CFC chillers. DIW together with the chiller and refrigerant suppliers need to prepare a refrigerant management strategy and action plan to cope with the recovered CFC as more CFC chillers are being replaced.

*Periodic Maintenance and Monitoring* Periodic maintenance required by the project has resulted in low downtime. In the hand of a competent operator, the computerized monitoring system installed together with the new non-CFC chiller provide added benefit to the enterprise as the operator could spot any operational irregularities and optimize the energy consumption according to the work environment. Therefore, the chiller operators need periodic training and refreshing exercise to ensure that they will be able to optimize the use of the new chillers. Furthermore, The project has facilitated learning by requiring that data logger be installed with every new non-CFC chiller to keep track of the energy consumption data which have been used to provide clear evidence of energy saving from the CFC chiller replacement. With about two year worth of daily data, significant energy savings have been consistently proven. This has erased any doubts people had about the new chiller performance.

## 9. Partner Comments

(a) Borrower/implementing agency:

08/23/2005 21:04 6622739058

▲ PDMD

PAGE 02

6622739058



No. 0903/PLBC3/043

Public Debt Management Office  
Ministry of Finance,  
Rama VI Road,  
Bangkok 10400.

๒ September B.E.2548 (2005)

Dear Mr. Pinnoi,

**Re : Requesting Comments on Thailand Building Chiller Replacement Project  
Intensive Learning Implementation Completion Report (ILI)**

Please refer to your letter dated 22 August 2005 requesting the comments on the above-mentioned project. We would like to comment as followings:

1. The project is relevance to the objective, although the project could not achieve target, 17 units from 24 units target of CFC chiller replacement (75%) and in total of 53 units replacement including from other funding support.
2. The impact and lesson learned from implementing this project will be applied to the awareness of energy saving, reduction in Ozone Depleting Substance.
3. The sustainability aspect of this project is significant because the Ministry of Energy and financial institution of this project, IFCT which is merged with TMB, will continue to assist and participate in the old CFC chiller replacement scheme.

Your kind cooperation on the above project would be much appreciated.

Yours sincerely,

(Teerasak Mongkolpod)  
Director of Project Loan Operation Bureau  
Acting Director General

Mr. Nat Pinnoi  
Environmental Economist  
The World Bank Office, Bangkok  
30<sup>th</sup> Fl., Siam Tower  
989 Rama I Rd., Pathumwan,  
Bangkok 10330



No. 0307/ 60

Treaties and International Strategies Bureau  
Department of Industrial Works  
Rama VI Road, Ratchathewi  
Bangkok 10400, Thailand  
Telephone : 662 202 4228  
Fax : 662 202 4015

21 October B.E. 2548 (2005)

Dear Sir,

Subject : Comments on Thailand Building Chiller Replacement Project Intensive Learning Implementation Completion Report (ILI)

Pursuant to our letter No.0307/51 dated 15 September 2005 on the above subject, we are very pleased to enclose herewith our comments on the final draft of the ILI report of the said project.

Should you have any question, please feel free to contact us. Thank you very much for your kind cooperation.

Sincerely yours,

(Mr. Soodsakorn Putho)  
Director

Mr. Nat Pinnoi, Ph.D.  
Environmental Economist  
Environment and Social Development Unit  
East Asia and Pacific Region  
The World Bank Office  
30th Fl., Siam Tower,  
989 Rama I Rd., Pathumwan,  
Bangkok 10330, Thailand  
Tel: 662-686-8300 Fax: 662-686-8301



**ธนาคารทหารไทย จำกัด (มหาชน)**  
**THAI MILITARY BANK PUBLIC COMPANY LIMITED**

NO. EED. 105 / 2548

September 2, 2005

Dr. Nat Pinnoi  
 The World Bank  
 30<sup>th</sup> Floor, Siam Tower,  
 989 Rama I Road, Pathumwan  
 Bangkok 10330

Dear Dr. Pinnoi,

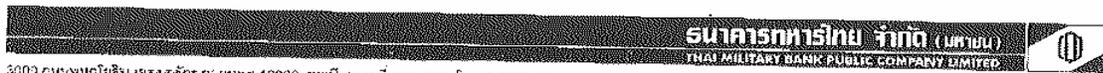
Subject: Comment on Thailand Building Chiller  
 Replacement Project Intensive Learning  
 Implementation Completion Report (ILI)

With regard to your letter No. 746/2005, TMB has a comment on section 4.5 "Institution development impact". We would like to revise the third line to be *".....also started development of a new line of both locally and globally environmental arena concerning innovative financing for energy efficiency/renewable energy and CDM project under the Kyoto Protocol"*.

