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Report No. _____

PROJECT DOCUMENT

FOR A

PROPOSED GRANT FROM THE GLOBAL ENVIRONMENT FACILITY TRUST FUND IN THE AMOUNT OF US$ 2.6 MILLION TO

AND A

PROPOSED GRANT FROM THE MULTILATERAL FUND FOR THE IMPLEMENTATION OF THE MONTREAL PROTOCOL IN THE AMOUNT OF $1 MILLION

Philippines

IN SUPPORT OF

THE CHILLER ENERGY EFFICIENCY PROJECT

February 26, 2010

CURRENCY EQUIVALENTS
(Multiple) Currency Unit=US$

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

ANSI	American National Standards Institute
ASHRAE	American Society of Heating, Refrigerating and Air-conditioning Engineers
BEE	Bureau of Energy Efficiency
CDM	Clean Development Mechanism under the Kyoto Protocol
CDM DOE	Clean Development Mechanism Designated Operational Entity
CDM EB	Executive Board of the Clean Development Mechanism
CE	Coordinating Entity
CEEP	Chiller Energy Efficiency Project
CER	Certified Emission Reduction
CF	Carbon Finance
CFC	Chlorofluorocarbon
CO	Carbon Monoxide
CO_{2e}	Carbon Dioxide Equivalent
COA	Commission on Audit
CPA	Clean Development Mechanism Program of Activities
DENR	Department of Environment and Natural Resources
DNA	Designated National Authority
DOE	Department of Energy
EIRR	Economic Internal Rate of Return
EMB	Environmental Management Bureau
EMF	Environmental Management Framework
EMP	Environmental Management Plan
ERPA	Emission Reductions Purchase Agreement
ERTA	Emissions Reduction Transfer Agreement
ESCOs	Energy Services Companies
ExCom	Executive Committee of the Multilateral Fund
FASPO	Foreign-assisted and Special Projects Office
FI	Financial Intermediary
FMIS	Financial Management Information System
GEF	Global Environment Facility
GHG	Greenhouse Gas
GOP	Government of the Philippines
GDP	Gross Domestic Product
GWP	Global Warming Potential

HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
IAs	Implementing Agencies
ICB	International Competitive Bidding
IFR	Interim Financial Report
IPCC	Intergovernmental Panel on Climate Change
IRR	Internal rate of return
KfW	Kreditanstalt für Wiederaufbau (German Reconstruction Bank)
KP	Kyoto Protocol
Kw	Kilowatt-hour
kw/TR	Kilowatt-hour per ton of Refrigeration
MOA	Memorandum of Agreement
MIS	Management Information Systems
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MM	Measurement and Monitoring
MM&V	Measurement, Monitoring and Verification
MoEF	Ministry of Environment and Forests
MOU	Memorandum of Understanding
MP	Montreal Protocol on Substances that Deplete the Ozone Layer
MT	Metric tons
MW	Megawatt
MWh	Megawatt-hour
NCCoPP	National CFC Consumption Phase-out Plan
NOx	Nitrous Oxides
NPV	Net Present Value
ODP	Ozone Depleting Potential
ODS	Ozone Depleting Substance
PIP	Project Implementation Plan
PoA	Program of Activities
PBD	Philippine Bidding Documents
PCR	Project Completion Report
PMC	Project Management Contractor
POD	Philippine Ozone Desk
PSU	Public Sector Undertaking
R11, R12, R22,	Refrigerant-11, Refrigerant-12, Refrigerant-22
R123, R134a	Refrigerant-123, Refrigerant-134a
RAC	Refrigeration and Air Conditioning
RFP	Request for Proposal
RMP	Refrigerant Management Plan
SME	Small and Medium Enterprise
SGA	Sub-grant Agreement
SOx	Sulphur Oxides
tCO_2e	tonnes of CO_2
TA	Technical Assistance
TR	Ton of Refrigeration, a unit of measure equivalent to 12,000 BTU/hour

UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNIDO	United Nations Industrial Development Organisation
US EPA	United States Environmental Protection Agency
VER	Verified emission reduction

