Document of
The World Bank

Report No: 21348-TH

PROJECT APPRAISAL DOCUMENT

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 25, 2001

Environment and Social Development Unit
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective October 2000)

Currency Unit = Baht
43.67 Baht = US$1.00
US$1.00 = 43.67 Baht

FISCAL YEAR

October 1 -- September 30

ABBREVIATIONS AND ACRONYMS

ASHRAE	American Society of Heating, Refrigeration and Air-Conditioning Engineers
Btu	British thermal unit
C	Carbon
CAS	Country Assistance Strategy
CEC	Energy Conservation Committee
CFC	Chlorofluorocarbons
CO_2	Carbon dioxide
CRF	Chiller Replacement Fund
DEDP	Department of Energy Development and Promotion
DIW	Department of Industrial Works
DSM	Demand-Side Management
ECF	Energy Conservation Fund
EGAT	Electricity Generating Authority of Thailand
ESCO	Energy service company
ExCom	Executive Committee for the Multilateral Fund
GEF	Global Environment Facility
GHG	Greenhouse gases
GWP	Global Warming Potential
IFCT	Industrial Finance Corporation of Thailand
kg	Kilogram
ktC	Kiloton carbon
kgC	Kilogram carbon
kW hr	Kilowatt hour
kW	Kilowatt
kW/hr	Kilowatt per hour
khr/yr	Kilowatt hour per year
kW/TR	kilowatt per ton of refrigeration
LIL	Learning and Innovation Loan
MLF	Montreal Protocol Investment Fund
MP	Montreal Protocol on Substances that Deplete the Ozone Layer
NEPO	National Energy Policy Office
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substances
OEPP	Office of Environmental Policy and Planning
OM	Operation Manual
PMU	Project Management Unit
SA	Special Account
SOE	Statement of Expense
t	Metric ton =1,000 kg
tC	Tons of carbon
TEWI	Total Equivalent Warming Impacts
TR	Ton of refrigeration

Vice President:	Jemal-ud-din Kassum, EAPVP
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Sector Manager/Director:	Zafer Ecevit, EASES
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THAILAND
BUILDING CHILLER REPLACEMENT PROJECT

CONTENTS

Annexes

MAP(S)
- Not Applicable

THAILAND

Building Chiller Replacement Project

Project Appraisal Document

East Asia and Pacific Region
EACTF

Date: November 8, 2000	**Team Leader:** Manida Unkulvasapaul
Country Manager/Director: J. Shivakumar	**Sector Manager/Director:** Zafer Ecevit
Project ID: P069027	**Sector(s):** VP - Pollution Control / Waste Management
	Theme(s): Environment
Focal Area: O - Ozone	**Poverty Targeted Intervention:** N
Global Supplemental ID: P069028	**Team Leader:** Manida Unkulvasapaul
	Sector Manager/Director: Zafer Ecevit
Supplement Fully Blended?	**Sector(s):** VP - Pollution Control / Waste Management

Program Financing Data

[ ] Loan [ ] Credit [ ] Grant [ ] Guarantee [X] Other: Global Environmental Facility (GEF), Montreal Protocol Investment Fund (MLF)/Ozone Trust Fund (OTF) financed interest-free loans

For Loans/Credits/Others:
Amount (US$m): GEF SDR 2 million , MLF US$ 2.475 million

Financing Plan (US$m): Source	Local	Foreign	Total
BORROWER	0.00	0.00	0.00
GLOBAL ENVIRONMENT FACILITY	0.00	2.50	2.50
MONTREAL PROTOCOL INVESTMENT FUND	1.20	1.28	2.48
Total:	1.20	3.78	4.98

Borrower/Recipient: IFCT
Responsible agency: THE INDUSTRIAL FINANCE CORPORATION OF THAILAND (IFCT)
Address: 1770 New Petchaburi Road, Bangkok 10320
Contact Person: Mr. Anothai Techamontrikul, President
Tel: 253-7111; 253-9666 Fax: 253-9677 Email: oz_ifct@ifct.th.com

Other Agency(ies):
Guarantor: THE KINGDOM OF THAILAND
Estimated Disbursements (MLF):

Estimated disbursements (Bank FY/US$m):

FY	2001	2002	2003					
Annual	0.47	2.00						
Cumulative	0.47	2.47						

Project implementation period: 4 years
Expected effectiveness date: 06/21/2001 **Expected closing date:** 04/15/2005

Estimated disbursements GEF (Bank FY/US$M):

FY	2001	2002	2003					
Annual	0.50	2.00						
Cumulative	0.50	2.50						

A. Project Development Objective

1. Project development objective: (see Annex 1)

The overarching objectives of the proposed project are 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) as required under the *Montreal Protocol on Substances that Deplete the Ozone Layer (MP)*. Specifically, the project will establish preferable conditions that facilitate early replacement of low-energy efficiency chillers using chlorofluorocarbons (CFCs) as refrigerant with high-energy efficiency non-CFC chillers. This will be achieved by demonstrating actual energy savings from replacing about 24 old CFC chillers. Overall evaluation on the project will be made 3 years after project effectiveness. The Government will apply the lessons learned from this Learning and Innovation Loan (LIL) to implement a larger program, which will replace an additional 420 CFC chillers.

Of the 1,500 CFC chillers which are in use in Thailand, 1,400 were identified in 1999. By replacing about 444 CFC chillers with an average capacity of 500 tons of refrigeration (TR), the amount of CFC refrigerant recovered from the replaced units will be enough to service the remaining CFC chillers until the end of their useful lives.

2. Global objective: (see Annex 1)

The project aims to create a market for high-energy efficiency chillers in Thailand by initially replacing about 24 CFC chilllers on a pilot basis to demonstrate the economics and feasibility of the technology. Following a sucessful demonstration, a larger-scale chiller replacement program would lead to the replacement of 30% of the remaining CFC chillers. It is expected that the demonstration effect of the project and the experience gained would lead to a more widespread use of energy efficient chillers in the chiller market as a whole. In addition to the market transformation benefits, the project would lead to a significant reduction in both greenhouse gas (GHG) emissions and ODS. By replacing the CFC chillers wiith systems that are 30% more efficient, the CO_2 emissions associated with air-conditioning can be reduced by the same amount.

3. Key performance indicators: (see Annex 1)

The ***output indicators*** are:

- all non-CFC chillers (approximately 20-24) installed under the pilot project achieve energy saving of 0.27 kW/TR; and or
- energy savings generate an internal rate of return of at least 15%;
- Government of the Kingdom of Thailand agree to proceed with the follow-on project and at the time of undertaking the evaluation, there is an expressed interest of having additional 80 CFC chillers replaced under a similar or equivalent scheme.

The ***outcome indicators*** are:

- reduced energy consumption of about 14,400 megawatt hours per year (MWhr/yr)
- reduced CO_2 emission of about 53 kiloton of carbon (ktC)
- reduced emission of CFC by about 20.4 ozone depleting potential (ODP) tons per year (t/yr)

B. Strategic Context

1. Sector-related Country Assistance Strategy (CAS) goal supported by the project: (see Annex 1)
Document number: 18002-TH **Date of latest CAS discussion:** June 16, 1998

Although the project is not explicity stated in the CAS, the project objectives are consistant with the CAS goals to help the Government to protect the environment including efforts to meet its obligations under the Climate Change Convention[2] and the Montral Protocol Convention. Moreover, energy savings gained from this project will improve efficiency of the private sector in Thailand which is in line with the Bank's medium-term strategy.

Energy Efficiency: Assisting the Government of Thailand to remove infrastructure investment bottlenecks is a key strategy identified in the CAS in response to the economic crisis. In this context, addressing the energy shortage faced by the country is considered a priority for economic recovery. The ongoing GEF-financed demand side management project points out that about one-third of total energy consumption in larger buildings is attributed to air-conditioning systems. The chiller replacement program targets such systems and therefore is consistent with the CAS objective. The replacement of inefficient CFC chillers will contribute to energy savings, release peak capacity, and generate long-term financial savings in energy development. In addition, introduction of higher-efficiency non-CFC chillers is expected to realize significant savings in operating costs of factories, hotels, hospitals and commercial buildings, thus improving the competitiveness of the manufacturing and service sectors, which is the cornerstone of the Bank's medium-term strategy.

Protection of the Environment: Environmental protection is a CAS priority. The proposed LIL will contribute to the Government's ongoing efforts to meet its obligations under the Climate Change Convention[2] and the MP [3]. It is estimated that the replacement of the 444 CFC chillers, with an average capacity of 500 TR[4], will enable the country to reduce CO_2 and other GHG emissions by 982 and 432 ktC respectively. The phaseout of imported virgin CFCs will reduce CFC demand by 35 ODP t/yr and avoid CFC emission of 377 ODP tons into the atmosphere. The replacement of 24 chillers financed by this project will reduce emissions of CO_2, and CFC (see A.2 above).

[2] Thailand ratified the Climate Change Convention in 1994.
[3] As a signatory to the MP, Thailand must phase out consumption of CFCs by 2010.
[4] TR = 12,000 BTU (British Thermal Unit).

1a. Global Operational strategy/Program objective addressed by the project:

Consistency with GEF Operational Program. The proposed project is consistent with GEF Operational Program (OP) #5 which aims to remove barriers to energy efficiency and energy conservation efforts. These efforts are not realized because of the existence of initial transaction cost, perceived risks, and other barriers. The GEF financing for this project will be utilized to cover the initial capital costs and to address the perceived technical and financial risks and promote Government efforts to remove barriers for energy efficiency investment. The specific barriers in the building chiller industry to be addressed by the project are described in Section B.3.

2. Main sector issues and Government strategy:

Energy Demand and the Economic Crisis. The peak power demand for 1999 stood at 14,200,000 kilowatts (kW), and demand has remained about the same since the crisis. In 1997, the demand showed an increase of about 9% when compared to 1996. The current electricity generating capacity of the Electricity Generating Authority of Thailand (EGAT) is 14,686,898 kW, and other generating sources add another 5,500,000 kW to the grid. Energy conservation will reduce the need for additional investments in capacity expansion and fossil fuel imports. Recent increases in fuel prices should further boost energy saving activities.

Energy Conservation Act (1992). In response to the rising energy demand and the potential savings that can be realized from demand-side management activities, the Government promulgated the Energy Conservation Act. The Act established an Energy Conservation Fund (ECF). The Fund receives contributions from various sources, including a small surcharge from the oil tax. The Act and the ECF are administered by the Energy Conservation Committee (CEC) chaired by the Prime Minister. The Department of Energy Development and Promotion (DEDP) is responsible for enforcement of mandatory activities, while the National Energy Policy Office (NEPO) is responsible for funding of pilot activities, research and development, and public relation programs. The Act also requires large energy users, identified as "controlled facilities," to hire energy managers, conduct energy studies, and develop energy conservation plans. Failure to comply invites financial penalties. In 1995, the Government established the energy consumption standards for building air-conditioning systems (centrifugal chillers) for both existing and new installations. Depending on the cooling capacity, energy consumption of existing centrifugal chillers shall not exceed 0.8-0.9 kW/TR, and 0.67-0.75 kW/TR for new installations. Limited technical expertise, lack of technical information on actual savings, difficulty in accessing ECF funding, lack of capital investments, and the unwillingness of sub-borrowers to invest in energy savings constrain the satisfactory implementation of standards.

ODS Phaseout Obligations. Thailand is an Article 5 country of Motreal Protocol (MP) and is required to meet specific targets for ODS phaseout[5] and is also eligible for funding from the Montreal Protocol Investment Fund (MLF). Thailand, through the Department of Industrial Works (DIW), has successfully implemented projects to eliminate the use of CFCs in the manufacturing sectors and completely phased out CFC in the domestic refrigerator manufacturing industry in January 1997. The Government is targeting the commercial refrigerator manufacturing industry next. The remaining CFC use in Thailand is comprised of end-users and servicing sectors, including building chillers, mobile air-conditioners, and industrial refrigeration systems. Phasing out CFC demand in these sectors is difficult, as logistics are more complicated than in the manufacturing sector. The Government is in the process of preparing a national CFC phaseout strategy and an action plan to ensure full compliance with MP. As part of this strategy, the Government is committed to encouraging early retirement of CFC chillers.

CFC Chiller Replacement Program. As both CFC phaseout and energy conservation have increasingly become major concerns, many building chiller manufacturers have introduced design improvements. This resulted in installation of some new non-CFC models, which are 30-40% more energy efficient compared to pre-1993 CFC chillers. This interest on the part of sub-borrowers prompted the Government to establish a national program and to seek World Bank assistance. Preliminary investigations concluded that most CFC chillers were installed prior to 1993 and are of the centrifugal type[6], using CFC-11 or CFC-12 as refrigerant. Of the 1,400 CFC chillers identified in 1999, about 1,060 units (76%) have a capacity of 300-500 TR or more and are being used in textile industries. A preliminary cash flow analysis suggested that by using a reinvestment strategy and a revolving fund mechanism, the financing requirement to replace 444 (see footnote 1) CFC chillers over a 10-year period would be about US$90 million. Of this amount about US$30 million is required as start-up capital while the remaining US$60 million can be financed by

reinvesting repayments collected from units that are replaced early on.

Nevertheless, implementation of the chiller replacement program is still technically and financially difficult at present, as demonstrated by the ECF experience. It is believed that existing old and inefficient chillers can be widely replaced with new energy efficient chillers if three market barriers (see below) are completely removed. When fully implemented, this program will have significantly contributed to energy consumption reduction in the country and also enabled the achievement of the CFC phaseout targets.

Market Barriers. There are three key market barriers to early retirement of old CFC chillers. First is the high up-front investment cost of new chillers and limited access to commercial credit, particularly after the financial crisis in 1997. Domestic lender awareness about the potential market for energy efficiency investments is also lacking. The second barrier is unfamiliarity with the new chiller technology in Thailand. Although high efficiency non-CFC chiller technology has been accepted in developed countries, it has not been widely recognized in developing countries. There is a perceived technology risk that energy savings realized in developed countries cannot be achieved in countries with a tropical climate. The third barrier is limited technical capacity in chiller design and maintenance in the country. Many of the large builders are oversized and sub-borrowers are unwilling to invest in proper operation and maintenance of the chiller systems. Technical expertise and practical experience in design and servicing building chillers is still limited to the large chiller suppliers and manufacturers. Further training in chiller design, operation, and maintenance is needed.

[5] Phaseout targets for Article 5 countries (annual consumption of Annex A less than 0.3 kg per capita) are: i) on July 1, 1999 to freeze at levels not exceeding the annual average of 1995-97; ii) by January 1, 2005, to reduce to less than 50% of the freeze level; iii) by January 1, 2007, to reduce to less than 15% of the freeze level; and iv) finally by January 1, 2010, to stop import of all CFCs.

[6] See Annex 11.

3. Learning and Development issues to be addressed by the project:

High Up-front Cost. To overcome the first barrier mentioned above, the proposed project plans to pilot the replacement of about 24 CFC chillers that can demonstrate actual energy savings, cost recovery arrangements, and appropriate financing mechanisms. GEF and MLF agreed to provide an interest-free concessional loan of approximately US$4.975 million (SDR 2 million equivalent from GEF and SDR 2.475 million equivalent from MLF) for which the foreign exchange risk is waived. A post-evaluation of the new chillers should be carried out within three years after project effectiveness. If the proposed project is considered satisfactory, then an additional 420 CFC chillers are to be replaced and the respective loan amounts will be repaid to GEF and MLF at the end of year eight. If the evaluation concludes that the project was not a success then the respective loan amounts will be returned to GEF and MLF at the end of year five. This concessional loan intends to demonstrate that the high up-front cost of the chiller can be recovered within a 4-5 year period through savings gained from improved energy efficiency. With proper credit arrangement, the barrier caused by high up-front costs can be overcome.

Perceived Technology Deficiency. To overcome this barrier, the actual energy consumption of the 24 chillers will be measured before and after replacement. This is to demonstrate actual saving of the new chiller technology in a tropical climate. About twenty-four CFC chillers will be selected according to the project guidelines and criteria and from different types of applications, covering industrial and commercial buildings of varied sizes. The sub-borrowers will be required to measure baseline energy consumption according to the methodology and guidelines developed for the project. To promote confidence of the sub-borrowerss, chiller suppliers will be required to provide a limited performance guarantee to the

sub-borrowers. The key stakeholders (sub-borrowers, suppliers, the Industrial Finance Corporation of Thailand-IFCT, and the Bank) will be required to reach up-front agreements on the methodology for calculating the energy consumption and the actual savings of the chiller, the monthly payment, and the payment period. GEF/MLF also agreed that the repayment to the GEF/MLF could be adjusted for losses from technology deficiency of the new non-CFC high-energy efficiency chillers. The proposed project however has been carefully designed to reduce this risk and potential conflicts. Detailed implementation arrangements are described in Section C.2. Procedures for establishing energy consumption and the definition for technology shortfalls are described in Annex 11.

Limited Technical Capacity. Optimal design and size, and proper maintenance will be important criteria in the selection of the 24 CFC chillers. Currently oversized chillers and inadequate maintenance have contributed to high energy consumption. Technical staff and the sub-borrowers will be trained in technical and preventive maintenance aspects. At present the Government, assisted by UNEP, has completed guidelines for chiller installation, operation, and maintenance; project participants will be required to comply with these standards. A group of technical consultants will be hired by IFCT to strengthen its technical capacity to monitor and supervise project activities.

Development Strategy for the Follow-on Program. Demonstration of actual energy savings and reasonable pay-back periods should persuade both sub-borrowers and lenders that the high up-front investment cost can be addressed through an appropriate lending arrangement and that chiller replacement is technically and financially viable. It is estimated that the energy consumption savings for 24 chillers will be 20,995,200 kWhr/yr, and the operational cost savings will be 46,189,440 Baht/yr. To demonstrate replicability of this project, the data on energy savings, chiller performance, and experience with contractual arrangements will be widely disseminated to other sub-borrowerss and stakeholders to promote confidence in the new technology and to encourage their participation. A database of CFC building chillers will be established in the early stages of the project to provide information on potential target groups, including their locations, type of business, etc. A proactive marketing strategy focusing on these target groups will be developed and carried out during the project.

As part of the development strategy, the workshop organized by IFCT to introduce the concept of the project attracted a wide ranging audience, including all stakeholders in the public and private sectors. This workshop resulted in an endorsement by the Thai Government, led by the Ministry of Industry, that chiller replacement would be an integral part of the Government's energy conservation strategy. Based on this endorsement, DIW has discussed the follow-on program with the National Energy Policy Office (NEPO). It was agreed that the ECF will be a major funding source for the follow-on program to replace the additional 420 chillers. DIW estimates that a further US$30 million is needed. It was also agreed that the proposal seeking ECF assistance would be prepared and submitted to relevant agencies after successful conclusion of the LIL.

In the meantime, NEPO has agreed in principle to provide technical assistance grant funding of up to US$260,000 to support an independent evaluation of the LIL and market development activities to promote building chiller replacement in Thailand. NEPO is currently reviewing a technical assistance proposal from DIW. This technical assistance will enable DIW to hire an independent consulting team to: (i) undertake overall evaluation of the LIL; (ii) disseminate information; (iii) promote public awareness activities; (iv) develop marketing strategies; and (v) prepare ECF funding proposal for the follow-on program. The selected consulting team will also undertake independent verification of the performance of newly installed chillers in case there is any dispute between chiller suppliers and sub-borrowers regarding the actual performance of the new chillers.