Please do not hesitate to contact us if you have any further comment.

Sincerely yours,  
 TMB Bank Public Company Limited

Anat Prapasawad (Mr.)  
 Executive Officer - Business Development



3000 ถนนพหลโยธิน แขวงจตุจักร เขตจตุจักร กรุงเทพฯ 10900 โทร. 0-2299-1111, 0-2617-9111  
 3000 PHAHON YOTHIN ROAD, CHATUCHAK, BANGKOK 10900 BOR MOR JOR REG. NO.249 TEL. 0-2299-1111, 0-2617-9111

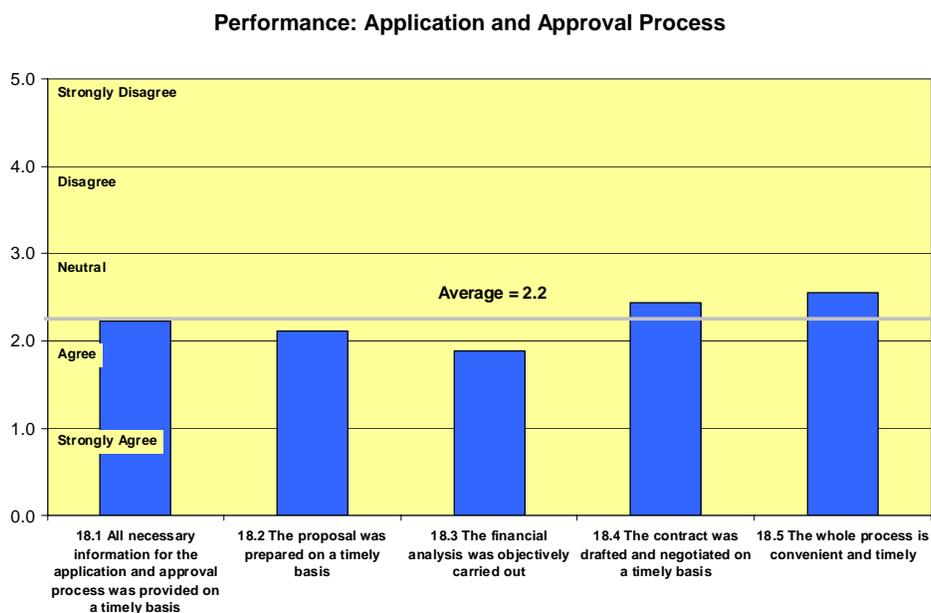
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*(b) Cofinanciers:*

*(c) Other partners (NGOs/private sector):*

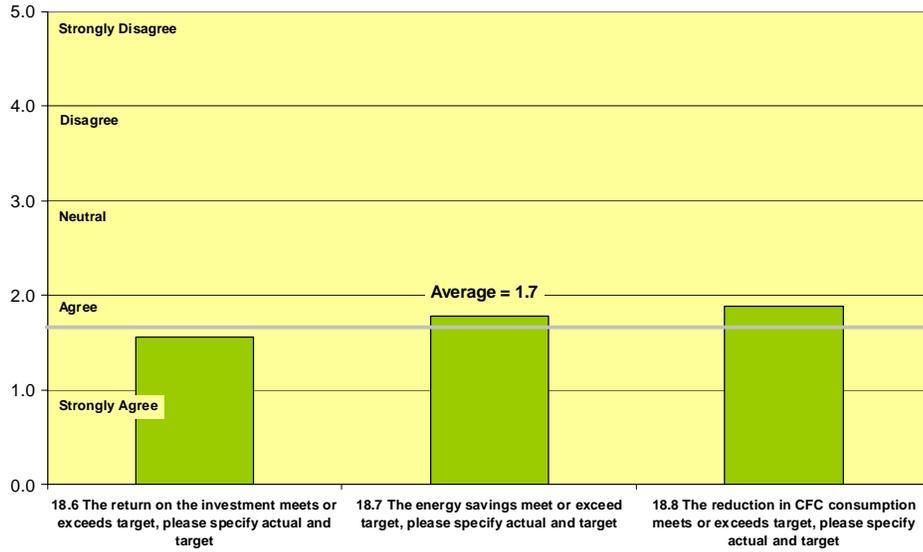
A perception survey of building owners who participated in the project was carried out in 2005. Key findings are summarized below:

1. On average, all building owners agreed that the Building Chiller Replacement program was successful.
2. When asked further on the performance of project implementation on specific issues, the following results emerged:
  - a. Although, the respondents agreed that the application and approval process was carried out on a timely basis, close attention should be provided to the information dissemination at the beginning of the project and legal contract between the owner and FI.
  - b. All respondents were satisfied with the performance of the new energy efficient non-CFC chiller units. Specifically, they agreed that returns on investment, energy savings, and reduction of CFC consumption meet or exceed the targets.

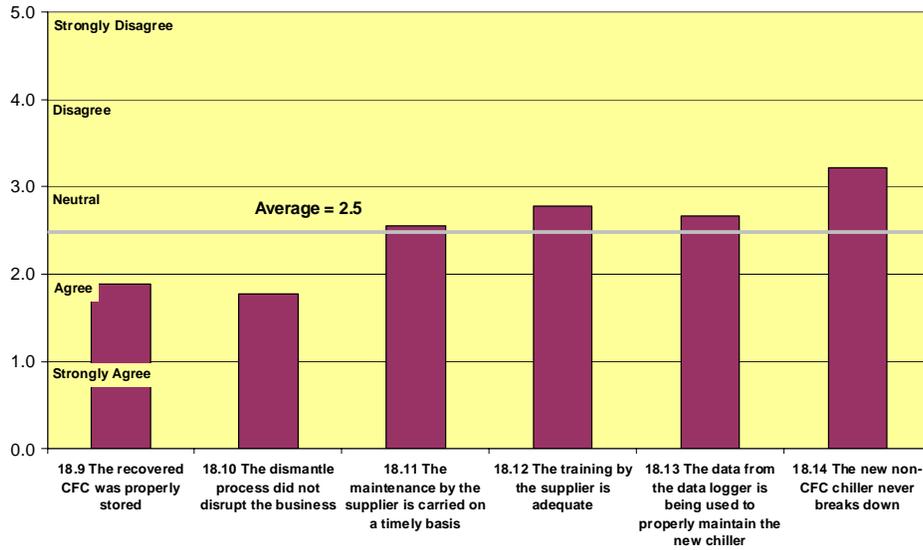


- c. Although on average, all respondents were reasonably satisfied with the operations and maintenance process, the supplier could improve the performance of the following activities: response to request from clients, training of the new chiller operators, utilization of data from data logger, and the quality of the new chiller units.

### Performance: New Non-CFC Chiller



### Performance: Dismantle, Installation, and Maintenance Process



## 10. Additional Information

Trane: the main challenges in implementing the project were as follows:

1. Cumbersome documentation requirements: the overall procedures, contracting requirements (one per chiller instead of per owner) and performance guarantee reporting were a challenge. As an example, the contract required checks on chiller performance every two months, but chillers' performance also requires performance in specified ambient conditions, cooling equipment etc, which are not specified.
2. Verification of chiller efficiency presents challenges. While this is essentially the responsibility of site owners, they expect the chiller supplier to take care of data and records. Cooperation of owners is essential: as reported, site visits have data problems which can relate to data loggers, or also to owner's operation and monitoring, proper installation, and to the specifications run by the operators (such as in-out temperatures that are different from design specifications). The specifications of flow meters are also an issue: Trane negotiated or recommended certain specifications when installing the chillers, which were considered adequate at the time; however, later reviews using other flow-meters (by EEC) provided different results. This suggests a need for standardizing measuring equipment in the successor program. Trane calculates that project requirements add about 15% to the costs of installation of chillers (data logger, other measuring equipment, dismantling and disposal of old chiller, verification visits, etc). This explains why Trane alone has successfully installed as many as *50 other chillers a year* during the implementation of the period. Some of these are of course of smaller specifications (250 Tons etc) but the statistic is significant.