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Philippines:
Chiller Energy Efficiency Program

I. STRATEGY CONTEXT AND RATIONALE

A. Country and Sector Issues

1. **Country Obligations under the Montreal Protocol.** The Philippines has made great progress in phasing out the consumption of chlorofluorocarbons (CFCs) (used in the Refrigeration and Air-conditioning (RAC) sector and other sectors) over the last ten years since 1999 in accordance with its obligations to the Montreal Protocol (MP) on Substances that Deplete the Ozone Layer**.** The MP mandates a complete phase-out of production and consumption[1] of new Ozone Depleting Substance (ODS)[2] in developing countries by January 1, 2010 and countries are requested to develop measures for the effective use of the ODS recovered from the chillers to meet servicing needs in the RAC sector[3]. The Philippines is neither a producer nor an exporter of CFCs. It has banned CFC-11 importation since 2005 and presently imports CFC-12. As of the end of 2007, the Philippines has phased out 2**,**847 MT of CFC, or 94% of its baseline consumption. It also intends to meet the MP total CFCs consumption phase-out deadline on January 1, 2010.

2. **Inefficiency of Old CFC-based and non CFC-based Chillers.** A chiller is the primary component in a refrigeration or air conditioning system. It produces chilled water through heat transfer by circulating a primary refrigerant medium (CFC, HCFC[4], HFC[5], NH3[6]) in pipe circuits or heat exchangers to a secondary refrigerant, usually water or water plus glycol (called chilled water), using centrifugal pumps and distributing this chilled water in a building pipe circuit as in the case of air conditioned buildings or in refrigeration or freezing plants.

3. Because use of stockpiled or recycled CFCs in the Refrigeration and Air-conditioning (RAC) servicing sector is not controlled under the MP, stockpiled or recycled CFCs can be used in servicing old CFC-based chillers beyond 2010. However, the average chiller manufactured today uses about 35% less electricity than chillers produced just two decades ago. With the best technology available, operated on HCFC-123 or HFC-134a, new chillers can use up to 50% less electricity than an average chiller

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[1] The Montreal Protocol Article 1 defines "Consumption" as Production plus imports minus exports of controlled substances.

[2] Applicable to ODS belonging to Group I of Annex A of the MP

[3] Sixteenth Meeting of the Parties Decision: UNEP/OzL.Pro.16/17, Decision XVI/13

[4] Hydrochlorofluorocarbon (2,2-Dichloro-1,1,1-trifluoroethane) is considered as an alternative to CFC-11in low pressure RAC systems, with a lower ODP

[5] Hydrofluorocarbon 134a (1,1,1,2-Tetrafluoroethane) is an inert gas, similar to CFC-12, but with a lower ODP, used primarily as a "high-temperature" refrigerant for domestic refrigeration and automobile air conditioners.

[6] Ammonia is a natural refrigerant

from 1976.[7] In addtion, due to poor chiller maintenance practice in the Philippines, younger non-CFC based chillers installed in late 1990s and early 2000s are also consuming high energy than expected. Energy efficiency savings is therefore a primary environmental consideration and potential economic incentive for conversion to non-CFC efficient chillers.[8] Replacing CFC-based chillers contributes to reduced greenhouse gas (GHG) emissions both from an energy consumption perspective and from reduced emissions of CFCs which have high global warming potential[9].

4. **CDM under Kyoto Protocol.** In its Fourth Assessment Report, the Intergovernmental Panel on Climate Change concluded that human activity is contributing to an unprecedented increase in the concentration of greenhouse gases in the atmosphere, which is causing the earth's climate to change. On a global scale, the Earth's average temperature has already increased, precipitation patterns have altered, sea levels have risen, and most non-polar mountain glaciers are in retreat. In response, the global community adopted the United Nations Framework Convention on Climate Change (UNFCCC), which came into force in 1994, with an objective to stabilize atmospheric concentrations of greenhouse gases at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time-frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner. In 1997, the international community adopted the Kyoto Protocol (KP), which requires developed countries to reduce emissions by an average of 5.2% between 2008 and 2012, compared to 1990 baseline. The KP has a number of flexibility mechanisms, including the Clean Development Mechanism (CDM), which enables developed countries to reduce the costs of compliance through the purchase of emissions reductions from projects in developing countries, provided that the emission reductions are real, measurable and long term, and that CDM projects meet sustainable development objectives in those countries. The Philippines ratified the UNFCCC in 1994 and subsequently ratified the KP in 2003.