As part of the replication strategy, IFCT has confirmed that if the LIL is successful, then chiller replacement will become a new line of business. IFCT will raise funds to support additional chiller replacement from its own lending facility and from other sources, including the ECF. EGAT is also planning to carry out a chiller replacement project through the existing loan provided by OECF.[7] EGAT is in the process of developing selection criteria and financial conditions for the project. The EGAT project will focus mainly on chiller replacement in the hotel industry. The Government's endorsement of the chiller replacement program and the current efforts of DIW and NEPO to secure additional funds to support the follow-on project will create synergies and promote healthy competition between IFCT and EGAT. This will ensure that no single institution will monopolize implementation of the follow-on project. This competition is, therefore, considered to be beneficial to the overall project and to Thai consumers.

It is not an intention of this project to demonstrate the ESCO business, but if opportunities arise, then the project will encourage technology transfer, information exchange, and dissemination of knowledge and experience on these aspects.

[7] EGAT was originally designated an implementing agency for the LIL project. The project was redesigned to have IFCT act as an implementing agency, instead of EGAT, as EGAT's status and viability are uncertain after the financial crisis and subsequent policies of the Government to privatize state enterprises. EGAT has, however, expressed its interests to participate in the chiller replacement program either as a technical consultant or under other appropriate capacity.

4. Learning and innovation expectations:

☐ Economic	☒ Technical	☐ Social	☐ Participation
☒ Financial	☐ Institutional	☒ Environmental	☐ Other

Financial. Modalities for channeling GEF and MLF funds as loans have not been widely tested, as their funds have traditionally been provided as grants. The concept of concessional loans employed by the project will provide an innovative and sustainable instrument for financing future global environmental projects. The LIL will demonstrate to both lenders and borrowers that replacement of old chillers can be financially viable and makes good business sense. A new market for high efficiency building chillers is expected to emerge once the technical and financial barriers are fully removed.

Technical. Actual energy saving from high-energy efficiency chillers has not been demonstrated in a tropical country. Moreover, the project will demonstrate that significant energy savings can be achieved by chiller units that are accurately sized for optimal performance and when properly installed and maintained. The common practice in Thailand is to select building chillers that have a cooling capacity greater than what is required, leading to gross energy wastage. The project will promote proper sizing, installation, and operation and maintenance of chillers by requiring the sub-borrowers to secure operation and maintenance contracts and performance guarantees from their chiller suppliers. Through these contracts, sub-borrowerss should ensure that adequate training is provided to their technical staff. This is expected to develop a cadre of specialized chiller design and maintenance technicians in Thailand, as the chiller suppliers will ensure that these submit chiller maintenance schedules and financial plans as part of the sub-loan applications. Detailed implementation procedures, which have already been reviewed and accepted by sub-borrowers and chiller suppliers, are described in the Operation Manual (OM) for this project.

Environmental. The proposed project will be the first of its kind to create a synergy between the two global environmental treaties, the MP and the Climate Change Convention, and to combine financing from both the MLF and GEF. Project-specific environmental impacts are minimal and will be limited to disposal of old CFC chillers and refrigerants. OM explains the disposal strategy.

C. Project Description Summary

1. Project components (see Annex 2 for a detailed description and Annex 3 for a detailed cost breakdown):

Component	Sector	Indicative Costs (US$M)	% of Total	Bank fin. (US$M)	% of Bank fin.	GEF fin. (US$M)	% of GEF fin.	MLF (a) (US$M)	% of MLF fin.
Global Components									
1. Replacement of approximately 24 chillers	Pollution Control / Waste Management	4.97	95.0	0.00	0.0	2.50		2.47	
2.Evaluation of LIL project and development of the follow-on program (financed by the ECF)	Pollution Control / Waste Management	0.26	5.0	0.00	0.0	0.00		-	
Total Project Costs		5.235	100	0.00	0.0	2.50		2.47	
Total Financing Required		4.975		0.00	0.0	2.50		2.47	

(a) The MLF funding of US$2.475 million for this project was approved by the Executive Committee (ExCom) for MLF in November 1998;
(b) The GEF Council approved this project in October 1998 with a financial provision of US$2.5 million. After endorsement of GEF CEO on the detailed implementation plan, the funds will be released to the Bank;

2. Institutional and implementation arrangements:

Organizational Arrangements. IFCT will be both the borrower and implementing agency for the proposed project, with the Kingdom of Thailand as the guarantor of the loan. DIW, the focal point for the MP and MLF-funded activities, and the Office of the Environmental Policy and Planning (OEPP), the focal point for GEF-funded activities, will be the Government agencies responsible for overseeing the implementation of the project. A steering committee comprising key stakeholders (IFCT, MOI, MOSTE, NEPO, EGAT, the private sector) will be established to ensure effective coordination and cooperation among relevant activities.

Responsibilities of IFCT and DIW. IFCT, through the Project Management Unit, will be responsible for: (i) subproject identification, technical and financial appraisal of subprojects and sub-borrowers; (ii) signing of sub-loan agreements; (iii) disbursement to and repayment collection from sub-borrowers; (iv) supervision of subproject implementation, collection of data on energy efficiency of new chillers, and periodic reporting to the DIW, OEPP and the Bank; (v) repayment of the loan to the Bank; (vi) preparation of the project completion report; and (vii) assistance in raising additional funds if the Government decides to proceed with the follow-on chiller replacement program. DIW will be responsible for: (i) preparation of project proposal for conducting a comprehensive evaluation of the LIL and development of marketing strategies for the follow-on project; (ii) seeking funding from ECF to support independent evaluation of the LIL and preparation of the project proposal for the follow-on project; and (iii) supervision of the implementation of the LIL and the independent evaluation.

Project Financing and Repayment to the Bank. This project is not a conventional IBRD lending instrument or grant technical assistance from the GEF and MLF. As an implementing agency and a trustee

for the funds from GEF and MLF, the Bank will provide a loan to IFCT under the same terms and conditions as approved by GEF/MLF. IFCT will repay the Bank in Baht, adjusted for losses due to technology shortfall and/or foreign exchange risk, if any.

On-lending Terms. IFCT will on-lend in local currency (Baht) to the sub-borrowers selected to participate in the project. All sub-loans provided by the LIL shall be used for covering costs of new chillers, civil work, and maintenance services. For each subproject, the amount for monthly repayment will be determined up-front at 90-100% of expected energy savings over a pre-agreed repayment period. The repayments will start soon after the commissioning of the new chiller. If the savings is lower than expected because of technical shortfalls beyond the control of sub-borrowers, chiller suppliers and/or their service contractors, the repayment amount may be adjusted for shortfalls, according to the pre-agreed procedures and conditions (Annex 11 and the OM). As approved by GEF/MLF, the shortfalls can be discounted from the amount to be repaid by IFCT to the Bank. Chiller suppliers will be required to provide limited performance guarantees while the sub-borrowers will be required to maintain operational conditions (cooling load, water temperature) at the time of measurement, as stated in the sub-loan agreements and/or agreements between chiller suppliers and sub-borrowers. The sub-loan agreements between IFCT and the sub-borrowers will reflect all these conditions. Based on a preliminary cash flow analysis of the project, as detailed in Annex 4, the repayments for all subprojects can be made within four years after commissioning of chillers.

Follow-on Program Development Activities. IFCT will provide assistance to the DIW and its consultants to develop the follow-on program and transfer experiences gained from the implementation of this project.

3. Monitoring and evaluation arrangements:

Management and Monitoring. IFCT will be responsible for the overall project management, supervision, and monitoring. IFCT and its PMU will be responsible for: (i) preparing semi-annual progress reports for the Bank; (ii) submitting an annual project audit report prepared by an independent auditor mutually acceptable to the Bank and IFCT; (iii) monitoring implementation of all individual subprojects to ensure full compliance with environmental and safety standards, and equipment disposal agreements; (iv) preparing a completion report for the project (For a LIL, a completion report must be prepared approximately 6 months before the closing date); and (v) notifying the Bank of any significant delays and problems with project implementation. (See Annex 2 for details.)

Overall Project Evaluation. Within three years after the project starts, DIW, in close cooperation with IFCT, Government agencies (OEPP, MOF), and the Bank, will carry out an overall evaluation of the project. DIW will hire an independent consultant to verify findings of this evaluation and assist the Government and IFCT in planning and securing additional funds for the follow-on project. Success of the LIL project will be evaluated against the following indicators:

- All non-CFC chillers installed under the pilot project achieve energy savings of 0.27 KW/Ton; and or
- Energy savings generate an internal rate of return at least 15%;
- Government agree to proceed with the follow-on project and at the time of undertaking the evaluation, there is an expressed interest of having additional 80 CFC chillers replaced under a similar or equivalent scheme.

Bank Supervision. The Bank's supervision will include field visits to current and prospective sub-borrowers, discussion with the Ministry of Finance, DIW, OEPP, NEPO and EGAT on project

implementation; review of progress/audit, and subproject appraisal reports. The Bank will also review with DIW and OEPP the overall progress in implementing national CFC phaseout and carbon emission reduction strategies. Supervision mission visits will monitor subproject implementation, compliance with environmental and safety standards and training, and evaluation of project performance according to the GEF and MP project monitoring criteria.

D. Project Rationale

[This section is not to be completed in a LIL PAD. Rationale should be implicit in paragraph B: 3.]

E. Summary Project Analysis (Detailed assessments are in the project file, see Annex 8)

1. Economic (see Annex 4):
[For LIL, to the extent applicable]
○ Cost benefit NPV=US$ million; ERR = % (see Annex 4)
○ Cost effectiveness
○ Incremental Cost
● Other (specify)

Incremental Cost Analysis. Based on the technical assumptions (see above), the benefits and incremental cost analysis of the project was carried out in line with the GEF and MLF guidelines, and the details are provided in Annex 3. The estimated benefits to the global environment were previously presented and the incremental costs are briefly summarized in this section. The incremental cost for replacement of 24 chillers would be about US$5 million which is the difference between the capital and incremental operating costs (" baseline") and the amount needed to overcome the barriers to establish a feasible financing arrangement (" GEF alternatives"). This is the basis for requesting GEF/MLF funds. Moreover, the project is expected to result in positive economic benefits for consumers, since at least 10% of the financial savings achieved through energy conservation will be passed on to them as lower prices and will contribute to increased competitiveness of participating industries and businesses. The project will also help the Government and EGAT to defer additional investment in new power plants. As the average cost of investment in new power plants is about US$1.25 per watt, replacing 444 chillers will defer more than US$250 million in investment in new power plants.

2. Financial (see Annex 4 and Annex 5):
NPV=US$ million; FRR = % (see Annex 4)
[For LIL, to the extent applicable]

A preliminary cash flow analysis of the project is presented in Annex 4. The analysis indicates that the proposed project is financially viable, and monthly sub-loan repayments set at 95% of energy savings realized will enable IFCT to recover sub-loan principal plus the management fees, and repay the Bank within 5 years after loan effectiveness.

3. Technical:
[For LIL, enter data if applicable or 'Not Applicable']

Depending on the cooling capacity, typical centrifugal CFC chillers (400-500 TR) that are commonly used

in Thailand consume energy within the range of 0.8-1.0 kW/TR (average 0.9 kW/TR) while most high efficiency non-CFC chillers that are commercially available consume less than 0.63 kW/TR. Assuming an average operating time of 12 hours per day, a typical CFC chiller will consume almost 2,000 MWhr/yr while the high efficiency non-CFC chiller with the same cooling capacity will consume about 1,400 MWhr/yr, and therefore result in about 30-40% savings. Only high efficiency non-CFC chillers with rated energy consumption of not more than 0.63 kW/TR will be installed under this program. The project will explore all technology alternatives available and support only those replacement options that promise the least global warming potential, and that are technically feasible, environmentally sound and economically viable. For certain circumstances where similar savings or more can be realized from replacing CFC chillers with absorption-cycle chillers, due consideretaion should be given to this technology.

Based on consultations with chiller specialists and key stakeholders, the methodology for measuring the baseline energy consumption levels of old and new chillers was agreed upon, as described in Annex 11.

4. Institutional:

IFCT is the both the borrower and implementing agency for the proposed project. The Kingdom of Thailand will be the guarantor of the loan. A steering committee comprised of key stakeholders (IFCT, MOI, MOSTE, NEPO, EGAT, the private sector) will be established to ensure effective coordination and cooperation among relevant activities.

4.1 Executing agencies:

IFCT is a financial intermidiary with the Ministry of Finance as one of its shareholders. IFCT has been working on the on-going MLF-funded ODS I Project for the past five years, and it has acquired extensive experience with procurement, disbursement and other requirements of the Bank, as well as policies and guidelines of the MLF. With the assignment of a special unit (PMU) and the technical support included in this project, IFCT will be able to strengthen its technical capacity to evaluate and appraise proposals for chiller replacements. An assessment of IFCT's financial management capacity has been completed during appraisal.

DIW is the focal point for the MP and MLF-funded activities. OEPP is the focal point for GEF-funded activities. Both DIW and OEPP will provide advisory support to IFCT to ensure that the project is implemented in line with the national strategies for ODS phaseout and GHG reduction, as well as policies and guidelines of the GEF and MLF.

4.2 Project management:

IFCT has established a Project Management Unit (PMU) within the Environment and Energy Development Center, which will oversee implementation of the project. This unit will comprise at least three fulltime staff (one senior manager, one engineer, and one financial specialist) and will involve other IFCT staff and a group of technical consultants as appropriate to ensure adequate technical and financial management capacity of this unit. The technical consultant should be familiar with the project and have adequate experience in chiller technology and energy audits. The PMU's scope of work is provided in Annex 2. IFCT will charge an administrative fee of not more than 4.5% per annum on the outstanding sub-loans to cover the costs of the PMU.

Subproject Selection and Technical Protocol. The selection process and technical criteria for 24 subprojects were developed in consultation with IFCT, DIW, MOF, NEPO, EGAT, Air Conditioning Association of Thailand, sub-borrowers, and chiller suppliers. Agreements on the selection process and criteria have already been secured from sub-borrowers and chiller suppliers. Terms and conditions for performance verification and guarantee, dispute settlement, including definitions of technical shortfalls, have already been agreed by sub-borrowers, chiller suppliers and IFCT. Agreements on other key elements, including pro-forma of key documents (subproject proposals, appraisal report, and sub-loan agreement) was confirmed during negotiations. IFCT has appointed a consultant team to assist in the identification, short-listing, and verification of the energy consumption of existing CFC chillers. A short list of qualified suppliers and a list of potential candidates (40-50 sub-borrowers) are already available. Workshops and/or a series of meetings have been carried out to ensure clear understanding of the project conditions, especially roles and responsibility of key stakeholders (DIW, sub-borrowers, suppliers, IFCT). IFCT will carry out a preliminary assessment of the sub-borrowers and invite those with satisfactory financial health to submit their proposals. About 24-30 CFC chillers will, then, be selected for the final appraisal, and detailed financial assessment will be made at that stage. More details on the selection process, eligibility criteria, performance verification and guarantee, dispute settlement, and definitions of technical shortfalls, are provided in Annex 11 and the OM.

Subproject Appraisal and Replacement of Chillers. IFCT, assisted by its consultant, will ensure timely appraisal of subprojects and sign sub-loan agreements with sub-borrowers so that commissioning of all chillers is completed within 12 months after the effectiveness of the project. It is planned to have about 24 chillers replaced in four consecutive groups of six units each with elapsed time from signing of sub-loans to commissioning of 9 months or sooner. Prior to signing of the sub-loans, sub-borrowers will submit their final implementation plans, including disbursement schedules, refrigerant management plans, and disposal of the CFC chillers. IFCT and its technical consultants will ensure timely commissioning of the chillers, verify test runs, and provide training to the chiller owners. sub-borrowers will be required to monitor performance of the new chillers. Details are presented in Annex 2. At least 3-4 sub-loan agreements should be ready for signing before the effectiveness of the project.

4.3 Procurement issues:

Procurement of goods and works will follow the World Bank Guidelines "Procurement under IBRD Loans and IDA Credits, January 1995, revised January and August 1996, September 1997, and January 1999". As the loan is to a financial intermediary (IFCT), the procurement of new chillers, including installation and performance guarantees (if applicable), will be undertaken by the sub-borrowers according to the commercial practices (clause 3.12 of Procurement Guidelines). The commercial practice for this kind of operation is satisfactory to the Bank. Procurement details are given in Annex 6. Each sub-borrower will select a chiller supplier who can develop a sub-project with the owner which optimizes the owner's benefits and who can submit a proposal in line with project requirements. A standard sub-loan agreement between IFCT and sub-borrowers was agreed during project appraisal.

4.4 Financial management issues:

IFCT's accounting system was reviewed and found to be satisfactory to the Bank (see Annex 6: Financial Management). Transactions of the project will go through the normal process of IFCT's operating and accounting system. The Project Management Unit (PMU) of IFCT will be responsible for maintaining the project accounts in accordance with sound accounting practices and for preparing the project financial reports as required by the Bank. The project accountant will be responsible for developing the project

financial management system and project financial management manual as well maintaining accounts for the project. The system will consist of accounting, reporting, and disbursement procedures, and be consistent with the Bank OP10.02. These actions will be completed before Board approval. The traditional disbursement method will be used. IFCT's external auditor would be required to provide separate audit opinion on the Special Account (SA), Statement of Expenditures (SOE), and Source and Use of Funds statement, in addition to an opinion on the IFCT's financial statements. The audit reports and IFCT's annual report will be furnished to the Bank not later than six months after the end of each fiscal year. For all the expenditures with respect to the project sub-loan, IFCT shall maintain the credit files with all necessary supporting documents for project identification, appraisal, supervision, and disbursements to chiller owners.

Financial Management is detailed in Annex 4.

Disbursement Arrangement. The loan proceeds will be used by: sub-borrowers to pay for replacement of CFC chillers. IFCT will open and maintain a Special Account (SA) in US dollars and the loan proceeds will be disbursed to this account in line with Bank guidelines. The investment for new chillers will be withdrawn from this account.

IFCT will open a project account in Thai Baht and the repayments from the sub-borrowers will be kept in this account. IFCT's administrative fees and the reduction in repayments (if applicable) for technology failure will be accounted for in this account. The interest income earned from the outstanding balance can be used to further strengthen technical and financial management capacities including the audit fee for the accounts of the project. If IFCT and the Government decide to implement the follow-on chiller replacement program and an additional US$30 million has been secured, the project account and outstanding sub-loans may become a revolving fund for the chiller replacement, namely the Chiller Replacement Fund (CRF). To minimize the foreign exchange risk, IFCT must manage the currency risk with due diligence.

If the proceeds of the loan and any part thereof are used for ineligible purposes as defined in the Loan Agreement, the Bank will require IFCT to either (i) return the amount to the SA to be used for eligible purposes; or (ii) refund the amount directly to the Bank, in which case the Bank will cancel an equivalent un-disbursed amount of the loan.

5. Environmental: Environmental Category: B (Partial Assessment)

5.1 Summarize the steps undertaken for environmental assessment and EMP preparation (including consultation and disclosure) and the significant issues and their treatment emerging from this analysis.