Refrigerant recovery: is seen as a big challenge. 100% recovery of a low pressure refrigerant such as CFC-11 presents logistical difficulties, as also the issue of what to do with recovered CFCs. Most owners expect Trane to take care of all or part of the problem, the CFC is too contaminated to reuse without re-purifying, and recycling is too expensive.

## Annex 1. Key Performance Indicators/Log Frame Matrix

### Outcome/Impact Indicators:

No.	Indicator/Matrix	Appraisal Estimate	Actual
1.	ODS phased out (ODP metric tons)	20.4	38.60
2.	Completion date	04/15/2005	09/30/2005
3.	Total disbursements (USD million)	2.475 (MLF)	1.20 (MLF)
4.	No. of subprojects	24	17
5.	Cost-effectiveness (USD/Kg ODP)	310	62

### Disbursement Schedule (Actual Fiscal Year) in USD million:

Disbursements	FY01	FY02	FY03	FY04	FY05
Actual		0.80 (GEF)	0.72 (MLF) 0.30 (GEF)	0.47 (MLF) 0.03 (GEF)	

### Disbursement Schedule (Cumulative) in USD million:

Disbursements	FY01	FY02	FY03	FY04	FY05
Appraisal Estimate	0.47 (MLF) 0.50 (GEF)	2.47 (MLF) 2.50 (GEF)			
Formal Revision					
Actual		0.80 (GEF)	0.72 (MLF) 1.17 (GEF)	1.20 (MLF) 1.20 (GEF)	
Actual as % Estimate		32%	29% (MLF) 47 % (GEF)	48% (each)	
Date of Final Disbursement		6/9/2002	08/20/2003	02/19/2004	

### Subprojects Approvals and Completions by Year:

Subprojects	FY02	FY03	FY04	FY05	Total
Approved	25	20	17		
Physical Completion			17		
Fin. Completion					

## Annex 2. Project Costs and Financing

Project Cost by Component (in US\$ million equivalent)

	<b>Appraisal Estimate</b>	<b>Actual/Latest Estimate</b>	<b>Percentage of Appraisal</b>
<b>Component</b>	US\$ million	US\$ million	
1. Replacement of approximately 24 chillers	4.97	4.97	100
2. Evaluation of LIL project and development of the follow-on program	0.26	0.26	100
<b>Total Baseline Cost</b>	5.23	5.23	
<b>Total Project Costs</b>	5.23	5.23	
<b>Total Financing Required</b>	5.23	5.23	

Project Costs by Procurement Arrangements (Appraisal Estimate) (US\$ million equivalent)

<b>Expenditure Category</b>	<b>ICB</b>	<b>Procurement NCB</b>	<b>Method<sup>1</sup> Other<sup>2</sup></b>	<b>N.B.F.</b>	<b>Total Cost</b>
<b>1. Works</b>	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<b>2. Goods</b>	0.00	0.00	4.97	0.00	4.97
	(0.00)	(0.00)	(4.97)	(0.00)	(4.97)
<b>3. Services</b>	0.00	0.00	0.00	0.26	0.26
	(0.00)	(0.00)	(0.00)	(0.26)	(0.26)
<b>4. Miscellaneous</b>	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<b>5. Miscellaneous</b>	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<b>6. Miscellaneous</b>	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<b>Total</b>	0.00	0.00	4.97	0.26	5.23
	(0.00)	(0.00)	(4.97)	(0.26)	(5.23)