5. The individual CDM projects are GHG reduction opportunities, but they have little or no impact on the carbon intensity of growth. In accordance with the decision taken at the first Meeting of the Parties to the Kyoto Protocol[10] and the June 2007 guidance provided by the CDM Executive Board (EB) at its thirty-second meeting[11], project activities under a program of activities (PoA) can be registered as a single CDM project activity (Programmatic CDM). A CDM PoA is considered "a voluntary coordinated action by a private or public entity which coordinates and implements any policy/measure

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[7] Report of the TEAP Chiller Task Force, Technical and Economic Assessment Panel of the Montreal Protocol, May 2004.

[8] Ibid. While some alternatives (HFCs) do possess Global Warming Potential (GWP), refrigerants on the whole do not contribute to global warming unless released into the atmosphere. Properly maintained chillers of modern design emit less than 1% of their refrigerant charge each year. The dominant global warming effect caused by chiller operation is therefore, the carbon dioxide emitted during combustion of fossil fuels used to generate the electricity required to drive them.

[9] CFC-11 has a GWP of 5000, while CFC-12 has a GWP of 8500

[10] paragraph 20 of decision 7/CMP.1

[11] Annex 38 of EB 32 Report

or stated goal (i.e., incentive schemes and voluntary programs), which leads to GHG emission reductions or increase net GHG removals by sinks that are additional to any that would occur in the absence of the PoA, via an unlimited number of CDM program activities (CPAs)". The programmatic CDM offers a promising framework to maximize sustainable development benefits through the inclusion of long tail residential/small business sectors in developing countries, and real incentives to promote energy efficiency improvements.

6. The Project is designed as a CDM PoA with many CPAs (chiller owners) to participate. It will build the capacity of chiller owners, energy service companies (ESCOs), commercial financing entities in the Philippines to realize energy efficiency transformation in the chiller sector.

7. **Barriers to Replacement of Inefficient Chillers.** Despite the clear benefit to chiller owners of opting for non-CFC energy efficient chillers through dramatic savings in energy costs, early replacement is not taking place because of financial, technology, and information barriers. In an environment of competing investment opportunities and resource constraints, chiller replacement which requires high upfront capital expenditures is not a priority of building owners. This situation is aggravated by other barriers including weak regulatory capacity, the longer-term achievement of the additional benefits of the investment compared with other less costly business upgrades with apparently better rates of return, access to capital, and perceived technology risks in operating new non-CFC chillers, and lack of awareness of the potential savings that could be rendered by the new technology. Results from demonstration projects funded by the MP's financial mechanism, the Multilateral Fund (MLF) and the Global Environment Facility (GEF) in Thailand and by the MLF in Mexico and Turkey, as well as a comprehensive MLF-World Bank Chiller Sector Study in India, confirm this finding. Therefore appropriate financial arrangements need to be put in place to accelerate the replacement of inefficient chillers to new non-CFC based energy efficient chillers.

8. The MLF Executive Committee agreed that the results of the mathematical/business model used in the India Chiller Sector Study was applicable to all Article 5 countries by underlying in its decision to fund chillers stating that "total funding per investment will be determined using an accessible mathematical and/or business model, taking into account relevant decisions of the Executive Committee." The decision was preceded by the confirmation that, "a mathematical model for establishing funding levels for individual chillers, as developed by the World Bank, had been accepted by the implementing agencies and the Secretariat, and UNDP and UNIDO." The Chiller Sector Study also found that, based on the relationship between the age of chillers and energy consumption, maintenance costs, and down-time (all impacting operating costs), the opportunity costs incurred for replacing a chiller of 10-25 years in age is approximately 20-30% of the initial cost of a new chiller.