This project will directly contribute to global environmental benefits. However, it is assigned a Category B, because appropriate procedures are required to ensure worker and building occupant safety during installation and major building renovations/retrofitting and disposal of old CFC chillers and refrigerant. With regards to operational health and safety of personnel, the Operation Manual states that the installation of new CFC chillers should comply with ASHRAE 15-1994 (Safety Code for Mechanical Refrigeration), in the event that they are not applicable to local conditions, than alternatives will be found. There are also health and safety issues caused by handling non-ODS chemicals. In line with the MLF guidelines, the sub-borrowers will be required to properly manage the recovered CFC refrigerant and to dismantle the old CFC chillers after their replacement, according to plans and procedures approved by DIW and the Bank. Workers need to be given appropriate training in safe handling in accordance with the Code of Good Practice agreed by the Thai chiller industry, DIW and UNEP's Regional Office for Asia and the Pacific, or ASHRAE Guideline 3-1996. DIW will inspect and certify compliance with the equipment disposal

guidelines. The sub-borrowers will also be required to provide access to their properties for such inspections, and share information on chiller performance and experience with refrigerant management with IFCT, relevant government agencies, the Bank, and the public. Close consultation among these key stakeholders will be maintained throughout the project period.

Adoption of chillers using HFC 134a (small Global Warming Potential-GWP) as the refrigerant is considered necessary at the present stage due to the lack of a better alternative. However, the project will explore all technology alternatives available and support only those replacement options that promise the least impact on global warming and that are technically feasible, environmentally sound, and economically viable. The final selection of the refrigerant type for each CFC chiller to be replaced will be assessed on a case by case basis and ensure that the new replacement chillers will use alternative refrigerant with low GWP

5.2 What are the main features of the EMP and are they adequate?

EMP will include:

- submission and endorsement of refrigeration management plan by DIW
- compliance with ASHRAE 15-1994, and the Code of Good Practice mentioned earlier or ASHRAE Guideline 3-1996.

5.3 For Category A and B projects, timeline and status of EA:
Date of receipt of final draft: Not Applicable

5.4 How have stakeholders been consulted at the stage of (a) environmental screening and (b) draft EA report on the environmental impacts and proposed environment management plan? Describe mechanisms of consultation that were used and which groups were consulted?

The above requirements have been been explained and disclosed in a series of meetings with chiller suppliers and owners, and other stakeholders. This process will be continued during project implementation.

5.5 What mechanisms have been established to monitor and evaluate the impact of the project on the environment? Do the indicators reflect the objectives and results of the EMP?

Each sub-borrower will be required to prepare a Chiller Dismantling and ODS Disposal Plan as per Annex 13 for review by IFCT and the Bank.

6. Social:

6.1 Summarize key social issues relevant to the project objectives, and specify the project's social development outcomes.

The proposed project will not involve any resettlement or land acquisition, and is not expected to cause any adverse social impacts. There will be no loss of employment due to the replacement of the old chillers. Existing owners will be trained to operate the new chillers. The project is expected to contribute to development of local technical capacity and human resources for the chiller sub-sector.

6.2 Participatory Approach: How are key stakeholders participating in the project?

The primary beneficiaries of the project are the owners of building chillers, such as factories, commercial buildings, hospitals, and hotels, as well as chiller suppliers. The Federation of Thai Industry (FTI), Thai Hotels Association (THA) and other relevant business associations are being consulted through stakeholder workshops to introduce the proposed chiller replacement program. Chiller suppliers have already been consulted as part of project preparation, and their continued participation and technical collaboration will be sought during implementation of the project. IFTC, OEPP and DIW will also disseminate the findings of the pilot project to, and seek guidance from NEPO and EGAT.

6.3 How does the project involve consultations or collaboration with NGOs or other civil society organizations?

Not Applicable

6.4 What institutional arrangements have been provided to ensure the project achieves its social development outcomes?

Not Applicable

6.5 How will the project monitor performance in terms of social development outcomes?

Not Applicable

7. Safeguard Policies:

7.1 Do any of the following safeguard policies apply to the project?

Policy	Applicability
Environmental Assessment (OP 4.01, BP 4.01, GP 4.01)	● Yes ○ No
Natural habitats (OP 4.04, BP 4.04, GP 4.04)	○ Yes ● No
Forestry (OP 4.36, GP 4.36)	○ Yes ● No
Pest Management (OP 4.09)	○ Yes ● No
Cultural Property (OPN 11.03)	○ Yes ● No
Indigenous Peoples (OD 4.20)	○ Yes ● No
Involuntary Resettlement (OD 4.30)	○ Yes ● No
Safety of Dams (OP 4.37, BP 4.37)	○ Yes ● No
Projects in International Waters (OP 7.50, BP 7.50, GP 7.50)	○ Yes ● No
Projects in Disputed Areas (OP 7.60, BP 7.60, GP 7.60)	○ Yes ● No

7.2 Describe provisions made by the project to ensure compliance with applicable safeguard policies.

Each sub-borrower will be required to prepare a Chiller Dismantling and ODS Disposal Plan (refer to Annex 13 for details) for review by IFCT and the Bank. The disposal plan is a condition of the approval of the subproject and subloan (refer to Annex 2). With regards to operational health of personnel, the installation of new CFC chillers will comply with ASHRAE 15-1994, and, in the event that these Guidelines are not applicable to local conditions, than alternatives will be found.

F. Sustainability and Risks

1. Sustainability:

This section is not to be completed in LIL PAD.

2. **Critical Risks** (reflecting the failure of critical assumptions found in the fourth column of Annex 1):

Risk	Risk Rating	Risk Mitigation Measure
From Outputs to Objective		
a) High efficiency non-CFC chillers not installed and maintained according to industry standard.	N	DIW assisted by UNEP prepared standards/guidelines for installation and maintenance of building chillers; sub-borrowers and their chiller suppliers will be required to comply with the standards and provide training to chiller owners; Suppliers will be encouraged to provide performance guarantee and maintenance contract; if technical deficiency is proven to be the case, MLF/GEF has agreed to discount.
b) Sub-borrowers are not satisfied with the new technology and do not accept the financing scheme proposed under this LIL project	M	Market mechanism and pre-agreement encouraged between sub-borrowers and suppliers; experience and achievements disseminated to sub-borrowers, professional association, industry associations and academic institutions; Marketing promotion activities and assessment of risk carried out during the LIL project.
c) Discontinued interest and lack of support from concerned agencies and industry for reduction of CFC and CO2 emissions in the building chiller industry.	M	Government is obliged to comply with the MLF and GEF funding conditions, but interests from the sub-borrowers would depend on level of incentives; Efforts made to disseminate information and facilitate consultation, collaboration, etc. in LIL project.
d) Significant change in foreign exchange rate or other financial stresses	M	Difficult to mitigate but any resulting losses would be borne by the MLF and GEF; IFCT be encouraged to reduce its risk exposure by converting collected repayments from BOs in Thai Baht to US currency as often as practically feasible.
From Components to Outputs		

a) Due to inappropriate design, installation, and/or O/M, performance of the high-energy efficiency non-CFC chillers in different local conditions may not achieve the minimum target of 0.63 kW/TR	N	Only new chillers that meet the following criteria will be selected in this LIL a) meet international standards, and b) there is agreement to provide performance guarantee, maintenance contract and training to sub-borrower staff; Detailed actual saving will be measured by qualified consultant for at least 4 chillers; The Bank will also seek independent review/technical assessment from international experts.
b) Inability to pay or untimely repayments by sub-borrowers and non-acceptance of baseline energy consumption	M	IFCT will carry out detailed financial appraisal of the candidate sub-borrowers and will require sub-borrowers to provide appropriate instruments as a guarantee for loan repayments; This will be included as part of the conditions of sub-loan agreements; Methodology for measuring baseline energy consumption will be reflected in sub-loan agreements; Qualified consultants will be hired to provide technical assistance to IFCT and maintain close consultation with chiller owners.
c) Inadequate technical capacity of implementing agency (IFCT) to supervise and monitor the project	M	IFCT will establish a special unit to implement this project; In addition to technical aspect (above), consultant will assist IFCT on overall management of project; The Bank will closely supervise project implementation
d) Significant change in foreign exchange rate or other financial stresses	N	MLF/GEF agreed to bear currency risk of the LIL. This risk would be considered during assessment of the overall project.
Overall Risk Rating	M	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N(Negligible or Low Risk)

3. Possible Controversial Aspects:

None

G. Main LoanConditions

1. Effectiveness Condition

- IFCT has appraised and approved 4 sub-projects and the related sub-loans.

2. Other [classify according to covenant types used in the Legal Agreements.]

Negotiations,

- Endorsement of the project by the Ministry of Finance (completed)
- IFCT will present a list of 24 participating chiller owners (completed)

Board Presentation,

- IFCT should present a revised version of the Operations Manual

Implementation

- All subprojects should be commissioned within approximately by June 30, 2002
- An overall evaluation of the project must be carried out by Dec. 31, 2004.

Repayment to the Bank

- If the project is successful and a decision is made to proceed with a follow-on chiller replacement program, the Government and/or IFCT will raise additional funds of about US$30 million. The repayments collected from chiller owners participating in the LIL project can be used to refinance the follow-on program, but the full payment of the LIL to the Bank shall be made by October 31, 2006, unless the Bank elects to extend the maturity of the Loans to October 31, 2009 upon the project meeting agreed indicators.
- IFCT and the Bank representatives agreed that the following performance indicators will be used as a basis for Bank' s decision whether or not to extend the maturity of the loans:

  (a) All non-CFC chillers (approximately 20-24) installed under the pilot project achieve energy saving of 0.27 kW/TR and/or the energy savings generate a financial internal rate of return of at least 15%;
  (b) By March 30, 2005, DIW has completed its overall evaluation of the pilot project and prepared a list of 80 additional CFC chillers to be replaced under a similar or comparable scheme;
  (c) By March 30, 2005, Thailand, through the Ministry of Finance, provides a written confirmation of its decision to proceed with a follow-on CFC chiller replacement project, such confirmation to include detailed information on the proposed schedule of the project and its implementation program.
- If, based on the evaluation, the project is considered unsuccessful, repayment of the LIL will be made by IFCT to the Bank not later than the end of year five after the effective date of the LIL project;
- The repayment can be discounted for technology deficiency and foreign exchange risk according to the criteria and guidelines developed for the project (Annex 11 and the OM);
- The LIL should be repaid in full by IFCT to the Bank in Baht, and in one single payment.

H. Readiness for Implementation

☐ 1. a) The engineering design documents for the first year's activities are complete and ready for the start of project implementation.
☒ 1. b) Not applicable.

☒ 2. The procurement documents for the first six months' activities are complete and ready for the start of project implementation; and a framework has been established for agreement on standard bidding documents that will be used for ongoing procurement throughout the life of LIL
☒ 3. The LIL's Implementation Plan has been appraised and found to be realistic and of satisfactory quality.
☐ 4. The following items are lacking and are discussed under loan conditions (Section G):

IFCT will approve 4 sub-projects before effectiveness. In turn, the proponents would employ commercial shopping practice to select chiller suppliers

I. Compliance with Bank Policies

☒ 1. This project complies with all applicable Bank policies.
☐ 2. The following exceptions to Bank policies are recommended for approval. The project complies with all other applicable Bank policies.

Manida Unkulvasapaul	Zafer Ecevit	J. Shivakumar
Team Leader	**Sector Manager**	**Country Manager**

Annex 1: Project Design Summary

THAILAND: Building Chiller Replacement Project

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Sector-related CAS Goal: 1) Removing infrastructure investment bottleneck by promoting energy efficient building chillers 2) Protecting environmental quality by reducing emission of carbon dioxide (CO_2) and greenhouse gases (GHG) and recovering CFC refrigerant from building chillers	**Sector Indicators:** 1.1) Lower operating costs of chillers 1.2) Number of building chillers being replaced beyond this program 2.1) Reduced annual emission of CO_2 and GHG 2.2) Reduced annual demand for CFC in the chiller sector	**Sector/ country reports:** a) Various reports from sub-borrowers, supplier on performance of the chillers, electric bills (if applicable) b) Various reports from sub-borrowers, supplier, concerned agencies (DIW)	**(from Goal to Bank Mission)** a) Ineffective execution of Government strategy to conserve energy in Thailand b) Ineffective execution of program to reduce generation of GHG in Thailand and other countries c) Ineffective execution of ODS phaseout programs in Thailand and other countries.
Follow-on Development Objective: 1) Replacing 444 units of low efficiency CFC chillers with high efficiency non-CFC chillers and ensuring their operation. **(See development strategy in Section A1.2)**	1.1) 444 chillers installed and in operation 1.2) Reduced energy consumption by 591MWhr/yr/chiller or 262,000 MWhr/yr 1.3) Avoided emissions of CO_2 by 982 ktC and reduced 432 ktC of GHG 1.4) Avoided emission of CFC by 377.4 ODP tons and reduced CFC demand for servicing of the remaining chillers by 111 ODP tons or a demand of 22.2 ODP ton/yr	a) Various project reports and records b) Main assumptions used to estimate impacts (Annex 3) were: average energy consumption 0.9 kW/TR for old chillers and 0.63 kW/TR for new chillers; average operation 12 hr/day; cooling capacity 500 TR; remaining lifetime 17 yr; carbon intensity of Thai power sector 0.22 kgC/kWhr; 30% more efficient chillers; 10% average leakage rate of CFC/yr or at 50 kg CFC/chiller/yr	a) Poor installation and maintenance (not carried out according to industry standards) b) Barriers to widespread replacement of low-energy efficiency chillers with high-energy efficiency chillers are not fully removed c) Inappropriate management of recovered CFC refrigerant

Project Development Objectives: 1) Establishing preferable conditions that facilitate early replacement of low-energy efficiency CFC chillers with high-energy efficiency non-CFC chillers by demonstrating actual energy saving of 24 CFC chillers and their financing mechanisms.	Outcome / Impact Indicators: 1.1) Reduced energy consumption by 14,400 MWhr/yr and therefore reduced CO_2 emission about 130 tC/chiller/yr or 53 ktC and reduced 23 ktC of GHG. 1.2) Eliminated emission of 50 kg CFC/chiller/yr or 20.4 ODP ton from dismantled 24 CFC chillers 1.3) Increased number of sub-borrowers registered for the follow-on project	Sources: a) Various project reports and records b) Main assumptions used to estimate impacts (Annex 3) were: average energy consumption 0.9 kW/TR for old chillers and 0.63 kW/TR for new chillers; average operation 12 hr/day; cooling capacity 500 TR; remaining lifetime 17 yr; carbon intensity of Thai power sector 0.22 kgC/kWhr; 30% more efficient chillers; 10% average leakage rate of CFC/yr or at 50 kg CFC/chiller/yr	(from DO to Sector-related CAS goal) a) Savings of operating costs of new chillers not enough to pay off the investment costs b) Discontinued support and interest from concerned agencies and industry for reduction of CFC and CO_2 emissions in the building chiller sector c) IFCT and Government decide not to continue with chiller replacement program as anticipated d) Significant change in foreign exchange rate or other financial stresses
GEF Operational Program: To contribute to energy efficiency and conservation (OP5)	Reduced energy consumption by 14,400 MWhr/yr and therefore reduced CO_2 emission about 130 tC/chiller/yr or 53 ktC and reduced 23 ktC of GHG.	(i) Project Progress Reports (ii) Actual measurement records of chiller owners/operators	Average energy consumption 0.9 kW/TR for old chillers and 0.63 kW/TR for new chillers; average operation 12 hr/day; cooling capacity 500 TR; remaining lifetime 17 yr; carbon intensity of Thai power sector 0.22 kgC/kWhr; 30% more efficient chillers; 10% average leakage rate of CFC/yr or at 50 kg CFC/chiller/yr
Global Objective: as above	**Outcome / Impact Indicators:**	**Project reports:**	**(from Objective to Goal)**

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Output from each Component:	**Output Indicators:**	**Project reports:**	**(from Outputs to Objective)**
1) Completed replacement of 24 low efficiency CFC chillers and demonstrated actual energy saving of high efficiency non-CFC chillers under Thailand conditions	1.1) 24 units installed and operated; actual energy saving of each unit will not less than 0.27 kW/TR 1.2) Increased number of chiller owners registered for follow-on program	Various project reports and records (progress reports; annual reports, supervision reports, technical reports, disbursement and financial audit records, etc.)	a) High efficiency non-CFC chillers not installed and maintained according to industry standard b) Sub-borrowers not satisfied with new technology and refusing financing scheme proposed under LIL project
2) Demonstrated financial viability of a CFC chiller replacement program, including development of a funding mechanism (revolving fund)	2.1) timely repayment complete within 5 years of commissioning of chillers.		c) Discontinued support and interest from concerned agencies and industry for reduction of CFC and CO_2 emissions in sub-borrower sector.
3) Demonstrated an effective management scheme for a CFC chiller replacement program, including a system to recover and manage use of CFC in the chiller sector	3.1) Activities carried out as scheduled and comply with loan agreements 3.2) Overall evaluation completed not later than 3 years project effectiveness.		d) Significant change in foreign exchange rate or other financial stresses

Hierarchy of Objectives	Key Performance Indicators	Monitoring & Evaluation	Critical Assumptions
Project Components / Sub-components:	**Inputs: (budget for each component)**	**Project reports:**	**(from Components to Outputs)**
1). Replacement of approximately 24 chillers	1) US$4.975 million	Annex 8: Document in file, including proposals to MLF; proposal to GEF; STAP comments; project PAD/LIL; project PIP/LIL; Legal agreements with IFCT and Government; inventory of chillers	a) Due to inappropriate design, installation, and/or O/M, performance of the high energy efficiency non-CFC chillers in different locations may be lower than 0.63 kW/TR
2) .Evaluation of LIL project and development of the follow-on program (financed by the ECF)	2) Additional fund (US$0.26M) from NEPO to DIW.		b) Inability or untimely payments by the chiller owners and non-acceptance of baseline energy consumption c) Inadequate technical capacity of implementing agency (IFCT) to supervise and monitor project d) Significant change in foreign exchange rate or other financial stresses

A1.3 Key performance monitoring indicators for LIL

a)The ***output indicators*** are:

- all non-CFC chillers (approximately 20-24) installed under the pilot project achieve energy saving of 0.27 kW/TR; and or
- energy savings generate an internal rate of return of at least 15%;
- Government of the Kingdom of Thailand agree to proceed with the follow-on project and at the time of undertaking the evaluation, there is an expressed interest of having additional 80 CFC chillers replaced under a similar or equivalent scheme.

b) The ***outcome indicators*** are:

- reduced energy consumption of about 14,400 megawatt hours per year (MWhr/yr)
- reduced CO_2 emission of about 53 kiloton of carbon (ktC)
- reduced emission of CFC by about 20.4 ozone depleting potential (ODP) tons per year (t/yr)

c) The ***Project Implementation indicators*** are:

Monitoring indicators	CY 2000	2001	2002	2003	2004	2005	2006
# of sub-borrowers registered	24						
# of chiller replaced, units	0	15	9				
Amount of repayment, $	0	0	0.76	1	1	1	1.2
Amount of energy saving, MWhr	0	0	16	21	21	21	21
Amount CFC recovered, tons	0	5	7				

d) The ***Overall Evaluation indicators*** are:

- All non-CFC chillers installed under the pilot project achieve energy savings of 0.27 KW/Ton; and or
- Energy savings generate an internal rate of return of at least 15%;
- Government agree to proceed with the follow-on project and at the time of undertaking the evaluation, there is an expressed interest of having additional 80 CFC chillers replaced under a similar or equivalent scheme.