**Project Costs by Procurement Arrangements (Actual/Latest Estimate) (US\$ million equivalent)**

<b>Expenditure Category</b>	<b>ICB</b>	<b>Procurement NCB</b>	<b>Method<sup>1</sup> Other<sup>2</sup></b>	<b>N.B.F.</b>	<b>Total Cost</b>
<b>1. Works</b>	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<b>2. Goods</b>	0.00	0.00	4.97	0.00	4.97
	(0.00)	(0.00)	(4.97)	(0.00)	(4.97)
<b>3. Services</b>	0.00	0.00	0.00	0.26	0.26
	(0.00)	(0.00)	(0.00)	(0.26)	(0.26)
<b>4. Miscellaneous</b>	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<b>5. Miscellaneous</b>	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<b>6. Miscellaneous</b>	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
<b>Total</b>	0.00	0.00	4.97	0.26	5.23
	(0.00)	(0.00)	(4.97)	(0.26)	(5.23)

1/ Figures in parenthesis are the amounts to be financed by the Bank Loan. All costs include contingencies.

2/ Includes civil works and goods to be procured through commercial practice.

### **Annex 3. Economic Costs and Benefits**

N/A

## Annex 4. Bank Inputs

(a) Missions:

Stage of Project Cycle Month/Year	No. of Persons and Specialty (e.g. 2 Economists, 1 FMS, etc.)		Performance Rating	
	Count	Specialty	Implementation Progress	Development Objective
<b>Identification/Preparation</b> 06/00	5	Global Environmental Specialist, Procurement Specialist, Fin. Mgt. Specialist, Environmental Engineer, and Technical Consultant	S	S
<b>Appraisal/Negotiation</b> 05/01	5	Global Environmental Specialist, Procurement Specialist, Fin. Mgt. Specialist, Environmental Engineer, and Technical Consultant	S	S
<b>Supervision</b> 10/01 and 11/01	4	Environmental Engineer, Global Environmental Specialist, and two technical consultants	S	S
06/02	4	Environmental Engineer, Global Environmental Specialist (MP), Project Economist, Technical Consultant	S	S
12/02	1	Environmental Economist	S	S
06/03	1	Environmental Economist	S	S
12/03	4	Environmental Economist, Environmental Engineer, Global Environmental Specialist (MP), EAP MP Coordinator	S	S
06/04	1	Environmental Economist	S	S

(b) Staff:

Stage of Project Cycle	Actual/Latest Estimate	
	No. Staff weeks	US\$ ('000)
Identification/Preparation	10	20
Appraisal/Negotiation	10	30
Supervision	40	30
ICR	10	25
Total	70	105

## **Annex 5. Ratings for Achievement of Objectives/Outputs of Components**

(H=High, SU=Substantial, M=Modest, N=Negligible, NA=Not Applicable)

### Rating

<i>Sector Policies</i>	<i>SU</i>
<i>Physical</i>	<i>SU</i>
<i>Financial</i>	<i>SU</i>
<i>Institutional Development</i>	<i>H</i>
<i>Environmental</i>	<i>SU</i>

*Social*

<i>Private sector development</i>	<i>SU</i>
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## **Annex 6. Ratings of Bank and Borrower Performance**

(HS=Highly Satisfactory, S=Satisfactory, U=Unsatisfactory, HU=Highly Unsatisfactory)

<i>6.1 Bank performance</i>	<u><i>Rating</i></u>
<i>Lending</i>	<i>S</i>
<i>Supervision</i>	<i>S</i>
<i>Overall</i>	<i>S</i>

<i>6.2 Borrower performance</i>	<u><i>Rating</i></u>
<i>Preparation</i>	<i>S</i>
<i>Government implementation performance</i>	<i>S</i>
<i>Implementation agency performance</i>	<i>S</i>
<i>Overall</i>	<i>S</i>