9. The Project is to tackle the numerous barriers to the adoption of commercially-available energy efficient non-CFC chiller technology through an offer of an innovative financial incentive that has been determined significant enough to overcome the barriers,

particularly the high upfront cost. The level of incentive represents an aggregation of the opportunity costs through the model developed by the chiller study (see Annex I) and is intended to catalyze market coversion by replacing not only CFC-based chillers but all inefficient chillers. The Project will assist a significant number of enterprises in the private and public sectors (around 375 chillers) - industrial, commercial, service and institutional establishments to bring about a massive shift in the market to adopt energy efficient, non-CFC chiller technology countrywide. On a macroeconomic level, the Project will showcase to building owners that making investment choices towards selecting energy efficient, environment-friendly technologies for their business solutions make good business sense.

10. **Consistent with National Strategies and GEF Operational Programs.** The Project is developed within the context of the Medium-term Philippine Development Plan 2004-2010 (MTPDP) which states that there is a need to manage natural resources and protect the environment to improve the quality of life of Filipinos and endorses systems conversion to ozone depleting substances (ODS) friendly technology, products and equipment. The MTPDP espouses energy independence and power sector reforms. To achieve higher energy self-sufficiency, the strategy includes among others pursuing energy efficiency and conservation measures such as (a) energy management programs and energy audits to assist industrial and commercial establishments, (b) energy labeling for appliances and equipment, (c) energy conservation in government offices, (d) fuel efficiency labeling for motor vehicles, and (e) heat rate improvement of power plants. A new MTPDP will be prepared starting in 2010, but the strategies for transport and energy are expected to be maintained. There is also a Philippine Energy Plan (2007-2014) prepared by the Department of Energy (DOE) which is regularly updated and which provides significant inputs to the MTPDP. This project contributes to achievement of the energy sector agenda which is focused on two objectives 1) attaining sustainable 60 percent energy self-sufficiency beyond 2010 and 2) promoting a globally competitive energy sector. The first objective specifically aims at strengthening and enhancing the government's energy efficiency and conservation program.

11. As a Party to both the Montreal Protocol (MP) and Kyoto Protocol (KP), the Philippines is eligible for financial and technical assistance from the MLF, the GEF, and the CDM for projects that meet the objectives of these international conventions. The Project meets the objective of the KP by encouraging energy savings which in turn help in the reduction in emissions of GHGs. It also fits into the objective of the GEF12 by transforming the marketplace and introducing the concept of life-cycle based decision making in the chiller sector. The Project will also meet the objective of the MP by facilitating the replacement of old CFC-based chillers and reducing the burden of CFC usage in the servicing sector. The project will contribute to the Government of the Philippines' ongoing efforts to meet its obligations under the MP by reducing demand for new CFC. It complements the MLF-financed National CFC Phaseout Plan which deals with all consumption subsectors except for chillers.

[12] Operational Program #5: Removal of Barriers to Energy Efficiency and Energy Conservation

11. This Project proposes to utilize GEF resources to address these environmental externalities, supported by the MLF to address the negative environmental externality associated with ozone layer depletion. The GEF support will enable the Philippines to increase market penetration of energy-efficient chillers, improve chiller maintenance practice, and improve the design practice (chiller sizing), in residential, commercial, and industrial establishments. GEF assistance is critical in accelerating the market conversion for EE chillers by addressing and removing barriers through the development, marketing and implementation of an incentive-based chiller replacement program. The Project meets the objective of GEF operational programs on SP #1 and 2 (energy efficiency in commercial buildings and promoting energy efficiency in the industrial sector) in that it will replace older chillers with newer ones that are more energy efficient and utilize refrigerants that are lower in global warming potential (GWP) and have lower or zero ozone depleting potential; support the development and transformation of the market for energy and facilitate a low-carbon growth path; increase market penetration of energy-efficient chillers in the residential and commercial building markets; support a single market transformation to accelerate GHG emissions reduction by making use of carbon finance; and, deploy and diffuse energy-efficient chillers in industrial production and manufacturing processes. The additional chillers replaced with financing by CDM resources is equivalent to a replicaton strategy, which is consistent with the goal of ensuring consistency between the efforts of the GEF and CDM, while avoiding duplication of efforts and funding between the two. The Project will also support the Philippines to meet its ODS phaseout obligations under the MP, with minimum disruption to industry and economic development (and also meeting GEF's sound chemicals management objectives).