Annex 2: Detailed Project Description
THAILAND: Building Chiller Replacement Project

By Component:

Project Component 1 - US$4.97 million
Replacement of Approximately 24 Chillers

The component aims to demonstrate actual energy savings realized by high efficiency non-CFC chillers under the climatic conditions of Thailand, by replacing approximately 24 CFC chillers and monitoring their performance. Main activities are (i) final appraisal[1] of 24 subprojects and signing of sub-loan agreements with chiller owners and (ii) physical replacement of the 24 chillers. Further details are presented in the following subsections.

IFCT is in the process of identifying the subprojects in close consultation with the Government and the Bank and details of the process are presented in the Operation Manual (OM) of the project (Annex 15). By end of June 2000, IFCT will prepare a list of at least 24-30 eligible subprojects and a scope of work of a Project Management Unit (PMU) which will be established by IFCT to assist in the institutional support component (Component 2). Before the effectiveness of the project, the following conditions should be met: (i) a shortlist of about 24-30 CFC chillers is available; (ii) appraisal of about 6 subprojects has been completed and 3-4 sub-loan agreements are ready to be signed; (iii) NEPO's approval of additional funds of about US$260,000 has been provided to support the evaluation of the LIL, information dissemination activities, development of market strategies to cover replacement of additional 400 chillers, development of financing plans, and preparation of a project proposal for submission to the ECF to secure additional funding of US$30 million to support the follow-on project.

Task 1. Final Appraisal of 24 Sub-projects and Signing of Sub-loans

Assumptions. IFCT, assisted by consultants, will appraise subprojects and sign sub-loan agreements with sub-borrowers in a timely fashion so that commissioning of all 24 chillers is completed within 12 months after the effectiveness of the project. According to the preliminary project implementation plan, the chillers will be physically replaced in four consecutive groups of six units each. It is assumed that time elapsed from signing of sub-loan agreements to commissioning will be about 9 months or less. A single payment (in full) will be made by IFCT to chiller owners, and subsequently to chiller suppliers, when chillers are successfully commissioned.

Financial Appraisal. In line with the criteria and appraisal pro-forma established for the project and in close consultation with DIW and the Bank, IFCT will carry out detailed financial appraisal of subprojects to ensure that sub-borrowers participating in this project are capable of servicing their sub-loans. IFCT will ensure the cost effectiveness of the subprojects; compliance with the eligible criteria; and that new chiller units are fully utilized for the largest possible benefit in terms of reduction in CO_2 emissions. IFCT will also assess sub-borrowers' readiness to implement the subprojects, and prepare draft sub-loan agreements with terms and conditions in line with Annex 11 and the OM of this project. The contracts (or a draft) between the chiller owners and the chiller suppliers should also be reviewed by IFCT to ensure that there are provisions for maintenance service of the new chillers, adequate training of technical staff, and appropriate arrangements for the performance guarantee to be provided by the suppliers.

Appraisal Reports and Signing of Sub-loans. IFCT will prepare the appraisal reports in line with the

appraisal report pro-forma agreed with the Bank. For the first six subprojects, the appraisal reports and the draft sub-loan agreements must be submitted for the Bank's review and clearance. Upon agreement with the Bank, the remaining 18 subprojects and sub-loan agreements may proceed without Bank prior approval. However, IFCT is obliged to implement all the agreed conditions as these sub-projects and sub-loan agreements are subject to ex-post review by the Bank. Upon no objection by the Bank for the first six subprojects or satisfaction by IFCT for the remaining subprojects, IFCT will sign the sub-loan agreements with the sub-borrowers.

Work Schedule. To facilitate readiness of 3-4 sub-loan agreements, appraisal of the first group of subprojects (6) should be carried out during July-November 2000.

Task 2. Physical Replacement of Chillers and Management of Recovered CFC Refrigerant

Commissioning Plans and Reports. Within one month after signing of the sub-loan agreement, the sub-borrower will enter into contract with the selected equipment supplier. The sub-borrower will submit the final implementation plan and disbursement schedule to IFCT in accordance with the sub-loan agreement. This plan will include a training program for technical staff, including name and number of responsible persons, and training schedule. The PMU will update the plans and schedules and report to the Bank every six months as part of the project progress reports. The PMU will ensure timely commissioning and proper installation of the chillers and verify adequacy and appropriateness of the training program.

Refrigerant Management Plan and Reports. It is important to ensure that the CFC refrigerant recovered from the dismantled chillers is properly handled and that the dismantled chillers are rendered unusable. Chiller suppliers will provide information pertaining to the handling of the CFC chillers and the recovered refrigerants and prepare a CFC chiller disposal plan and a CFC refrigerant management plan satisfactory to DIW and the Bank. To comply with the MP requirement, the recovered CFC refrigerant and disposal of the CFC chillers should be properly recorded. Chiller suppliers/contractors will be required to submit semi-annual reports to PMU and DIW on this aspect. These reports should provide information pertaining to the number of CFC chillers that have been replaced by the suppliers, quantity of CFC refrigerant recovered and recycled, quantity of CFC refrigerant still being reused, and disposal methods of the replaced CFC chillers and the non-recyclable CFC refrigerants.

Test Run Verification and Reports. At the time of commissioning, the chiller suppliers will undertake a test run to demonstrate actual performance of the newly installed non-CFC chillers. The sub-borrower will ensure that their technicians/owners and the representatives from the PMU of IFCT, DIW and the independent consultant team appointed by DIW, are present at least at the beginning of the measurement. The actual power consumption of the new chillers will be measured in accordance with procedures set forth in Annex 11 and the OM. Suppliers will submit reports documenting the commissioning results to the sub-borrowers, PMU, DIW and its independent consultant. The report should also provide information on the compliance with the refrigerant management plan and chiller disposal plan as proposed. The PMU will verify correct measurement of the energy consumption of new chillers and proper handling of the CFC refrigerant and disposal of the CFC chillers.

Task 3. Monitoring and Reporting

Chiller Performance Assessment. After commissioning, sub-borrowers are required to operate and maintain a proper record of the performance of the new chillers, including log sheets, kW-hours and the amount of refrigerant consumed by the new chillers, and inventory of recovered refrigerants. As part of the

maintenance contract, chiller suppliers will monitor chiller performance, including interpretation of the data. If there is any indication that performance of the new chillers is deteriorating, proper measures should be carried out to restore their performance within 7 days. If it takes longer to restore chiller performance to the initial state, sub-borrowers can claim a compensation for that particular month. The detailed guarantee and compensation mechanism is described in the OP. If sub-borrowers wish to have this assessment done by a third party, the assessment costs should be incurred by the sub-borrowers. The third party is the independent evaluation consultant team appointed by DIW. sub-borrowers and chiller suppliers must state their agreement in the project proposal and relevant agreements that they will accept the findings and recommendations of the independent consultant as final. These requirements will be included in the sub-loan agreement.

Data from sub-borrowers and chiller suppliers should be submitted to the PMU on a quarterly basis. In case there is any doubt regarding the performance of the new chillers, the PMU can request detailed explanation from the equipment suppliers through the sub-borrowers. If there is any dispute with regard to actual performance, sub-borrowers can request an independent evaluation. The independent consultant shall provide its findings in writing to sub-borrowers, PMU, DIW, and chiller suppliers once the assessment process is completed.

Semi-annual Progress Reports. Based on the information provided by sub-borrowers and/or chiller suppliers, the PMU will prepare semi-annual progress reports describing progress and implementation status, and submit them to DIW's independent consultant and the Bank. Progress reports are to include, but not be limited to the following information: (i) numbers of chiller owners already participating and those interested in the chiller replacement program; (ii) number of chillers already replaced under the program; (iii) methods for disposing of replaced CFC chillers; (iv) performance of new non-CFC chillers (energy consumption, CO_2 emission reduction, downtime, refrigerant leakage rate, and other relevant information); (v) total amount of CFC recovered from the dismantled units; (vi) quality of recycled CFC, the amounts of unusable CFC and their disposal plans; (vii) current cash-flow of the program; and (viii) information dissemination and other non-investment activities.

Semi-annual Workshops. With semi-annual progress reports provided by PMU, the independent consultant will evaluate the progress of the implementation of that particular reporting period. The findings of the evaluation and progress of other activities (information dissemination, public awareness, and marketing activities) will be discussed at semi-annual workshops with relevant stakeholders (DIW, NEPO, OEPP, and sub-borrowers). PMU will assist the independent evaluation consultant to conduct these workshops. The first semi-annual workshop should be held not later than one year after the effectiveness date of the project.

Task 4. Preparation of Project Completion Report

The PMU will prepare a completion report for the project in line with the forms and requirement of MLF and GEF.

Task 5. Self Evaluation of the Project

A evaluation will be carried out by PMU within 3 years after the effectiveness of the LIL. The evaluation will be made against the following indicators:

- Number of chiller owners expressing interest to participate in the follow-on chiller replacement

program
- Reduction of electricity consumption and its associated abatement of carbon dioxide emissions
- Reduction of CFC emissions and CFC demand from the chiller sector
- Timeliness of project implementation.

The assessment should include site visits to interview chiller owners and their technicians on the performance of the new chillers. A quick check should be made to verify that the level of energy consumption per refrigerated ton meets the target of this project. The PMU should compile information pertaining to actual operating hours at these 24 sites, the annual leakage rate of new refrigerant, and other relevant information. The evaluation report should provide information pertaining to global environmental impacts (carbon emission reduction and CFC phaseout) of th pilot project. The report should be submitted to DIW and its independent consultant, and the Bank.

[1] Identification and screening of the subproject will be carried out by IFCT during the preparation phase.

Project Component 2 - US$0.26 million
(Government counterpart fund)

Technical Assistance

An independent evaluation consulting team should be engaged within six months after the pilot project starts. This is to ensure that the evaluation consulting team will be able to oversee and evaluate quality of works of all equipment suppliers at the time of dismantling the existing units and installation of new chillers.

Objectives

The main objectives of these consulting services are to (i) evaluate the success and lessons learned from the pilot project; (ii) market and promote the development of the follow-on chiller replacement program; and (iii) design and prepare the implementation plan of the follow-on chiller replacement program, including recommendations on a strategy to enhance implementation of the energy conservation program.

Scope of Work

Task 1. Evaluation of Success and Lessons Learned

The consultant will work closely with PMU to ensure early knowledge on agreements between IFCT and the sub-borrowers and commitments of the equipment suppliers. Due focus would be given but not limited to:

- ***Quality of Works by Equipment Suppliers.*** The consultant will evaluate the performance and the quality of works of the equipment suppliers.

- ***Effectiveness of the Refrigerant Management Plan.*** The consultant will monitor the effectiveness of CFC recovery and recycling practices carried out by equipment suppliers. Based on the information provided either by sub-borrowers or chiller suppliers and site visits, the consulting team will set up an inventory of these recovered refrigerants. The inventory should be updated every month during the installation of 24 building chillers. After that, the inventory should be updated on an annual basis. Chiller suppliers and sub-borrowers are also required to provide information on the refrigerant charges

of their new chillers and leakage rate. The consulting team should provide advice to sub-borrowers and chiller suppliers on how the data should be reported. The annual report should provide an analysis of the quantity and quality of recovered CFCs and the leakage rate of the new chillers.

- ***Review Performance of Newly Installed Non-CFC Chillers.*** The independent evaluation consulting team should request IFCT to submit new chillers' performance datasheets of the previous month within 15 days after the end of the month. The consulting team should develop a system to evaluate the performance of these chillers based on the performance data sheets. In case there are any signs of deteriorating performance, the consulting team should inform IFCT immediately. The consulting team should also follow up with IFCT to ensure that the identified problems are immediately corrected by chiller suppliers.

- ***Review Maintenance Log Sheets of New Chillers.*** Maintenance log sheets of new chillers will be reviewed by the independent consulting team on a monthly basis to ensure that maintenance contracts and programs are fully implemented. During the review process, the evaluation consulting team should also assess the quality of chilled and condensing water, and provide necessary recommendations to ensure that chilled and condensing water systems are always in good operating conditions.

- ***Conduct Interviews with sub-borrowers and Their Technicians.*** Interviews should be conducted with sub-borrowers and their technicians on at least a quarterly basis. The interviews should address technicians' capacity in maintaining the new chillers and how this knowledge is being applied to their maintenance programs for existing CFC chillers. The evaluation consulting team should also attempt to find out from sub-borrowers and their technicians whether they are satisfied with services provided by chiller suppliers. Chiller suppliers should be informed of the feedback and any comments from sub-borrowers. Based on success and lessons learned compiled from these interviews, the evaluation consulting team should make recommendations for improvement and discuss it with sub-borrowers. These recommendations should be used for the design of the follow-on project.

- ***Conduct Power Consumption Measurement If Requested by sub-borrowers.*** When there is dispute between sub-borrowers and suppliers with regard to power consumption or energy efficiency of new chillers, the evaluation consulting team should act as an independent party to undertake power consumption measurement of new chillers as requested by sub-borrowers. Costs of undertaking this task should be borne by sub-borrowers. Although the cost of this dispute settlement is not part of the cost of this evaluation component, the evaluation consulting team should make its cost known at the time of signing the contract of this project. The proposed cost should not exceed 100,000 Baht per measurement.

- ***Prepare Fact Sheets for New Non-CFC Chillers.*** The evaluation consulting team should prepare the first fact sheet summarizing conditions of the 24 chillers to be replaced under the demonstration project. The objective of this first fact sheet is to introduce the demonstration project. Therefore, information related to expected benefits, project arrangement and other relevant information should be included in the first fact sheet. The evaluation consulting team will organize a workshop to inform key stakeholders, including sub-borrowers that are target groups for the follow-on projects, Government officials from relevant agencies, and others, of the benefits of the demonstration project and the future plan to replace additional 400 CFC chillers.

  The second fact sheets describing lessons learned and experience gained from dismantling existing CFC chillers and installation of new non-CFC chillers, should be prepared for each site within 3 months after successful commissioning of each chiller. Information pertaining to performance of new chillers

and any practical difficulties in maintaining condensing and chilled water qualities should be discussed. The evaluation consulting team should also investigate whether sub-borrowers' technicians have received proper training on chiller operations from chiller suppliers. Other issues related to prevention of refrigerant leakage, downtime, and any other practical experience should be recorded and presented in the fact sheet.

Within one year after commissioning of each chiller, a final fact sheet describing all the issues listed above and actual energy savings during the first year of operation should be documented. sub-borrowers' satisfaction should also be assessed.

All fact sheets produced should be used as promotion materials for the project. As a means to gain wider audience, an internet web site should be established. Information pertaining to the project and Government regulations related to energy consumption of building chillers should be distributed through the web site. At the end of the project, the web site should be transferred to DIW. The evaluation consulting team is responsible for providing necessary training to DIW to enable DIW's staff to maintain and update this web site after the end of the contract of the independent evaluation consulting team.

- ***Evaluate Effectiveness of Performance Guarantee Requirements.*** The evaluation consulting team should evaluate the effectiveness of the terms and conditions of the performance guarantee employed in the demonstration project. The review should cover the effectiveness of the arrangement proposed in the demonstration project to deal with any disputes between sub-borrowers and chiller suppliers. The objective of this task is to determine whether the performance guarantee is still required in the follow-on project, or whether terms and conditions of the performance guarantee should be strengthened.

Task 2. Information Dissemination and Market Development

- ***Organize Semi-Annual Workshops.*** Semi-annual workshops should be organized to inform Government agencies, potential sub-borrowers for future chiller replacement and other stakeholders, of the progress and lessons learned from the demonstration project. The workshops should address all tangible technical, financial and environmental benefits of this demonstration project. Feedback received from participants of these workshops should be used for improving the implementation of the on-going demonstration project and the design of the future follow-on project.

- ***Prepare Articles Related to Project for Technical Journals, Newspaper and Other Media.*** The evaluation consulting team shall prepare articles detailing data and information obtained through the demonstration project. Specific articles for various audience should be prepared and published in technical journals, newspaper and other media. The evaluation consulting team should work closely with DIW and other government agencies (NEPO and DEDP) to ensure that their efforts will complement the on-going effort of these agencies to promote energy conservation and ozone layer protection. All these articles should be made available also through the internet web site of the project. The evaluation consulting team should participate in any exhibitions related to ozone layer protection or energy conservation in order to promote this project.

- ***Develop a Database of Existing CFC Chillers Installed in Thailand.*** The evaluation consulting team should work in close cooperation with IFCT to develop a complete database of all existing CFC chillers installed in Thailand. The database should contain information such as installation sites, chiller types, refrigerant types, cooling capacity, installation dates, types of chiller application, and names of

the chiller manufacturers. The database should be able to sort chillers by business types or other criteria such as applications, cooling capacity, etc.

- ***Develop and Utilize Marketing Strategies and Marketing Tool Kits.*** Based on data available from the above database, the evaluation consulting team should develop marketing strategies addressing various target groups. Target groups are sub-borrowers in various sectors (industry, hotels, hospitals, commercial buildings), and financial institutions that may be potential lenders for future CFC chiller replacement. Information on success and lessons learned from the demonstration project should be taken into account when developing marketing strategies for future replacement of CFC chillers. The evaluation consulting team should also develop marketing tools to promote energy conservation and CFC elimination through chiller replacement. Marketing tools include posters, pamphlets, and computer software demonstrating financial benefits from replacing CFC chillers with high efficiency non-CFC chillers.

- ***Organize a Series of Workshops Targeting Each Sector Using CFC Chillers.*** In addition to the semi-annual workshops described above, the evaluation consulting team should propose additional workshops for management levels of potential buildings to promote CFC chiller replacement. Representatives from financial institutions, chiller suppliers, government officials and other interested parties should be invited. Site visits should be included as part of these workshops. Participants should have the opportunity to learn more about benefits or drawback of chiller replacement projects from sub-borrowers whose chillers were replaced under the demonstration project.

- ***Design and Implement Public Awareness on Energy Conservation in Major Buildings and Factories.*** The evaluation consulting team should explore various options to promote chiller replacement as part of energy conservation programs in major/commercial buildings and factories. The consulting team may design stickers or plaques and award them to sub-borrowers using high efficiency non-CFC chillers. In addition, the consulting team may propose that the on-going environment protection programs such as the Green Leaf Program and the Green Building Program, should include high efficiency non-CFC chillers as part of the criteria of these two on-going programs.

Task 3. Design a Follow-on Chiller Replacement Program

- ***Review Existing Policies and Procedures of NEPO and DEDP.*** The evaluation consulting team should review the existing policies and procedures of these two agencies to ensure that the follow-on project will complement the efforts of these two agencies. Other activities related to energy conservation carried out by other agencies or parties in Thailand should also be reviewed. Any potential synergy among those programs and the chiller replacement project should be identified. The consulting team should review and recommend how existing policies of the Ministry of Industry to improve competitiveness of small- and medium-scale industries, could be employed for promoting chiller replacement in these industries.

- ***Modify Selection Criteria for Future CFC Chiller Replacement.*** Based on experience from replacing the first 24 CFC chillers and actual performance of new non-CFC chillers, the evaluation consulting team should review and make recommendations as to whether the selection criteria for future CFC chiller replacement should be modified in order to enlarge coverage and increase benefits of the chiller replacement project. The evaluation consulting team may want to assess and recommend improvements for the practicality of existing criteria and guidelines for determining energy efficiency of new chillers.