## **Annex 7. List of Supporting Documents**

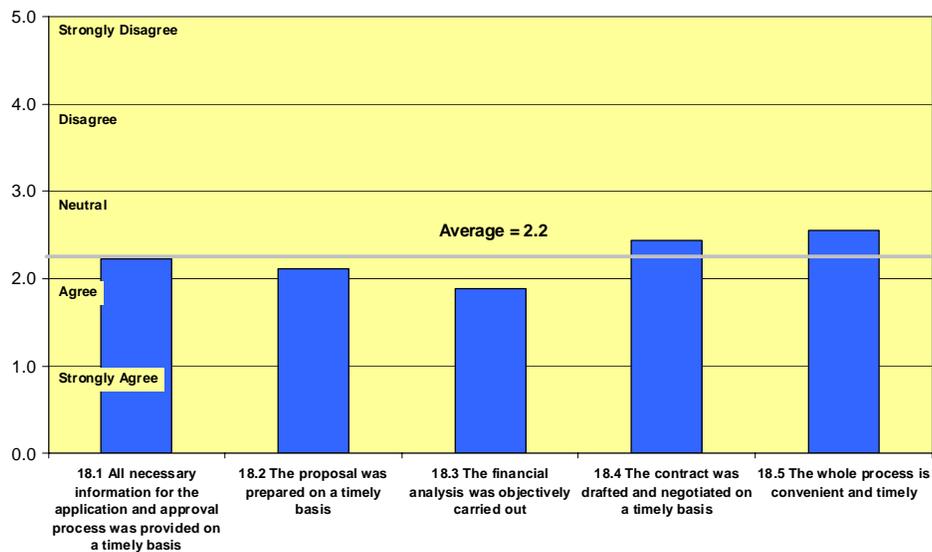
Thailand: Building Chiller Replacement Project – Project Appraisal Document

## Annex 8. Beneficiary Survey Results

A perception survey of building owners who participated in the project was carried out in 2005. Key findings are summarized below:

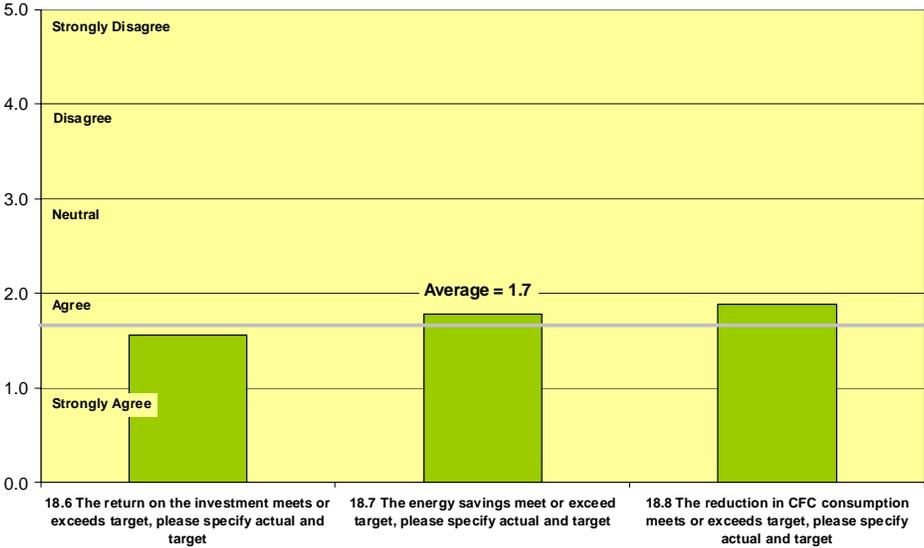
1. On average, all building owners agreed that the Building Chiller Replacement program was successful.
2. When asked further on the performance of project implementation on specific issues, the following results emerged:
  - a. Although, the respondents agreed that the application and approval process was carried out on a timely basis, close attention should be provided to the information dissemination at the beginning of the project and legal contract between the owner and FI.
  - b. All respondents were satisfied with the performance of the new energy efficient non-CFC chiller units. Specifically, they agreed that returns on investment, energy savings, and reduction of CFC consumption meet or exceed the targets.