12. **Chiller Population in the Philippines.** A national survey of chillers to update the baseline information for replacement was carried out in August 2008 which includes conduct of meetings and public consultations with chiller owners, suppliers, manufacturers, ESCOs and government institutions. Based on the baseline information to date covering only Metro Manila and neighboring cities, there are more than 375 inefficient chillers with a total of at least 123,000 Tons Refrigeration using R11, R12, R22, R123, and R134a. Using an emission rate of around 0.47 tCO_2/Mwh which is applicable to the Luzon grid, the carbon emission reductions (CERs) that will be achieved in replacing these chillers will be more than 700,000 CERs.

13. Using the combined funding from the three sources - MLF, GEF and CDM - around 195 inefficient chillers (average of 330 TR each) by 2012 and an additional 180 chillers (average of 330 TR each) by 2019 can be provided with a 15% subsidy. Given that equipment suppliers' records suggest that there are about 375 eligible chillers in the country, this represents a major reduction in these chillers. A national inventory is being conducted to update the baseline information of the whole chiller population in the country.

B. Rationale for Bank Involvement

14. The Project is consistent with goals of the Philippines CAS which will contribute to achieving more inclusive growth by supporting the Philippines to, among others, reduce vulnerabilities by expanding and rationalizing the country's social safety net, improving improving disaster risk management, piloting climate change adaptation measures and expanding climate change mitigation programs. Based on the Initial National Communication on Climate Change of the Philippines (DENR, 1999) in 1994 the Philippines released a total equivalent of 100 Mt of CO_2 into the atmosphere half of these emissions are generated by the energy sector. Within the energy sector, more than 60% were from power generation and transport. The Philippines is now preparing the Second National Communication, and a 2000 inventory of GHG emissions will be published in late 2009. It is expected that the GHG contributions from the power and transport sectors will remain most significant in the immediate term. This project, which is counted as one of the country's climate change mitigation programs, will contribute to reducing emissions from the power sector.

15. The World Bank is uniquely positioned to mobilize funds from a number of sources to achieve the desired outcomes of this project. Firstly, it is the largest Implementing Agency (IA) of the GEF and MLF[13], and is committed to implementation of activities toward achievement of GEF operational programs and MP goals. Secondly it is a significant player in the global carbon market and has extensive experience in the development of CDM methodologies, project design and implementation of CDM interventions. On their own, the GEF, MLF and CDM mechanisms are not able to overcome the significant barriers to the accelerated replacement of chillers. However, the Bank has a wealth of experience in managing potentially complex financing mechanisms that are required for the successful delivery of the Project. Finally, a comparative advantage of the Bank is its vast experience in dealing with both large scale energy saving projects as well as ODS reduction projects, including those relating to the replacement of CFC-based chillers in Mexico, Thailand and Turkey, as is detailed in Annex 2.

16. The Bank has initiated a similar project in India. The Bank has pioneered the carbon market in many sectors, by developing benchmark baseline and monitoring methodologies that can be replicated in other projects or countries. It has developed more than 25 % of all methodologies approved by the CDM Executive Board so far, and has developed a methodology for the accelerated replacement of chillers in India which was approved in late 2007 and will be used for the Philippines.

17. The Bank has already mobilized strategic bilateral cooperation and private sector interest to support the successful implementation of the Project. Possible involvement of commercial lending institutions would demonstrate to the Philippines banking industry that energy conservation is a good business opportunity for future lending portfolios. Partnership with the financial industry is essential to future energy efficincy activities in

[13] Other Implementing Agencies are UNDP, UNIDO and UNEP, along with bilateral donor agencies

the Philippines and the Project will complement other efforts in the Philippines to promote energy efficiency in the private sector such as the IFC-funded Sustainable Energy Finance Program. In addtion, the US Environmental Protection Agency has promised its in-kind financial support for the development of a marketing tool that would outline the advantages of the Project to chiller owners as it did for the similar project in India.