- ***Determine a Level of Subsidy for Future CFC Chiller Replacement.*** Investigation should also be

made to determine a minimum level of subsidy that could be sufficient to trigger Sub-borrowers to invest in new chillers. This information will be critical for designing an incentive structure for the follow-on project. The evaluation consulting team should also investigate possible funding sources and innovative funding mechanisms through private sector participation, to support the follow-on project.

- ***Propose Project Implementation Priority to Maximize Contribution of this Project to the Government's Overall Effort in Meeting the Montreal Protocol Obligations.*** Based on the effectiveness of the implementation of the refrigerant management plan which is one of the components in the demonstration project, the evaluation consulting team should review the extent of the contribution of this project to the Government's overall effort in reducing the CFC demand in the country. An analysis should be carried out to determine the extent of the follow-on project that will effectively and adequately contribute to the Government's effort in reducing CFC consumption by 50% by 2005, 85% by 2008, and 100% by 2010.

- ***Develop Financial Plans to Support Implementation of the Follow-on Program.*** The evaluation consulting team should develop financial plans based on various options, including a revolving fund mechanism, and various levels of subsidy, to support additional chiller replacement. In developing these plans, the consulting team shall explore potential funding sources to support their respective financial plans. The financial plans should be able to support sufficient chiller replacement as required by the above analysis (contribution to the Government's effort in meeting the Montreal Protocol obligations).

  It is expected that the financial analysis of various options would have adequate details for decision making, including both direct and indirect benefits. Indirect energy savings and financial benefits gained from the remaining CFC chillers should also be evaluated, including whether proper sizing of the new non-CFC chillers can improve cooling load distribution among all chillers within the facilities. Without any modification, CFC chillers normally perform with higher efficiency at a cooling load closer to the design conditions. Valuation should also be made on cost benefits of routine preventive maintenance and how training provided to sub-borrowers' technicians affects downtime, leakage rate of refrigerant, and other operating costs.

- ***Assist IFCT to Secure Required Funding from Potential Sources.*** The evaluation consulting team should assist IFCT to prepare proposals, presentation materials, and any other analyses or documentation to support IFCT's effort to raise additional funds to support the follow-on project.

Annex 3: Estimated Project Costs
THAILAND: Building Chiller Replacement Project

Sector Review, Benefit, and Incremental Cost

Broad Development Goals and Baseline

The Green Building Project that is part of the energy efficiency development project (DSM) financed by GEF and implemented by the Electric Generating Authority of Thailand (EGAT) suggested that about one-third of total energy consumption in larger buildings is attributed to air-conditioning systems. The efficiency of the building chillers is therefore important for sustainable development in the energy sector. The chiller sector in Thailand has grown dramatically in the past decade due to the large amount of construction that has taken place as the Thai economy has expanded. Information obtained in 1996 suggested that building chillers of a wide variety are used, but most systems are of the centrifugal type and utilize CFC-11 as a refrigerant. Some 3-5% of chillers -- mostly installed in large buildings -- use CFC-12. It is estimated that just under 1,500 CFC systems are currently in operation and more than 80% are in Bangkok. The recent survey conducted in 1999 by the Department of Industrial Works already identified about 1,200 CFC chillers installed in Thailand. All of these CFC chillers were installed in or before 1993 (only 5 CFC chillers were installed after 1993). The non-CFC chillers that have been installed in new buildings are more energy efficient, as well as more ozone-friendly, than CFC chillers, but they do not necessarily constitute international state-of-the-art technology.

There are seven chiller suppliers, but the main five are Carrier, Daikin, McQuay, Trane, and York. The majority of the CFC chillers (about 60% of identified CFC chillers) were 8-11 years old, and their average cooling capacity is 400-500 ton refrigerated (TR). More than 60% of these chillers are installed in the industry and hotel sectors. Depending on the cooling capacity, energy consumption of the existing centrifugal chillers would range from 0.8 to 1.0 kW/TR (average 0.9 kW/TR), which implies an energy consumption of almost 2,900 MWhr per year (assuming a running time of 12 hr/day). This is about 30% more energy consumption than current state-of-the-art technology. While the chillers have a remaining technical lifetime of almost 20 years on average, their replacement with modern systems would generate pay back within a few years. The inventory of CFC chillers installed in Thailand is available in the project file.

This annex presents the benefits and incremental costs determined in line with the Montreal Protocol Investment Fund (MLF) for Implementation of the Montreal Protocol (MP) and the GEF requirements. Proposals submitted to the GEF and MLF are available in the project file. Since the project yields both ozone layer protection and climate change benefits, the MLF and GEF agreed to share the incremental cost. The estimated benefits and the incremental cost, including the main assumptions, are briefly summarized below.

Benefits and Incremental Cost

Global Environmental Objective/Benefits. The project aims to create a market for high-energy efficiency chillers in Thailand by initially replacing 24 CFC chillers on a pilot basis to demonstrate the economics and feasibility of the technology. A larger-scale chiller replacement program, following a successful demonstration, would lead to replacement of about 30% of the remaining CFC chillers – or 444 systems in total. It is expected that the demonstration effect of the project and the experience gained would in turn lead to a more widespread use of energy efficient chillers in the chiller market as a whole. This latter effect has

not been quantified, however.

In addition to the market transformation benefits sought in accordance with the objective of Operational Program 5, the project would lead to a significant reduction in GHG emissions. By replacing CFC chillers with systems that are 30% more efficient, the CO_2 emissions associated with air-conditioning can be reduced by the same amount. The energy efficiency benefits of the project are shown in Table A3.1.

Table A3.1: Carbon abatement benefit from energy savings

Parameter	*Value*
Average cooling capacity of chiller (TR)	500
Average consumption, baseline chiller (kW/t)	0.90
Energy consumption, alternative (kW/ton)	0.63
Estimated operating time (hr/day)	18*
Estimated remaining lifetime (yr)	17
Carbon intensity of Thai power sector (kgC/kWhr)	0.22

*Average operating time of chillers installed in Thailand is about 12 hours. However, for those used in industrial and hotel applications average operating time is approximately 18 hours. To ensure timely repayment of the provided loan, the demonstration project will emphasize replacement of CFC chillers in the industrial and hotel applications.

Equally significant are the GHG reduction benefits that would occur from a decrease in leakage rates and the replacement of CFCs with substitute refrigerants that have a lower global warming potential, as shown in Table A3.2. Energy efficiency and leakage effects combined, the project would lead to direct GHG emission reductions of 102.86 ktC equivalent (190 ktC x 24 units x17 years plus direct GHG savings of 23.3 ktC), and programmatic benefits of 1,413.6 ktC equivalent (lower operating time, 12 hours, used for estimating programmatic benefits as chillers used in other applications have a shorter operating time).

Table A3.2: Climate change benefit from refrigerant substitution

Parameter	*Value*
Average global warming potential, baseline*	4,225
Leakage rate, baseline (% per year)	10.0
Global warming potential, alternative**	153
Leakage rate, alternative (% per year)	2.0
Direct GHG savings (24 systems – ktC)	23.3
GHG savings, program (444 systems – ktC)	431.7

* Assuming 95% of systems are using CFC-11 (global warming potential 4,000) and 5% are using CFC-12 (global warming potential 8,500).

** Assuming HCFC-123 (global warming potential 93) and HFC-134a (global warming potential 1,300) would replace CFC-11 and CFC-12, respectively.

GEF and MLF Alternative. The proposed project would seek to remove the barriers that prevent a wider use of high-energy efficiency chillers in Thailand. The project would focus on the replacement of remaining CFC chillers, for two reasons:

- Replacing CFC chillers yields higher and more immediate energy efficiency gains, and is therefore better suited to demonstrate the economic benefits of the technology
- Replacing CFC chillers yields extra global environmental benefits by eliminating the demand of 20.4 ODP tons of substances that are highly damaging to the ozone layer and have a global warming potential several times higher than that of their substitutes.

It is expected that the demonstration benefits from, and experience gained in, the replacement program would ultimately also spill over to the market for newly installed systems.

Without the Project. In the absence of the external support to remove these barriers, it is likely that the CFC chillers that were installed before 1993 would remain in service for the rest of their product lifetime and would face difficulty in servicing leakage (about 50 kg/chiller/year). As part of Thailand's strategy in meeting its obligations under the Montreal Protocol, the Government has implemented a quota system for imports of CFC-11 and CFC-12 since 1995. The import quota of each of these chemicals has been reduced 10% per year since the establishment of this system.

Incremental Cost Analysis. The focus of the project is on the replacement of CFC chillers. Consequently, the system boundary of the analysis is restricted to the market for this particular type of chiller, of which some 1,500 units are still in use.

Estimated Costs. The incremental cost of this project is the costs of removing the barriers that prevent the realization of what would otherwise be a win-win opportunity. It is judged that most barriers can be removed through a demonstration package involving the replacement of 24 chillers, which – if successful – would trigger a larger scale replacement program. Included in the package would be a maintenance contract with the supplier to assure adequate servicing of the new equipment and to build capacity in the country to take over these tasks in due course. Information barriers would be removed through technical workshops and a marketing and public awareness program. The estimated cost of individual project components and the incremental cost are shown in Table A3.3 and Table A3.4. The parameters and assumptions used in the incremental cost analysis reflect the recent development in the project implementation arrangement as well as the improved exchange rate between the Thai Baht and US dollar. The proposed approach and financing modalities have been discussed and agreed in principle with IFCT. The analysis will be refined at project appraisal, as necessary, and will be formally agreed with Thai authorities in the course of project negotiations.

Preliminary Cash-flow Analysis. Over a 7-year time horizon (excluding one year required for equipment procurement and installation), project costs would add up to a present value of about $5.2 million. It can be expected that these extra costs would be roughly offset by savings in electricity costs in the order of perhaps $50,000 per chiller per year, worth $5.5 million over 7 years - which would make replacement a win-win opportunity.

However, these savings are uncertain and there is a strong perception among stakeholders that they may not materialize. To remove this barrier and cover incremental risks an *interest free loan* of about $5 million would be provided for the procurement and installation of the first 24 chillers, repayable after 7 years (assuming project success). The terms of this arrangement correspond to a de facto incremental cost grant of $2.6 million (A $5 million interest free loan has the same present value as $2.6 million in grant plus a $2.4 million loan at 10% interest). Given that this project is jointly financed by GEF and MLF (50/50), the incremental cost grant provided by GEF is about $1.3 million.

This in turn is equivalent to compensation for an incremental risk of project failure of approximately 50%.

With a 50% chance of success the expected value of energy savings would be reduced to $2.7 million in present value terms – implying incremental operating costs of another $2.5 million.

Table A3.3: Estimated costs for replacement of a chiller

Item	*Cost ($)*
Investment costs (per chiller)	
Chiller	150,000
Installation and site preparation	30,000
Maintenance contract	15, 000
Procurement / shipping / insurance	5,000
Total	*200,000*
Overhead costs (annual)	
Program marketing and public awareness	20,000
Accounting and loan management	50,000
Evaluation (monitoring and reporting)	10,000
Total	*80,000**

*Overhead costs are covered by the management fee of 4.5% to be charged to building owners.

Table A3. 4: Incremental Cost Matrix

	Baseline	Alternative	Increment
Domestic Benefit	1,500 chillers in operation	1,500 chillers in operation	0
Global Environment Benefit	*Direct:* 265.38 ktC (energy) 23.5 ktC (leakage) *Indirect:* 3,273.2 ktC (energy) 434.9 ktC (leakage)	*Direct:* 185.82 ktC (energy) 0.2 ktC (leakage) *Indirect:* 2,291.1 ktC (energy) 3.2 ktC (leakage)	*Direct:* 79.56+23.3 = 102.86 ktC *Indirect:* 981.9+431.7 = 1,413.6 ktC
Costs ($ million)			
Capital costs	0.0	4.8	4.8
Electricity costs	19.1	16.4	-2.7
Overhead costs	0.0	0.4	0.4
Total	*19.1*	*21.6*	*2.5*

A3.3 Main Assumptions: see Tables A3.1, A3.2, A3.A3.3, A3.4 above

A3.4 Sensitivity analysis / Switching values of critical items: N/A

Annex 4

THAILAND: Building Chiller Replacement Project

	A	B	C	D	E	F	G	H	I	J	K	L
1					**Cashflow Analysis for the Chiller Replacement Project for Thailand**							
2												
3	**Existing CFC chillers**											
4		Cooling Capacity (Avg.)						500 tons				
5		Energy Consumption (Avg.)						0.9 kW/ton				
6												
7	**New non-CFC chillers**											
8		Cooling Capacity (Avg.)			500 tons							
9		Energy Consumption (Avg.)			0.63 kW/ton							
10		Estimated Cost			150,000 US$							
11												
12	**Delivery and Payment Conditions**											
13		Delivery and Installation						9 months				
14		Down Payment						0% of total cost				
15		Payment due at equip. shipment						0% of total cost (6 months after down payment)				
16		Payment after commissioning						100% of total cost				
17		Time lags from down payment to commissioning						9 months				
18												
19	**Repayment Condition**											
20		Monthly payment						95% of total savings				
21												
22	**Operating Conditions**											
23		Electricity cost						2.2 Baht/kWh				
24		Estimated Running Time						18 hours/day				
25		No. of Days in Operations						30 days/month				
26												
27	**Other Conditions**											
28		Special Account (S/A)						4.975 US$ million				
29		Interest earned from S/A						0%				
30		Technical Assistance						0.13 US$ million				
31		Administrative Fee						4.50% of outstanding loans				
32		Number of Units to be replaced						24 Units				
33												
34	**Exchange Rate**											
35		US$1				equals		42 Baht				
36												
37	**Definitions**											
38		adminfee	=Sheet1!$H$31									
39		downpayment	=Sheet1!$H$14*Sheet1!$E$10									
40		electricitycost	=Sheet1!$H$23									
41		energysavings	=Sheet1!$H$4*(Sheet1!$H$5-Sheet1!$E$9)*Sheet1!$H$24*Sheet1!$H$25									
42		exchangerate	=Sheet1!$H$35									
43		interest	=Sheet1!$H$29									
44		loansize	=Sheet1!$H$28									
45		ta_cost	=Sheet1!$H$30									

	A	B	C	D	E	F	G	H	I	J	K	L	M
47	Month	No. of Units Purchased	No. of Units Shipped	No. of Units Comissioned	No. of Units Installed	Energy Savings per month (kWh)	Monthly Repayment Received (Million Baht)	Admin. Fee (Million Baht)	Fund Disbursed (Million Baht)	Repayment Collected (Million Baht)	Local A/C Balance (Million Baht)	Outstanding Loan (Million Baht)	S/A Balance (US$ million)
48	*Total fund transferred to the Special Account*												
49	1	0	0	0	0	0	0	5.56	5.56	0	0	-	4.84
50	2	0	0	0	0	0	0	0	0	0	0	-	4.84
51	3	0	0	0	0	0	0	0	0	0	0	-	4.84
52	*Subloan agreements signed. Procurement of equipment starts with 20% down-payment when the order is made.*												
53	4	6	0	0	0	0	0	0.00	-	0	0.00	-	4.84
54	5	6	0	0	0	0	0	0.00	-	0	0.00	-	4.84
55	6	6	0	0	0	0	0	0.00	-	0	0.00	-	4.84
56	7	6	0	0	0	0	0	0.00	-	0	0.00	-	4.84
57	8	0	0	0	0	0	0	0.00	0	0	0.00	-	4.84
58	9	0	0	0	0	0	0	0.00	0	0	0.00	-	4.84
59	*Additional payment of 60% of total equipment costs paid prior to shipment.*												
60	10	0	6	0	0	0	0	0.00	0.00	0	0.00	-	4.84
61	11	0	6	0	0	0	0	0.00	0.00	0	0.00	-	4.84
62	12	0	6	0	0	0	0	0.00	0.00	0	0.00	-	4.84
63	*Last payment of 20% made when equipment is installed and commissioned. Repayment takes place immediately after commissioning.*												
64	13	0	6	6	6	0.00	0.00	0.00	37.80	0.00	0.00	37.80	3.94
65	14	0	0	6	12	437.40	0.91	0.14	37.80	0.91	0.77	74.83	3.04
66	15	0	0	6	18	874.80	1.83	0.28	37.80	2.74	2.32	111.08	2.14
67	16	0	0	6	24	1312.20	2.74	0.42	37.80	5.48	4.65	146.55	1.24
68	17	0	0	0	24	1749.60	3.66	0.55	0.00	9.14	7.75	143.45	1.24
69	18	0	0	0	24	1749.60	3.66	0.54	0.00	12.80	10.87	140.33	1.24
70	19	0	0	0	24	1749.60	3.66	0.53	0.00	16.45	14.00	137.20	1.24
71	20	0	0	0	24	1749.60	3.66	0.51	0.00	20.11	17.14	134.06	1.24
72	21	0	0	0	24	1749.60	3.66	0.50	0.00	23.77	20.30	130.90	1.24
73	22	0	0	0	24	1749.60	3.66	0.49	0.00	27.42	23.46	127.74	1.24
74	23	0	0	0	24	1749.60	3.66	0.48	0.00	31.08	26.64	124.56	1.24
75	24	0	0	0	24	1749.60	3.66	0.47	0.00	34.74	29.83	121.37	1.24
76	25	0	0	0	24	1749.60	3.66	0.46	0.00	38.39	33.03	118.17	1.24
77	26	0	0	0	24	1749.60	3.66	0.44	0.00	42.05	36.25	114.95	1.24
78	27	0	0	0	24	1749.60	3.66	0.43	0.00	45.71	39.47	111.73	1.24
79	28	0	0	0	24	1749.60	3.66	0.42	0.00	49.36	42.71	108.49	1.24
80	29	0	0	0	24	1749.60	3.66	0.41	0.00	53.02	45.96	105.24	1.24
81	30	0	0	0	24	1749.60	3.66	0.39	0.00	56.68	49.22	101.98	1.24
82	31	0	0	0	24	1749.60	3.66	0.38	0.00	60.33	52.50	98.70	1.24
83	32	0	0	0	24	1749.60	3.66	0.37	0.00	63.99	55.78	95.42	1.24
84	33	0	0	0	24	1749.60	3.66	0.36	0.00	67.65	59.08	92.12	1.24
85	34	0	0	0	24	1749.60	3.66	0.35	0.00	71.30	62.39	88.81	1.24
86	35	0	0	0	24	1749.60	3.66	0.33	0.00	74.96	65.72	85.48	1.24
87	36	0	0	0	24	1749.60	3.66	0.32	0.00	78.62	69.05	82.15	1.24
88	37	0	0	0	24	1749.60	3.66	0.31	0.00	82.27	72.40	78.80	1.24
89	38	0	0	0	24	1749.60	3.66	0.30	0.00	85.93	75.76	75.44	1.24
90	39	0	0	0	24	1749.60	3.66	0.28	0.00	89.59	79.14	72.06	1.24
91	40	0	0	0	24	1749.60	3.66	0.27	0.00	93.24	82.52	68.68	1.24
92	41	0	0	0	24	1749.60	3.66	0.26	0.00	96.90	85.92	65.28	1.24
93	42	0	0	0	24	1749.60	3.66	0.24	0.00	100.56	89.33	61.87	1.24
94	43	0	0	0	24	1749.60	3.66	0.23	0.00	104.21	92.76	58.44	1.24
95	44	0	0	0	24	1749.60	3.66	0.22	0.00	107.87	96.20	55.00	1.24
96	45	0	0	0	24	1749.60	3.66	0.21	0.00	111.53	99.65	51.55	1.24
97	46	0	0	0	24	1749.60	3.66	0.19	0.00	115.18	103.11	48.09	1.24
98	47	0	0	0	24	1749.60	3.66	0.18	0.00	118.84	106.59	44.61	1.24
99	48	0	0	0	24	1749.60	3.66	0.17	0.00	122.50	110.07	41.13	1.24
100	49	0	0	0	24	1749.60	3.66	0.15	0.00	126.15	113.58	37.62	1.24
101	50	0	0	0	24	1749.60	3.66	0.14	0.00	129.81	117.09	34.11	1.24