**Performance: Application and Approval Process**

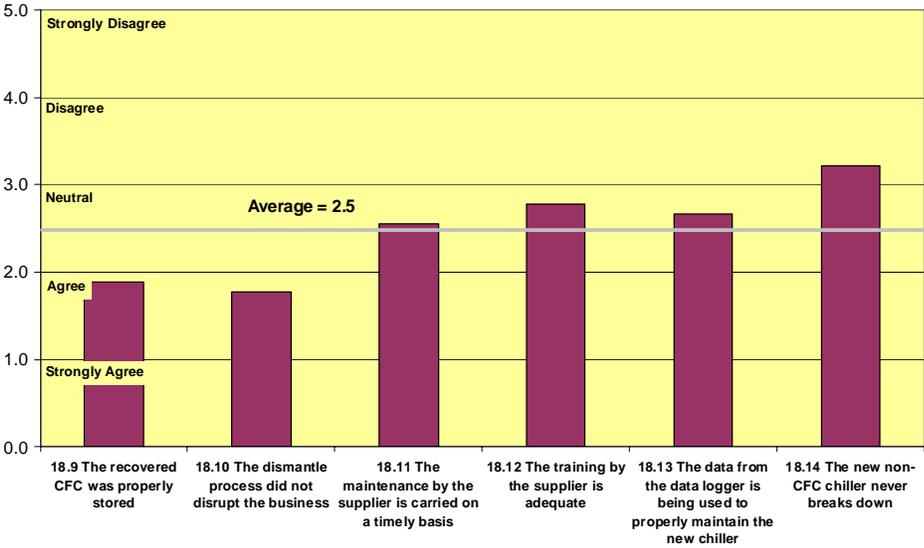


- c. Although on average, all respondents were reasonably satisfied with the operations and maintenance process, the supplier could improve the performance of the following activities: response to request from clients, training of the new chiller operators, utilization of data from data logger, and the quality of the new chiller units.

**Performance: New Non-CFC Chiller**



**Performance: Dismantle, Installation, and Maintenance Process**



## **Annex 9. Stakeholder Workshop Results**

Two Stakeholder workshops were organized. First, the one-day workshop entitled Innovative Financing for Energy Efficiency and Sustainable Environment was co-hosted by IFCT, DIW, Energy Efficiency Development Association (EEDA), and the World Bank on April 28, 2004. The objectives of the workshop were to (i) share early lessons learned from the Building Chiller Replacement Project; (ii) raise interests of the private sector in replacing CFC chillers; and (iii) present various financial options in developing energy efficiency projects. H.E. Phinij Jarusombat, the Minister of Industry provided the opening remark.

The event was attended by over 200 technicians and senior managers from various organizations. The representatives of the project beneficiaries, suppliers, DIW, and Ministry of Energy also participated in the panel discussion on the lessons learned from the chiller project. About 80 percent of the participants were either satisfy or highly satisfy with the knowledge and information received from the workshop. Forty enterprises registered for additional consultation with IFCT regarding the financing options to replace CFC chillers and other energy efficiency projects.

Second, the focused group discussion was organized by the Bank in cooperation with DIW and IFCT on June 10, 2005. About 20 representatives from the IFCT, DIW, and project beneficiaries, and UNEP (participated as observers) participated in the discussion.

Summary of the key results from the two stakeholder workshops are listed below:

- (i) High rate of return on investment (higher than the designed rate) leading to a short payback period were cited by the beneficiaries as the key benefit of the project;
- (ii) Project technical requirements (type and age of the chiller, destruction of the CFC chiller compressor, data logger, and detail technical proposal), terms, and conditions (rate of interest, payback period requirement, and required collateral and performance guarantee) should be made more flexible and less cumbersome;
- (iii) Responsive after-sales services and training of the chiller operators were needed to ensure uninterrupted operations of the new non-CFC chillers and full utilization of the data logger and the computerized control system. In addition, a more user friendly Management Information System should be developed in order to optimize the chiller performance;
- (iv) Additional investment on the complementary equipments was needed to fully optimize the new chiller. However, only investment in replacing chiller was financed by the project. The beneficiaries needed to finance any additional investment themselves.
- (v) Recovered CFC refrigerant needed to be properly handled to prevent any leakages into the atmosphere;
- (vi) Clear Government policy on subsidizing energy efficiency projects was needed to allow the private sector to decide how and when the old CFC chillers would be replaced.