C. Higher level objectives to which the project contributes

18. The higher level objective of the project is to contribute to the phase out of CFCs and achieve CO2 emission abatement by promoting a more energy conscious decision-making by chiller owners in general and, eventually, a significant market transformation of the chiller sector.

19. **National Energy Efficiency Program**. This project will support the Philippine government's program on energy efficiency which is embodied in several government laws, policies, plans and programs. Republic Act No. 7638 (1992), the "Department of Energy Act of 1992" the Presidential Administrative Order No. 110 (2004), and the "Institutionalization of a Government Energy Management Program", are four of the major laws and policies that require that conservation, renewal and efficient use of energy keep pace with the country's growth and economic development. The Government's five (5) point energy reform agenda on energy independence aims to achieve a sixty (60) percent self-sufficiency level by 2010 and effectively implement a National Energy Efficiency and Conservation Program (NEECP). A National Food and Energy Council was created which is tasked to assess, formulate, coordinate, monitor and adjust national long-term policies, programs and projects to ensure adequate food and energy needs for the country.

20. **Montreal Protocol and GEF Climate Change** s**trategy**. The Project will synergize the phasing out of ODS and reduction of GHG emissions to the atmosphere, which is in line with the Bank's Environment Strategy for protecting the global environment. It will also address the objectives of the GEF's Strategic Program #1 and 2 (energy efficiency in commercial buildings and promoting energy efficiency in the industrial sector) while achieving substantial leveraging effects with carbon finance revenues and mobilization of commercial finance in that it will (a) replace older chillers with newer, energy-efficient ones; (b) support the development and transformation of the market for energy and facilitate a low-carbon growth path; (c) increase market penetration of energy-efficient chillers in the residential and commercial building markets; (d) support a single market transformation to accelerate GHG emissions reduction by making use of carbon finance; and, (e) deploy and diffuse energy-efficient chillers in industrial production and manufacturing processes.

21. **Carbon Finance and the Clean Development Mechanism**. In carbon finance, the Project will build the capacity of chiller owners, energy service companies (ESCOs), and commercial financing entities in the Philippines, which are seen as quite important in realizing carbon finance from bundled and/or programmatic energy efficiency programs

and as a possible catalyst for increased energy efficiency activities. In addition, the Project will demonstrate the application of the Programmatic Approach to accelerate the implementation of the CDM for energy efficiency measures.

II. PROJECT DESCRIPTION

A. Lending instrument (Financial Modality)

22. The Project will be financed by GEF grant funds, with co-financing from the MLF and chiller owners. GEF and MLF will be delivered initially through provision of financial incentives on a grant basis to support 15% of chiller replacement costs. The incentive, which allows for implementation of conversions, will result in additional revenues from carbon finance. The chiller owners that receive the initial assistance from the MLF and GEF grant funds will be requested to surrender potential carbon credits to the overall program. Carbon credits from these initial conversions, when certified, will be used to replace additional chillers. This is similar to a revolving fund concept, where savings from initial replaced units are returned to the project and are used for replacing additional units. CDM-eligible chillers with high emission reduction potentials will have priority for replacement to be funded by GEF and MLF grants. The project has a fixed CDM crediting period of ten (10) years. It will close in June 30, 2020. At the end of the project, carbon credits that will accrue to the project revolving fund will be used by the government to further energy efficiency investments.

23. As the Project will only provide financial incentives (15% subsidy) to attract early replacement of chillers, significant co-financing from commercial sources will also be mobilized to complete the financial framework. To cover for the remaining 85% chiller cost, chiller owners can secure their own financing from several commercial banks, government financial institutions, Energy Service Companies (ESCOs), leasing companies, chiller manufacturers and suppliers which offer financing on attractive terms to chiller owners who comply with eligibility norms. The financing options available to the chiller owners include corporate loans (working capital financing, short term loan and revolving promissory note line, capital expenditure financing, medium and long term loans), leasing, ESCO financing, and chiller manufacturer/supplier credits.