	A	B	C	D	E	F	G	H	I	J	K	L	M
102	51	0	0	0	24	1749.60	3.66	0.13	0.00	133.47	120.62	30.58	1.24
103	52	0	0	0	24	1749.60	3.66	0.11	0.00	137.12	124.16	27.04	1.24
104	53	0	0	0	24	1749.60	3.66	0.10	0.00	140.78	127.72	23.48	1.24
105	54	0	0	0	24	1749.60	3.66	0.09	0.00	144.44	131.29	19.91	1.24
106	55	0	0	0	24	1749.60	3.66	0.07	0.00	148.09	134.87	16.33	1.24
107	56	0	0	0	24	1749.60	3.66	0.06	0.00	151.75	138.46	12.74	1.24
108	57	0	0	0	24	1749.60	3.66	0.05	0.00	155.41	142.07	9.13	1.24
109	58	0	0	0	24	1749.60	3.66	0.03	0.00	159.06	145.70	5.50	1.24
110	59	0	0	0	24	1749.60	3.66	0.02	0.00	162.72	149.33	1.87	1.24
111	60	0	0	0	24	1749.60	3.66	0.01	0.00	166.38	152.98	(1.78)	1.24
112	61	0	0	0	24	1749.60	3.66	0.00	0.00	170.03	156.64	(5.44)	1.24
113	62	0	0	0	24	1749.60	3.66	0.00	0.00	173.69	160.30	(9.10)	1.24
114	63	0	0	0	24	1749.60	3.66	0.00	0.00	177.35	163.95	(12.75)	1.24
115	64	0	0	0	24	1749.60	3.66	0.00	0.00	181.00	167.61	(16.41)	1.24
116	65	0	0	0	24	1749.60	3.66	0.00	0.00	184.66	171.27	(20.07)	1.24
117	66	0	0	0	24	1749.60	3.66	0.00	0.00	188.32	174.92	(23.72)	1.24
118	67	0	0	0	24	1749.60	3.66	0.00	0.00	191.97	178.58	(27.38)	1.24
119	68	0	0	0	24	1749.60	3.66	0.00	0.00	195.63	182.24	(31.04)	1.24
120	69	0	0	0	24	1749.60	3.66	0.00	0.00	199.29	185.89	(34.69)	1.24
121	70	0	0	0	24	1312.20	2.74	0.00	0.00	202.03	188.63	(37.43)	1.24
122	71	0	0	0	24	874.80	1.83	0.00	0.00	203.86	190.46	(39.26)	1.24
123	72	0	0	0	24	437.40	0.91	0.00	0.00	204.77	191.38	(40.18)	1.24
124	73	0	0	0	24	0.00	0.00	0.00	0.00	204.77	191.38	(40.18)	1.24
125	74	0	0	0	24	0.00	0.00	0.00	0.00	204.77	191.38	(40.18)	1.24
126	75	0	0	0	24	0.00	0.00	0.00	0.00	204.77	191.38	(40.18)	1.24
127	76	0	0	0	24	0.00	0.00	0.00	0.00	204.77	191.38	(40.18)	1.24
128	77	0	0	0	24	0.00	0.00	0.00	0.00	204.77	191.38	(40.18)	1.24
129							204.77	13.40	156.76				
130													
131	Total Loans equal			4.975	US$ million	or	208.95 Million Baht						
132	Funds available at end of Month 70 =			Local A/C		plus	Special A/C						
133				188.63	Baht plus		52.19 (M) Baht	equals	240.83 (M) Baht				
134								plus					
135							Refund of the Advanced Funds of		5.56 (M) Baht	From the Total Fee of		13.40	
136							Total Fund Avail. For Repayment		246.38 (M) Baht			(M) Baht	
137													
138													

Annex 5: Financial Summary

THAILAND: Building Chiller Replacement Project

Not Applicable

Annex 6: Procurement and Disbursement Arrangements
THAILAND: Building Chiller Replacement Project

Procurement

Procurement, Disbursement, and Financial Management Arrangements

Procurement: Procurement of goods and works will follow the World Bank Guidelines "Procurement under IBRD Loans and IDA Credits, January 1995, revised January and August 1996, September 1997, and January 1999". As the loan is to a financial intermediary (IFCT), the procurement of new chillers, including installation and performance guarantees (if applicable), will be undertaken by the sub-borrowers according to the commercial practices (clause 3.12 of Procurement Guidelines). The commercial practice for this kind of operation is satisfactory to the Bank. Each chiller owner will select a chiller supplier who can develop a sub-project with the owner which optimizes the owner's benefits and who can submit a proposal in line with project requirements. Selection of the 24 subprojects will be made according to cost-effectiveness and other criteria as detailed in Annex 11 and the OM. A standard sub-loan agreement between IFCT and chiller owners will be agreed during the appraisal of the project.

Procurement methods (Table A)

Goods, Works, Services. Procurement of goods and works will follow the World Bank Guidelines " Procurement under IBRD Loans and IDA Credits, January 1995, revised January and August 1996, September 1997, and January 1999". This is a loan to a Financial Intermediary (IFCT); the procurement of new chillers, including installation and guarantee (if applicable) will be undertaken by the respective beneficiaries (sub-borrowers) according to commercial practices and in line with clause 3.12 of said Guidelines. The commercial practices for this type of project are satisfactory to the Bank.

In this project, about 24 non-CFC chillers will be procured at a cost of about $4.975 million, including dismantling and disposal of old chillers and installation, maintenance contract, and performance guarantee (if applicable) of the new chillers. As the chillers have to be fitted into an existing operational situation a fair amount of tailoring will be required to fit new chillers to an owner's needs, the sub-borrowers will select the chiller supplier who optimizes the owner's benefits. The sub-borrowers will submit a proposal in line with project requirements and selection of participants will be made according to cost-effectiveness and other criteria as stipulated in Annex 11. A draft sub-loan agreement between IFCT and the sub-borrower will be provided during appraisal of the sub-projects.

Table A: Project Costs by Procurement Arrangements
(US$ million equivalent)

Expenditure Category	Procurement Method[1]				Total Cost
	ICB	NCB	Other[2]	N.B.F.	
1. Works	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
2. Goods	0.00	0.00	4.97	0.00	4.97
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
3. Services	0.00	0.00	0.00	0.26	0.26
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
4. Miscellaneous	0.00	0.00	0.00	0.00	0.00
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)
Total	0.00	0.00	4.97	0.26	5.23
	(0.00)	(0.00)	(0.00)	(0.00)	(0.00)

[1/] Figures in parenthesis are the amounts to be financed by the Bank Other (Specify). All costs include contingencies.

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

Prior review thresholds (Table B)

The appraisal reports and draft sub-loan of the first six proposals considered eligible for funding under the project will be subject to Bank's prior review. This would cover about 25% of the procurement works. Post review of the remaining sub-loans may be undertaken during the supervision missions at a rate of 1 in 4.

Table B: Thresholds for Procurement Methods and Prior Review [1]

Expenditure Category	Contract Value Threshold (US$ thousands)	Procurement Method	Contracts Subject to Prior Review (US$ millions)
1. Works	N/A	Commercial practice as stated in the "Procurement in Loans to Financial Intermediaries," p. 36 of Procurement under IBRD Loans and IDA credits Guidelines, Jan. 95, Revised Jan. and Aug. 96, Sept. 97, and Jan. 99.	
2. Goods	N/A	See above.	
3. Services	N/A	See above.	
4. Miscellaneous			
5. Miscellaneous			
6. Miscellaneous			

Total value of contracts subject to prior review:

Overall Procurement Risk Assessment

Average

Frequency of procurement supervision missions proposed: One every months (includes special procurement supervision for post-review/audits)

IFCT, which is the implementing agency of the project, has been involved as the Financial Intermediary for investment activities of Montreal Protocol Investment Fund projects in Thailand for about eight years and has considerable experience in the Bank's procurement procedures. Task management will be led from the Bank's Bangkok office, which also provides the procurement supervision. Frequency of supervision will be in response to the needs, which are expected to be minimal after the first couple of procurements.

[1] Thresholds generally differ by country and project. Consult OD 11.04 "Review of Procurement Documentation" and contact the Regional Procurement Adviser for guidance.

Disbursement

Allocation of other (specify) proceeds (Table C)

Disbursement will use traditional disbursement methods through a Special Account. The loan proceeds will be used by:sub-borrowers to pay for replacement of CFC chillers. In this case, IFCT will open a Special Account (SA) in US$. The amount of SA should be equivalent to the disbursement of proceeds to four sub-borrowers equivalent to US $800,000.

IFCT will open a project account in Thai Baht and repayment from the chiller owners will be made to this account. IFCT's administrative fee and the discount (if applicable) for technology shortfall will be withdrawn from this account. If IFCT and the Government decide to implement the follow-on chiller replacement program and approximately US$30 million in addition has been secured, the project account and its outstanding balance may become a revolving fund for chiller replacement (CRF). To minimize the foreign exchange risk, IFCT must manage the currency risk with due diligence. The Special Account, the Project Account, and CRF (if any) will be audited annually by independent auditors mutually acceptable to the Bank and IFCT.

If the proceeds of the loan and any part thereof is used for ineligible purposes as defined in the Loan Agreement, the Bank will require IFCT to either (i) return the amount to the SA to be used for eligible purposes, or (ii) refund the amount directly to the Bank; in which case the Bank will cancel an equivalent undisbursed amount of the loan.

Table C shows the allocation of loan proceeds by category and the disbursement percentages in each category. The estimated disbursements by financial year and the cumulative amounts are shown in the box on Project Financing Data.

Table C: Allocation of Loan Proceeds (in US$ million)

Expenditure Category	Amount ($m)	Financing Percentage
Works (see below)		
Goods and works (supply and install)	4.975	100% excluding taxes and duties
Total Project Costs	4.975	

The project is expected to disburse over a period of about 30 months from date of effectiveness. Disbursement will use traditional disbursement methods. All disbursements against contracts for subproject loans, services for consulting firms costing US$100,000 equivalent or more or individual consultants costing US$50,000 equivalent or more will be fully documented. All contracts below the above thresholds will be made against certified Statements of Expenditures. The documentation supporting SOE disbursements will be retained by the PMU for at least one year after the receipt by the Bank of the audit report for the year in which the last disbursement was made.

Financial Management Assessment

Internal Control System. **The internal control system of the IFCT was reviewed and found acceptable.** The project's internal control system will follow the existing internal control system. The authorization including credit approval procedures will conform to IFCT's existing procedures. The accounting system and internal control procedures will go through the standard IFCT process. The Audit Committee and internal control unit has already been established to oversee auditing and management control. With this structure, it will ensure the credibility and objectivity of the accountability process at the entity and the project.

Project Organization and Staffing. The PMU will be established within the Environment and Energy Development Center of the IFCT and will be responsible for compiling accounting and preparing financial reports for the project in addition to its usual technical monitoring. The PMU key staff have been appointed from existing staff within the Small & Medium Project Finance Department (SMPF) department. They will play a major role in reviewing and monitoring subproject loans to meet the project's objectives. The staff who handle the accounting shall be shared with Human Resource & Information Technology Division while loan withdrawal and disbursement functions staff would be shared with the financial operation department. There is no specific financial management personnel assigned to the project. As such, PMU staff are required to be trained to become familiar with the Bank's guidelines and procedures and shall be responsible for overseeing the transaction processing to ensure its compliance with the Bank's guidelines.

Project Accounting System. The accounting system and procedures cover overall business activities of funding, lending, cash management and credit control. It is deemed to be appropriate for the business needs. The PMU on behalf of the IFCT will maintain the accounts for the loan in accordance with sound accounting practices and will prepare the financial reports specific to the project. The preparation of the reports will be simple without any re-entry into the system. They would be extracted from the IFCT's main books and reconciled with the transactions in the bank statements of the project. A computerized spreadsheet package will be used to generate monthly, quarterly and annual account statements in the formats which are mutually acceptable to the Bank and to IFCT.

For all expenditures with respect to the sub-loans, IFCT will maintain a copy of credit files with supporting documents related to subproject identification, appraisal, supervision and disbursements to chiller owners.

A specific project accounting system and procedures will be designed and documented in the Project Financial Management System Manual for use by the PMU by negotiation.

Financial Reporting. The PMU will prepare a consolidated progress report including financial reports on a semi-annual basis and will provide this to the Bank not later than one month after the end of the 2nd and 4th quarters. The following reports will be produced according to the requirements of the Project Financial Management Manual, Exposure Draft Feb 1999.

(a) Financial Report: Statement 1a: Project Source and Uses of Fund
Statement 1b: Uses of Fund by Project Activity and subloans
Statement 1c: Special Account Statement and Reconciliation
Statement 1d: Project Account Statement and reconciliation
Statement 1e: Subproject Loans Receivable
Statement 1f: Project cash forecast

(b) Project Progress report:

Statement 2a: Output (Loan) Monitoring Report
Statement 2b: Loan Visiting Report or Call Report
Statement 2c: Loan Classification Report

The PMU will prepare annual project financial statements for audit. The required annual audit of financial statements will be carried out according to the Financial Accounting Reporting and Auditing Handbook (FARAH) and will be comprised of:

Statement 1: Annual report of the entity of the IFCT
Statement 2: Project Financial Statements
Statement 3: Special Account and Project Account Statements.
Statement 4: Statement of Expenditure (SOE)

Audit Arrangement. Internal auditors will carry out their responsibilities in auditing project activities including compliance with credit approval, lending criteria, and financial management systems of the project. An independent auditor mutually acceptable to the Bank and IFCT will be appointed to audit all the project accounts.

IFCT's external auditor would be required to provide separate audit opinions on the Special Account (SA), Statement of Expenditures (SOE), and Source and Use of Funds statement, in addition to an opinion on the IFCT's financial statements. The IFCT and Bank will develop a mutually acceptable scope of the audit opinion. The audit reports will be furnished to the Bank not later than six months after the end of each fiscal year.

Financial Management Action Plan. Given that this is a small loan being disbursed in a short period with a large proportion distributed to a small numbers of contracts, the IFCT approach with a set of the following actions is deemed to be appropriate and acceptable.

Actions	Responsibility	Completion Date
a) Establishment of Project Management Unit	IFCT	Completed
b) Appointment of the Project Accountant	IFCT	By Negotiation
c) Establishment of the Project Accounting System	IFCT	By Negotiation
d) Development of the Project Financial Management Manual	IFCT	By Negotiation
e) Appointment of an independent auditing firm acceptable to the Bank	IFCT	By Loan Effectiveness

Annex 7: Project Processing Schedule
THAILAND: Building Chiller Replacement Project

Project Schedule	Planned	Actual
Time taken to prepare the project (months)	16	17
First Bank mission (identification)	02/25/99	02/25/99
Appraisal mission departure	05/15/2000	
Negotiations	09/30/2000	11/29/2000
Planned Date of Effectiveness	04/15/2001	

Prepared by:

The Industrial Finance Corporation of Thailand, IFCT and the Bank.
Time taken to prepare project (months) - excludes the time and efforts used to prepare proposals for the ExCom and GEF Council, which was started in 1997.

Preparation assistance:

Project Preparation Funds from the MLF and GEF

Bank staff who worked on the project included:

Name	Speciality
Manida Unkulvasapaul	Senior Environmental Specialist/Task Leader, EACTF
P. Illangovan	Senior Environmental Specialist/Task Leader, EASES
Chinnakorn Chantra	Procurement Specialist, EACTF
Finn Nielsen	Senior Operations Officer, EASUR
Tanatat Puttasuwan	Financial Officer, EACTF
Nipa Siribuddhamas	Financial Management Specialist, EACTF
Viraj Vithoontien	Environmental Specialist, ENV
Kanchalika Klad-Angkul	Team Assistant, EACTF
Chittrakarn Bunchandranon	Team Assistant, EACTF
Thanaphol Udomthanakij	Team Assistant, EACTF
Robin Broadfield	GEF Coordinator, EASES
Hoi-Chan Nguyen	Senior Counsel, LEGEA
Rosa Muleta	Disbursement Officer, LOAAS
Priya Mathur	Environmental Specialist, EASES
Kumi Kitamori	Environmental Specialist, SASEN

Annex 8: Documents in the Project File*
THAILAND: Building Chiller Replacement Project

A. Project Implementation Plan

- The proposals submitted to the Executive Committee of the Montreal Protocol Investment Fund (July 1998 & November 1998).
- Approval conditions by ExCom
- The proposal submitted to the GEF council (date 1998).
- Approval condition of GEF

B. Bank Staff Assessments

- Inventory of CFC Chillers
- Terms of Reference for the Project Preparation Consultant (PPC)
- Terms of Reference for the Project Management Consultant (PMC)
- Financial Management Review by K. Nipa - May 16, 2000
- Financial Management Assessment: Assessment of IFCT Credit Approval and Credit Management Procedure

C. Other

- The proposal (PAD/GEF) submitted to the GEF CEO in June 1999
- Comments of STAP
- An internal summary note on the pre-PAD meeting (6 April 2000)
- Thailand Code of Good Practice;
- ASHRAE Guidelines

*Including electronic files

Annex 9: Statement of Loans and Credits

THAILAND: Building Chiller Replacement Project

20-Sep-2000

Project ID	FY	Purpose	Original Amount in US$ Millions IBRD	IDA	SF	GEF	Cancel.	Undisb.	Difference between expected and actual disbursements* Orig	Frm Rev'd
P042268	1997	DISTR AUTOM & RELIA	100.00	0.00			0.00	73.98	68.98	63.98
P053616	1998	FIN SEC IMPL ASST	15.00	0.00			0.00	7.39	7.39	0.28
P004800	1996	HIGHWAYS V	150.00	0.00			64.90	48.43	113.33	-7.97
P004799	1995	LAM TAKHONG PUMP STO	100.00	0.00			0.00	18.37	18.37	0.00
P004803	1995	LAND TITLING III	118.10	0.00			0.00	42.83	42.83	0.00
P037086	1997	METROPOL'N DIST REIN	145.00	0.00			30.00	72.20	48.88	0.00
P004791	1996	TH-SEC EDUC QUALITY IMPROV	81.90	0.00			0.00	60.10	56.54	0.00
P056269	1999	TH-SOCIAL INVESTMENT PROJ I	300.00	0.00			0.00	132.82	50.19	0.00
P004793	1996	TH-TECHNICAL EDUCATION	31.60	0.00			0.00	11.88	10.48	0.00
P004805	1997	TH-UNIVERSITY SCIENCE & ENG. EDUC	143.40	0.00			0.00	115.27	81.87	0.00
P056522	2000	THAILAND - PSRL	400.00	0.00			0.00	196.00	114.00	0.00
P054799	1998	THAILAND-ECO MGT IMPLE ASSIST	15.00	0.00			0.00	8.66	8.66	0.00
		Total:	1600.00	0.00			94.90	787.93	621.52	56.29

THAILAND
STATEMENT OF IFC's
Held and Disbursed Portfolio
20-Sep-2000
In Millions US Dollars

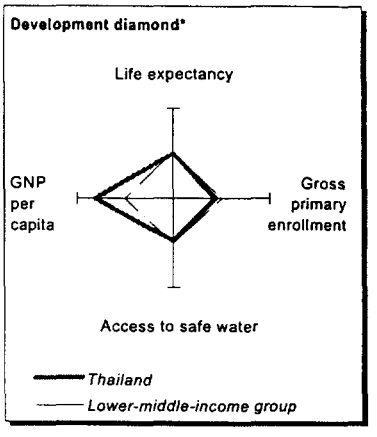
		Committed				Disbursed			
		IFC				IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic	Loan	Equity	Quasi	Partic
1993	Advance Agro	10.00	0.00	0.00	0.00	10.00	0.00	0.00	0.00
1991/93/96/98	Ayudhya Leasing	0.00	0.92	0.00	0.00	0.00	0.92	0.00	0.00
1995/96/98	BTSC	30.00	0.00	0.00	0.00	30.00	0.00	0.00	0.00
1993	Bumrungrad	25.00	1.67	0.00	29.00	25.00	1.67	0.00	29.00
1993	Central Hotel	0.00	13.95	0.00	0.00	0.00	13.95	0.00	0.00
1994	Dhana Siam	14.87	0.00	0.00	2.29	14.87	0.00	0.00	2.29
1995	Finance One	30.00	0.00	0.00	132.40	30.00	0.00	0.00	132.40
1987/96	HMC Polymers	0.00	0.65	0.00	0.00	0.00	0.65	0.00	0.00
1992	Krung Thai IBJ	0.00	0.35	0.00	0.00	0.00	0.35	0.00	0.00
1996	NFS	7.50	0.00	0.00	0.00	7.50	0.00	0.00	0.00
1988	Peroxythai	2.51	0.00	0.00	0.00	2.51	0.00	0.00	0.00
1989	SCB-CKAP	0.00	0.41	0.00	0.00	0.00	0.41	0.00	0.00
1989	SCB-Thai Baroda	0.00	0.78	0.00	0.00	0.00	0.78	0.00	0.00
1984/91	SEAVI Thailand	0.00	1.46	0.00	0.00	0.00	1.46	0.00	0.00
1995	Saha Farms	23.00	9.90	10.00	23.00	23.00	9.90	10.00	23.00
1990	Siam Asahi	0.00	7.56	0.00	0.00	0.00	6.37	0.00	0.00
1993	Star Petroleum	77.68	0.00	0.00	227.50	77.68	0.00	0.00	227.50
1989	TFB-Ladprao	0.00	0.33	0.00	0.00	0.00	0.33	0.00	0.00
1989	TFB-Top Easy	0.00	0.15	0.00	0.00	0.00	0.15	0.00	0.00
1993	TUNTEX	11.28	4.92	0.00	92.00	11.28	4.92	0.00	92.00
1996	Thai Petrochem	76.67	0.00	20.00	383.33	76.67	0.00	20.00	383.33
1995	UPOIC	0.00	1.08	0.00	0.00	0.00	1.08	0.00	0.00
1991	VIM Thailand	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1994	Vinythai	24.52	0.00	0.00	31.96	24.52	0.00	0.00	31.96
	Total Portfolio:	333.03	44.13	30.00	921.48	333.03	42.94	30.00	921.48

		Approvals Pending Commitment			
FY Approval	Company	Loan	Equity	Quasi	Partic
2000	TEF	0.00	0.00	75000.00	0.00
2000	TEF Mgmt. Co.	0.00	0.00	200.00	0.00
	Total Pending Commitment:	0.00	0.00	75200.00	0.00

Annex 10: Country at a Glance

THAILAND: Building Chiller Replacement Project

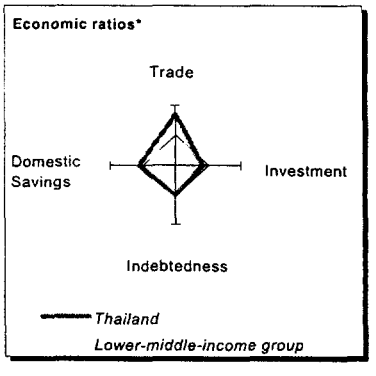
POVERTY and SOCIAL	Thailand	East Asia & Pacific	Lower-middle-income
1999			
Population, mid-year *(millions)*	61.7	1,837	2,094
GNP per capita *(Atlas method, US$)*	1,960	1,000	1,200
GNP *(Atlas method, US$ billions)*	120.9	1,833	2,513
Average annual growth, 1993-99			
Population *(%)*	1.0	1.2	1.1
Labor force *(%)*	0.6	1.3	1.2
Most recent estimate (latest year available, 1993-99)			
Poverty *(% of population below national poverty line)*	16	..	..
Urban population *(% of total population)*	21	34	43
Life expectancy at birth *(years)*	69	69	69
Infant mortality *(per 1,000 live births)*	30	35	33
Child malnutrition *(% of children under 5)*	19	22	15
Access to improved water source *(% of population)*	81	84	86
Illiteracy *(% of population age 15+)*	5	15	16
Gross primary enrollment *(% of school-age population)*	99	119	114
Male	..	121	114
Female	..	121	116



KEY ECONOMIC RATIOS and LONG-TERM TRENDS

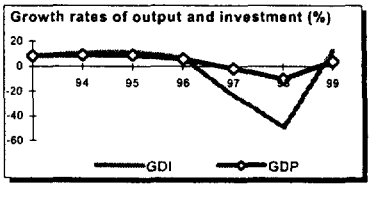
	1979	1989	1998	1999
GDP *(US$ billions)*	27.4	72.3	112.1	124.3
Gross domestic investment/GDP	27.2	35.1	18.7	21.6
Exports of goods and services/GDP	22.6	34.9	58.6	57.1
Gross domestic savings/GDP	20.5	32.5	34.6	33.4
Gross national savings/GDP	19.6	31.6	34.6	30.2
Current account balance/GDP	-7.6	-3.5	12.9	9.1
Interest payments/GDP	1.2	1.5	3.4	2.6
Total debt/GDP	24.3	32.6	93.7	76.9
Total debt service/exports	19.7	16.4	18.6	19.7
Present value of debt/GDP	..	..	76.1	..
Present value of debt/exports	..	..	119.8	..

	1979-89	1989-99	1998	1999	1999-03
(average annual growth)					
GDP	6.8	5.4	-10.2	4.2	5.0
GNP per capita	4.8	4.0	-11.6	4.1	4.0
Exports of goods and services	12.5	10.0	6.7	8.9	9.0

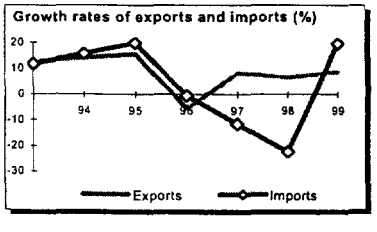


STRUCTURE of the ECONOMY

	1979	1989	1998	1999
(% of GDP)				
Agriculture	24.0	15.1	13.4	11.6
Industry	30.3	36.3	37.4	41.7
Manufacturing	21.0	26.7	29.2	..
Services	45.7	48.7	49.2	46.7
Private consumption	67.5	58.0	54.6	55.6
General government consumption	12.0	9.5	10.8	11.0
Imports of goods and services	29.3	37.5	42.7	45.3



	1979-89	1989-99	1998	1999
(average annual growth)				
Agriculture	4.0	2.3	-1.4	2.6
Industry	8.5	6.6	-13.2	7.8
Manufacturing	8.0	8.3	-10.8	..
Services	6.6	5.2	-9.5	1.5
Private consumption	5.3	5.0	-12.3	2.9
General government consumption	4.5	5.4	1.9	2.8
Gross domestic investment	7.1	-0.2	-49.3	12.6
Imports of goods and services	8.0	6.3	-22.3	19.6
Gross national product	6.6	5.2	-10.8	4.9



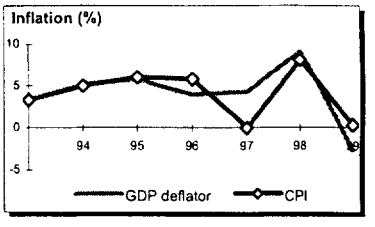
Note: 1999 data are preliminary estimates. This table was produced from the Development Economics central database.

This table was produced from the Development Economics central database.

* The diamonds show four key indicators in the country (in bold) compared with its income-group average. If data are missing, the diamond will

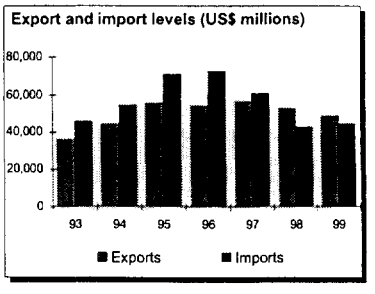
PRICES and GOVERNMENT FINANCE

	1979	1989	1998	1999
Domestic prices				
(% change)				
Consumer prices	..	5.4	8.1	0.3
Implicit GDP deflator	8.6	6.1	9.2	-2.6
Government finance				
(% of GDP, includes current grants)				
Current revenue	13.7	17.0	15.5	15.2
Current budget balance	0.7	5.1	4.7	2.8
Overall surplus/deficit	-3.2	2.9	-3.3	-4.7



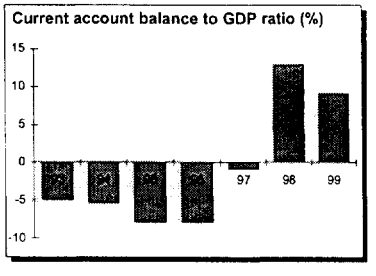
TRADE

	1979	1989	1998	1999
(US$ millions)				
Total exports (fob)	5,234	19,834	52,873	49,098
Rice	764	1,779	2,099	1,963
Rubber	605	1,034	1,340	1,012
Manufactures	..	13,091	42,323	49,612
Total imports (cif)	..	25,823	42,895	44,710
Food	..	..	1,774	1,804
Fuel and energy	..	2,325	3,159	4,364
Capital goods	..	..	19,747	22,602
Export price index *(1995=100)*	..	106	96	91
Import price index *(1995=100)*	..	88	97	98
Terms of trade *(1995=100)*	..	120	99	93



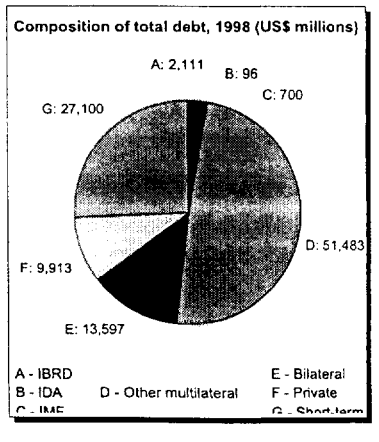
BALANCE of PAYMENTS

	1979	1989	1998	1999
(US$ millions)				
Exports of goods and services	6,269	25,291	66,400	71,485
Imports of goods and services	8,137	27,127	48,813	57,577
Resource balance	-1,868	-1,836	17,587	13,907
Net income	-278	-908	-3,571	-2,945
Net current transfers	60	246	419	383
Current account balance	-2,086	-2,498	14,434	11,346
Financing items (net)	2,050	7,511	-18,890	-16,556
Changes in net reserves	36	-5,012	4,456	5,210
Memo:				
Reserves including gold *(US$ millions)*	3,129	10,509	29,536	34,800
Conversion rate *(DEC, local/US$)*	20.4	25.7	41.4	37.8



EXTERNAL DEBT and RESOURCE FLOWS

	1979	1989	1998	1999
(US$ millions)				
Total debt outstanding and disbursed	6,645	23,537	105,000	95,600
IBRD	552	2,271	2,111	2,723
IDA	28	110	96	93
Total debt service	1,310	4,399	13,261	15,012
IBRD	66	613	294	330
IDA	0	2	1	4
Composition of net resource flows				
Official grants	59	178	68	..
Official creditors	431	55	1,094	3,218
Private creditors	922	1,625	-1,458	..
Foreign direct investment	55	1,776	6,941	5,745
Portfolio equity	0	1,426	2,341	809
World Bank program				
Commitments	213	177	390	1,000
Disbursements	143	164	453	806
Principal repayments	22	410	191	183
Net flows	121	-247	262	623
Interest payments	45	205	104	150
Net transfers	76	-452	158	473



Note: This table was produced from the Development Economics central database. 9/12/00

Additional
Annex 11

Technical Protocol and Eligible Criteria
Thailand: Building Chiller Replacement Project

Background

This annex presents the technical protocol and eligibility criteria to be considered during the selection of the 24 subprojects. The technical protocol is designed to address and overcome the key market barriers that prevent widespread adoption of new high efficiency building chillers and to promote early retirement of the existing CFC chillers. Experience gained from this project will be used for improving the design of the follow-on project.

Type of Chillers

Water chillers cool water, or a water/antifreeze mixture, which is then pumped through a heat exchanger in an air handler or fan-coil unit for cooling and dehumidifying air. This project will consider all commercially available high efficiency non-CFC centrifugal chillers, and support only replacement options that promise the least impact on global warming. These options should be technically feasible and economically viable. As centrifugal chillers are commonly used in Thailand, the project will focus on centrifugal chillers (vapor compression type) using CFCs, HFCs, or HCFCs refrigerants. Market reviews based on Total Equivalent Warming Impacts (TEWI) indicate that CO_2 and ODP reduction targets will be achievable, even if refrigerant replacements with remaining GWP, such as HFC 134a, have to be used because of the lack of better alternatives. The new chillers to be installed under this project would have the least TEWI feasible under current conditions. The final selection of the refrigerant type for each CFC chiller to be replaced will be made after thorough case-by-case assessments are done.

While technical protocol and OM are desgined specifically for replacement of CFC chillers with other non-CFC vapor-compression chillers, other types of chillers (i.e. absorption-cycle chillers) should also be considered as potential technology for this project if they offer similar or better energy savings (IFCT and DIW will decide whther provisions regarding technical shortfalls should apply to this technology).

Centrifugal Chillers

Distribution. As of 1999, there are about 1,400 CFC chillers identified in various types of buildings in Thailand. Of these, about 76% (1,000 units) have capacity of 300-500 TR or more and their age ranges from 6 to 37 years. Of these large-capacity chillers, about 44% (444 units) are used in textile and other industries, 19% (200 units) in hotels, 18% (192 units) in department stores, 18% (188 units) in offices, and the remaining 3% are used in hospitals (28 units) and state enterprises (7 units). Detailed profiles of existing chillers in Thailand are available in the project file.

Application	No. of Chillers Installed by Capacity and Year of Installation						Summary		
	>500 Tons		300 - 500 Tons		< 300 Tons				
	<15 Years	>15 Years	<15 Years	>15 Years	<15 Years	>15 Years	<15 Years	>15 Years	Total
Textile	83	34	106	66	9	41	198	141	339
Industry	43	10	73	29	34	27	150	66	216
Hotel	79	22	78	22	40	44	197	88	285
Hospital	2		20	6	9	14	31	20	51
Offices	63	17	89	19	39	41	191	77	268
Department Store	64	20	84	24	7	14	155	58	213
State Enterprise	1	5	1		5	14	7	19	26
	335	108	451	166	143	195	929	469	1398

Technical Characteristics and Performance. Centrifugal compressor chillers are the most efficient technology in their range of applications, from 100 to 10,000 refrigerated tons. Water chillers employing these compressors are designed for specific refrigerants. The traditional refrigerants were CFC-11, CFC-12, HCFC-22 and R-500.

CFC-11 and CFC-12 are being replaced by HCFC-123 and HFC-134a, respectively. Chillers employ all three of these refrigerants with power consumption ranging from 0.65 kW/tons to 0.55 kW/tons. Manufacturers have made further improvements in power consumption. The most efficient products in the market in 1998 have power consumption of less than 0.47 kW/ton at standard rating conditions. This rated power consumption can vary depending on ambient conditions and load characteristics of the building. In addition, to achieve the design performance chillers must be properly installed and maintained.

To demonstrate energy savings of the new non-CFC chillers, the LIL project is designed to address the following factors:

- Proper equipment selection
- Proper installation
- Proper maintenance.

Methodology for Evaluating Energy Consumption of the Chillers

The rated energy consumption (kW/TR) provided by the chiller suppliers, as pointed out earlier, is normally the value under certain designated conditions. Under other operating conditions, however, energy consumption may vary from this rated value. To achieve expected energy savings, proper parameters and a methodology that take into account actual operating conditions of each chiller should, therefore, be used in the chiller selection process. The proposed methodology should be practical and contain key parameters that will enable sub-borrowers to make an informed decision in investing in a new high efficiency non-CFC chiller.

Measurement of Power Consumption of Existing CFC Chillers. This should be carried out in accordance with the following procedures and witnessed by representatives of IFCT or its appointed consultant team. At the time, IFCT will inspect the sites in order to determine any physical and technical

constraints (such as passage ways, conditions of water pumps, cooling towers and safety equipment). This information will form a part of the criteria when evaluating replacement proposals of sub-borrowers.

Electrical and thermal parameters should be measured at the ambient conditions prevailing at the sites. Measurement should be made at two operating conditions:

- Condition 1: at 90 – 100% of full load current
- Condition 2: at the operating condition about 10% lower than Condition 1.

At least seven data sets for each condition should be collected. Each data set should be collected five minutes apart. For each measurement made, the following data should be recorded: voltage, current, power factor, and kW input. The measurement of these electrical parameters must be done at the main electrical feeder of that particular chiller. In addition, the following thermal parameters must be collected: chilled water flow rate, chilled water temperature at inlet and outlet.

The chilled water flow rate of existing chillers should be made by an ultrasonic liquid flow meter. The set-up of this measurement device should be done in accordance with the recommendation of the manufacture of the flow meter. *The chilled water flow rate should be measured on the inlet side and in gallon per minute (GPM).* Measurement of chilled water flow rate of the outlet side is only allowed when the measurement on the other side is not possible.

To measure temperature of inlet and outlet chilled water, the measurement should be done at the locations where thermometers for inlet and outlet chilled water are currently located. Temperature should be recorded in degrees Farenheit ($^{\circ}$F).

Cooling load is, then, determined by the following equation:

$$\text{Cooling Load (RT)} = \frac{\text{Flow Rate x (Inlet Temp. – Outlet Temp.)}}{24}$$

where:

Cooling Load	=	refrigerated ton (RT) with 1 RT = 12,000 British Thermal Unit;
Flow Rate	=	gallon per minute (GPM)
Inlet/Outlet Temp.	=	$^{\circ}$F

Data sets should, then, be filled in Table shown below:

Time	Temp (°F)		Flow Rate	Cooling Load	Energy
	Inlet	Outlet	(GPM)	(RT)	(kW)
@ 90 - 100% of Full Load Current					
0:00					
0:05					
0:10					
0:15					
0:20					
0:25					
0:30					
@ 10% Reduction From Above Condition					
0:00					
0:05					
0:10					
0:15					
0:20					
0:25					
0:30					
Average				Σ/14	Σ/14

Average power consumption (kW/RT) is, therefore, equal to:

kW/RT = kW average / RT average

where kW average = sum of kWs of the 14 data points divided by 14;
RT average = sum of RTs of the 14 data points divided by 14.

Power Consumption of New Non-CFC Chillers

The rated power consumption (kW/ton) of new non-CFC chillers, as stated in the specification, must be based on the recommended operating conditions at the site where the existing CFC chillers will be replaced. Power consumption of new non-CFC chillers shall be measured by employing the same methods used for measuring power consumption of existing CFC chillers as described above.

When installing a new non-CFC chiller, a separate power meter (kW meter) or a data logger should be installed to continuously monitor energy consumption of the new unit. sub-borrowers or chiller suppliers will be required to collect the real-time data of the existing CFC chiller based on the methodology similar to the above or any other equivalent methodology to be proposed by IFCT. All chiller replacement proposals are to take into consideration the performance of existing chilled water plants to ensure optimal cooling performance of the new air-conditioning systems.

Guidelines and Standards for Chiller Installation and Maintenance

To ensure that new chillers perform as designed by their manufacturers, installation and maintenance of these new units must be carried out in accordance with industrial standards. The proposed replacement project should be presented on a turn-key basis. That means the scope of replacement should include design, engineering, manufacturing, procurement, transportation, dismantle of existing chillers, installation of new chillers, start-up and commissioning, performance test, and maintenance contract for a two year period after commissioning. Suppliers that participate in the LIL project are required to follow the safety standard of the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE 15-1994) and either ASHRAE Guideline 3-1996 or the Code of Good Practice jointly developed by the DIW, the Thai chiller suppliers and the United Nations Environment Programme (UNEP). The Thai Code of Good Practice and ASHRAE Guideline 3-1996 and ASHRAE 15-1994 are included in the project file.

Eligibility Criteria for Chiller Selection

The basic eligibility criteria should include the principal conditions approved by the GEF and MLF. Additional criteria will be needed to ensure compliance with Bank operational policy and to reduce the project risks. As the project funding of US$4.975 million provided by the GEF/MLF is sufficient for replacing about 24 chillers, the demand is anticipated to exceed existing resources. IFCT, assisted by its technical consultant, will finalize the eligibility criteria and the selection process in close consultation with the Government, the Bank, and the potential sub-borrowers. Agreements should be reached during appraisal.

The following criteria will be used for screening of subprojects:

- The existing chillers have CFCs as refrigerants
- Energy consumption of the existing chillers is not less than 0.8 kW/TR
- Energy consumption of the new non-CFC chillers does not exceed 0.63 kW/TR
- Funding priority is given to chillers with cooling capacity of 500 TR or more, and preferably in operation not more than 15 years
- Funding priority is given to the subprojects that have the shortest payback period
- The appraisal of the financial status of sub-borrowers is satisfactory
- Interest, committment and willingness of sub-borrowers to participate in the program
- Hold legal status of the buildings
- sub-borrowers agree to comply with the technical protocol and actively participate in the project
- All chiller replacement proposals are to take into consideration the performance of existing chilled water plants to ensure optimal cooling performance of the new air-conditioning systems
- Installation and maintenance of new chillers must be done by qualified technicians and in accordance with ASHRAE 15-1994, and ASHRAE Guideline 3-1996 or the Thai Code of Good Practice.

Maintenance Contract

A maintenance contract for a period of two years, in addition to a one-year manufacturer warranty, from the commissioning date is mandatory for all chiller replacement under this project. It should cover preventive maintenance as recommended by chiller manufacturers. Maintenance contracts should include a requirement for chiller suppliers that provide these services to measure power consumption of the new chiller on a monthly basis. When providing routine preventive maintenance as required by the maintenance contract, chiller suppliers will also evaluate performance of other systems that may affect performance of the chiller unit (conditions of chilled and condensing water, water pumps and other accessories).

Performance Guarantee

At Commissioning. At commissioning, the procedures for measuring power consumption described above should be followed. If power consumption (kW/TR) measured during commissioning exceeds the value agreed in the proposal by more than 5%, chiller suppliers are obliged to rectify the problem and ensure that power consumption remains within the agreed limit within 30 days. If the problem cannot be rectified within 30 days, the most recent power consumption measured during commissioning will be used for recalculating energy savings and the level of monthly repayment. The method to calculate energy savings and the level of monthly repayment is described in the OM. sub-borrowers should be compensated for the loss in energy savings at the amount equal to the difference between the monthly repayment in the proposal and the revised monthly repayment times the payback period (number of months). As no payments will be made to chiller suppliers until 30 days after commissioning is completed, the amount to be compensated to sub-borrowers, in case the new chiller could not deliver power consumption as indicated in the proposal, should be automatically deducted from the final amount to be paid to chiller suppliers. However, the amount to be deducted should not exceed *six times the monthly repayment*. The balance should be paid by MLF and GEF.

If power consumption of new non-CFC chillers exceeds the expected value due to sub-borrowers' failure to provide ambient conditions as agreed in the proposal, no compensation will be given to sub-borrowers.

After Successful Commissioning. Chiller suppliers must provide a bank guarantee for a period of two years after the date of commissioning. A bank guarantee shall have a total value of at least three times the monthly repayment. The bank guarantee can be redeemed by sub-borrowers providing that conditions set forth in the verification process are met. sub-borrowers should be allowed to cash in on the bank guarantee providing that there is a written notification from chiller suppliers or the independent consultant appointed by DIW. Under this performance contract, chiller suppliers guarantee that power consumption of new chillers at the operating conditions specified in the project proposal and at the time of commissioning, will not exceed the level defined in the project proposal by more than 5%.

As part of the maintenance contract, chiller suppliers are required to measure power consumption of their new chillers on a monthly basis. If there is any indication that performance of the new chiller is deteriorating, proper measures should be carried out to restore its performance within 7 days. If it takes longer to restore performance of the chiller to within 5% of its initial performance as stated in the proposal, chiller suppliers shall notify sub-borrowers and agree in writing that sub-borrowers can claim compensation for that particular month from the bank that issues a bank guarantee for that particular chiller supplier. The letter from the chiller suppliers should indicate the amount that sub-borrowers can claim from the issuing bank.

Dispute Settlement. In case of any dispute on the actual power consumption, sub-borrowers can request an independent evaluation to be conducted by a consultant team appointed by DIW. Costs of this independent consultant team should be borne by sub-borrowers. sub-borrowers and chiller suppliers must state their agreement in the project proposal and all relevant legal documents that they will accept the findings and recommendations of the independent consultant as final. The independent consultant shall provide its findings in writing to sub-borrowers and chiller suppliers once the assessment process is completed. In case compensation needs to be made to sub-borrowers, the independent consultant shall ensure that its report will include the amount that sub-borrowers can claim from the bank that issues the bank guarantee.

Technical Shortfalls

At Commissioning. If power consumption of the new chiller measured at the commissioning time exceeds

the level agreed in the proposal and/or contracts by more than 5%, chiller suppliers are required to rectify the problem within 30 days. If power consumption cannot be restored to the agreed level within 30 days, this new chiller should be considered as a unit with technical shortfalls. If these shortfalls lead to a loss of savings more than six times the monthly repayment, the exceeded amount should be paid to sub-borrowers by MLF and GEF. IFCT will render this compensation as a one-time rebate to sub-borrowers. sub-borrowers are still required to make monthly payments as scheduled in the original proposal. In this case chiller suppliers are no longer responsible for providing any maintenance services.

After Successful Commissioning. If power consumption of new chillers after commissioning deteriorates more than 5% of the level agreed to in the proposal, sub-borrowers can claim compensation from chiller suppliers through the mechanism described above. However, if the power consumption deficiency becomes a recurrent problem and the cumulative compensation resulting from the inferior performance of the new chiller exceeds the value of the bank guarantee, the new chiller installed at that site should be considered as a unit with technical shortfalls. IFCT will, therefore, make a one-time rebate to sub-borrowers. The amount to be rebated is determined by multiplying the difference in the level of monthly energy savings with the cost of electricity and the number of the remaining monthly installments. Once any chillers are declared as having technical shortfalls, chiller suppliers for the chillers concerned are no longer obliged to provide any maintenance services.

Compensation for technical shortfalls can be made only within the first two years after commissioning.

Cash-Flow Analysis

Cash-flow of subprojects. sub-borrowers (assisted by chiller suppliers) will be required to provide a cash-flow analysis in their proposals. The analysis for determining the level of savings per month after installation of new high efficiency chillers should follow the methodology elaborated in the OM. A repayment schedule will then be established on the basis of a fixed level of monthly savings determined by this analysis. Only those proposals with a repayment period of not more than 48 months should be eligible for financing under this project.

Cash-flow of the Overall Project. To select the subprojects, IFCT will carry out the overall cash flow analysis to ensure that the project budget is sufficient and the repayment period is appropriate. The project assumption used in the preliminary cash flow analysis (Annex 4) should be constantly checked.

Guidelines for Selection of Suppliers and Contractors

Only suppliers and contractors that meet these guidelines will be qualified to participate in this project. The proposed guidelines should include, but not be limited to, the following conditions:

- Installation, commissioning, and after sales service including routine maintenance shall be carried out by technicians certified by the United States Environmental Protection Agency or other equivalent agencies;
- Suppliers and contractors must follow ASHRAE Guideline 3-1996 or the Code of Good Practice adopted by the Thai chiller suppliers, the Ministry of Industry, and UNEP's Regional Office for Asia and the Pacific, and ASHRAE 15-1994;
- Suppliers and contractors must have proper refrigerant recovery and recycling facilities;
- Suppliers and contractors must guarantee delivery and performance of their equipment; they are required to provide sub-borrowers with a performance bond at a value agreed with the sub-borrowers and acceptable by IFCT.

Selection of the 24 subprojects

Overall Process. The following tasks have been or are being undertaken to identify potential chillers to be replaced under the LIL project. The IFCT, as an implementing agency for this project, a technical consultant team has been appointed by IFCT to assist in preparation of the project. A separate funding source is being used to finance the cost of this consultant team. The team is carrying out, among other tasks, preparation of a pro-forma project proposal.

With assistance of the consultant team, IFCT has initiated a series of project preparation activities to inform key stakeholders and invite eligible sub-borrowers to participate in this project. A workshop to inform sub-borrowers and stakeholders of this chiller replacement project was organized by IFCT. Sub-borrowers were requested to provide information pertaining to their chillers and their business entities in the questionnaires prepared by the consultant team. To date, more than 30 questionnaires have been returned to IFCT. It is expected that more than 50 questionnaires will be received before appraisal.

The selection process includes, but is not limited to, the following steps: (i) preparation of clear eligibility criteria and procedures; (ii) identification of 40-50 qualified subprojects, (iii) preparation and submission of the subproject proposals by the qualified sub-borrowers; (iv) appraisal and selection of about 24-30 priority subprojects; and (v) negotiation of the sub-loan agreements. It is expected that the subprojects will be selected in a series of four groups (about 6 chillers each). Specific conditions for project effectiveness are given in Annex 2.

Main Tasks. The main activities and their implementation procedures are described in the OM. The OM is available in the project file.

Additional
Annex 12

Energy and Cost Savings of Chillers Summary Table

	Existing Chiller Unit	New Chiller Unit	Savings/Difference (1 chiller)
Cooling Capacity	500.00	500.00	
Energy Consumption (kW/ton)	0.90	0.63	0.27
Operating Hours (hrs/yr)*	6,480.00	6,480.00	
Energy Consumption (kWhrs/yr)	2,916,000.00	2,041,200.00	874,800.00
Unit Cost of Electricity (Baht/kWh)	2.20	2.20	
Operation Cost (Baht/yr) **	6,415,200.00	4,490,640.00	1,924,560.00

Average cost of new chiller (including shipping, and maintenance)	7,423,560.00	Baht
Operation Cost Savings (24 chillers)	46,189,440.00	Baht/yr
Energy Consumption Savings (24 chillers)	20,995,200.00	kWhrs/yr

* Based on operation of 18hrs/day

** Assuming maintenance cost is the same for both old and new chillers. Higher cost of new refridgerant in new chillers offsets the costs of higher maintenance in old chillers

Additional
Annex 13

Disposal and Safety Requirements of CFC Building Chillers

Disposal of CFC Building Chillers

Proposals for building chiller replacement must include an equipment destruction plan to ensure that existing CFC chillers, particularly compressors, will be dismantled and rendered unusable. Any components to be retained by sub-borrowers as spare parts for servicing remaining CFC chillers within the building or to be sold as scrap, shall be listed in the plan. Destruction of key components (i.e. compressors) should be done not later than successful commissioning of new non-CFC chillers and should be witnessed by IFCT and/or DIW or their respective representative(s).

After commissioning of new non-CFC chillers is completed, a final report on the equipment destruction must be provided by chiller suppliers to IFCT or its representative(s).

The proposal should clearly describe how CFC refrigerant in the existing CFC chiller will be recovered, recycled or reused. The quantity of CFCs recovered from the replaced unit shall be recorded and submitted to IFCT or its representative(s) as part of its equipment destruction report. Sub-borrowers will develop an inventory of recovered CFCs. This inventory should be updated and reported to IFCT on an annual basis. In case sub-borrowers decide to sell all recovered CFCs to chiller suppliers at the time of new chiller installation, chiller suppliers will be responsible for submission of the annual report on the inventory of recovered CFCs. IFCT will share this report with DIW.

Installation, testing, operations and maintenance of new non-CFC chillers, and disposal of CFC equipment and systems must strictly follow procedures and practices recommended by AHSRAE Guideline 3 - 1996 "Reducing Emission of Halogenated Refrigerants in Refrigeration and Air-Conditioning Equipment and Systems," or the code of good practice adopted by the Thai chiller suppliers, the Ministry of Industry, and UNEP's Regional Office for Asia and the Pacific.

Sample Disposal Plan for CFC Building Chillers

Name of Chiller Supplier/Contractor:
Name of Chiller Owner:
Description/Information related to replaced unit:

Table A13-1: Disposal of Equipment

LIST OF EQUIPMENT RENDERED UNUSABLE (the baseline)*		IMPLEMENTED		
Name of Equipment	Description**	Disposal Type ***	Date of Disposal	Certified by:
Sample: Trane Compressor	Compressor Model No. xxxx Serial No. zzzz	Destroyed	11/15/2000	

*List of equipment to be destroyed (including compressors, condenser evaporator, purge system, control devise, others), scrapped, and used as spare parts
** Description should include model and serial numbers where applicable
***Type of equipment disposal

Table A13-2: CFC Recovery

CFC Type and Amount	Approximate Charge	Amount Recovered	Amount Reusable	Unusable Amount	Storage Location of Reusable CFCs*	Storage Location of Unusable CFCs*	Certified by:
Sample: CFC-11	500kg	400kg	300kg	100kg	xx street, Bangkok, Thailand	xx street, Bangkok, Thailand	

*Specify owner of refrigerant (sub-borrower, chiller supplier)

Safety Requirement for Design, Construction, Installation, and Operation of Refrigerating Systems

Chiller suppliers are required to abide to safety standard prescribed by ANSI/ASHRAE 15 - 1994. This standard is directed toward the safety of persons and property on or near the premises where refrigeration facilities are located. This includes specifications for fabrication of tight systems but does not address the

effects of refrigerant emissions on the environment. The effects of refrigerant emissions on the environment are address by ASHRAE Guideline 3 - 1996, and the Thai Code of Good Practice mentioned above.

The safety standard ANSI/ASHRAE 15 - 1994 covers restrictions on refrigerant use for different types of occupancy classification and prescribes system application requirements, including detectors (refrigerant, oxygen, etc.) and ventilation systems, for various applications. It also prescribes, among others, general requirements for refrigerating machinery rooms; signs and identification; charging, withdrawal, and disposition of refrigerants; refrigerant storage; periodic tests of detector(s), alarm(s), and mechanical ventilating systems, to ensure safety of persons and property.

Additional
Annex 14

Replication Strategy and Criteria for Initiation of the Follow-on Program

Replication Strategy

The replication strategy includes removal of market barriers to early replacement of CFC building chillers, information dissemination, and market development for future CFC chiller replacement.

Barrier Removal

The development of the Thailand Building Chiller Replacement project is based on the assumption that the following barriers have to be removed before widespread replacement of old CFC chillers can take place:

- Uncertainty of actual energy efficiency of new non-CFC chiller technology in the Thai market
  The design of the project focuses on establishing an agreed method for measuring performance of existing and new non-CFC building chillers. Contract conditions for the performance guarantee have been carefully designed by this project to have both chiller owners and chiller suppliers share responsibilities in ensuring that the new non-CFC chillers are well-maintained and the environment where new non-CFC chillers are installed is kept at the designed conditions. By doing so, this project will help remove the uncertainty of whether the performance of the new chillers achieved in developed countries can be similarly attained under the climatic conditions prevailing in Thailand.

- Limited technical capacity on chiller design and maintenance
  Contract conditions for the performance guarantee designed by this project also provide incentives for chiller owners and chiller suppliers to ensure that their technicians are adequately trained for the job.

- High up-front investment cost of new chillers and limited access to commercial credit.
  The barrier of a high up-front investment cost of new chillers and limited access to commercial credit is due partially to the lack of awareness of domestic lenders of the potential market for energy efficiency investments. To overcome this barrier, the project is designed to ensure early and full participation of IFCT and NEPO, which are potential sources of funding for a larger-scale chiller replacement project.

Information Dissemination

Once barriers related to technology are addressed, the replication strategy should focus on how to disseminate success and lessons learned from this project to a wider audience. Proposed information dissemination activities include:

- Develop fact sheets for all new non-CFC chillers replacements under this project
- Review the effectiveness of performance guarantee requirements
- Organize semi-annual workshops to inform stakeholders and potential beneficiaries of future chiller replacements, of the progress and lessons learned from this project
- Organize a series of workshops for management levels of potential beneficiaries in each CFC chiller application, in order to provide sector-specific information to promote CFC chiller replacement
- Publish articles related to this project in technical journals, newspapers, and other media
- Produce posters, pamphlets, computer simulation programs demonstrating costs and benefits of CFC chiller replacement

- Design and implement public awareness on energy conservation in large buildings and factories. This activity will be carried out in close coordination with the on-going programs in Thailand such as the Green Leaf Program and the Green Building Program.

Market Development

To facilitate the replication of this project on a larger scale, the following activities will be undertaken:

- Develop a database of existing CFC chillers installed in Thailand
- Develop marketing tools and strategies focusing on owners of chillers identified by the above database and financial institutions that could be potential lenders for future CFC chiller replacement
- Develop financial plans to support implementation of the follow-on program.

Criteria for Initiation of the Follow-on Program

Within three years after project effectiveness, an evaluation will be undertaken jointly by IFCT and DIW. A proposal for securing additional funds from the ECF or other sources, to support the follow-on program, will be submitted to relevant agencies, if the result of the evaluation indicates that the following criteria have been met. (The Government of Thailand has already agreed in principle that energy conservation through the CFC Chiller Replacement Program should be supported by the Energy Conservation Promotion Fund.) The evaluation criteria are:

- All non-CFC chillers installed under the pilot project meet all the technical requirements set by this project. Any dispute related to performance of new non-CFC chillers is resolved by the dispute resolution established under this project;
- Energy savings generate an internal rate of revenue of at least 15%;
- At the time of undertaking the evaluation, there is an expressed interest of having an additional 80 CFC chillers replaced under a similar or equivalent scheme.