24. The Project is innovative in its approach, in that the Department of Environment and Natural Resources (DENR) - Foreign Assisted and Special Projects Office (FASPO), a separate office in DENR will act as the Coordinating Entity (CE) and will hire an independent consulting firm as a Project Management Contractor (PMC) [14]to aggregate a number of eligible chiller replacements. It is envisioned that this approach will reduce the transaction costs involved for each chiller owner in a carbon finance operation, thereby allowing many small individual projects to participate in the carbon market. KfW [15] is the

[14] CE is required for a PoA. The Project is designed as a CDM-PoA.

[15] **KfW** Kreditanstalt für Wiederaufbau (German Reconstruction Bank) is Europe's biggest promotion bank.

carbon buyer of the Project. The emission reductions will be measured, monitored and verified following a CDM approved methodology[16] specifically developed for a similar project in India. The Emission Reduction Purchase Agreement (ERPA) will be signed between the CE and KfW.

B. Project Development Objective, Global Environment Objective and key indicators

25. The Project development objective (PDO) and Global Environment Objective (GEO) are to reduce GHG emissions by replacing inefficient chillers including both old CFC-based chillers and non-CFC-based chillers.

26. The Project has significant scope for replication as it will develop and implement an approach that bridges the gap between the techno-economic and institutional aspects related to energy efficiency.

27. Following are the quantifiable indicators to monitor the progress toward the PDO. The project design includes an exhaustive monitoring program to measure the quantifiable indicators (see more details in Annex 3):

a. Number of inefficient chillers replaced by the Project;
b. Phaseout amount of new CFCs in the RAC servicing sector. It is estimated that about 22 tons of CFC will be phased out under the Project.
c. CO_2 emission reductions as direct and indirect benefits from the Project;
d. MWh saved and MW of demand reduced through chiller replacement;

C. Project Components

28. The Project has four key components, as defined below.

Component 1: Investment to Chiller Replacement

29. This component will provide financial incentives (about 15% of the new chiller cost) to accelerate the replacement of inefficient chillers to non-CFC energy efficient ones, in advance of the natural attrition rate of the existing equipment.

30. The grant funds from GEF will be used to provide incentives for inefficient chillers, in the initial phase of project implementation (until grant funds are exhausted). Additional units will be replaced through revenues generated by carbon credits. In the initial phase, chiller owners will have the following two choices of incentives which they must decide upon as soon as they join the program:

a. Up-front grant subsidy of 15% of the normative cost of new non-CFC based energy efficient chillers, or

[16] Approved baseline and monitoring methodology AM0060: "Power saving through replacement by energy efficient chillers" Version 1.1, July 2008

b. Future carbon finance revenues to be generated by energy savings from replacing inefficient chillers with new non-CFC based energy efficient chillers.

31. For the first option, chiller owners would have to agree to relinquish future carbon finance revenues that would be generated from their subprojects (i.e. CPAs) to the program. These revenues would then be used to replace additional chillers.

32. For the second option, chiller owners would receive annual payments of about 80%[17] of carbon credits earned over the previous twelve-month period until 2020 (the validity of the ERPA). 20% of the CDM revenues may be used for covering the costs for administration, financial management, sub-project processing, reporting, marketing and other CDM related costs. This option will also support the special circumstances of public sector institutions who are constrained by procedural and legal implications in accepting up-front incentives, but which are encouraged by the GOP to participate in the carbon market.

33. Chiller owners interested in joining the program will need to fulfill the following conditions[18]:

a. **Old Chillers:** Any chiller that meets the eligibility criteria of approved technology AM0060 (essentially electrically powered and of compression type) of the CDM is eligible to be included as a subproject in the investment component 1. This excludes old absorption chillers until such time as an approved methodology is in place that would cover this type of chiller.
b. The inefficient chiller identified for replacement must have at least five years of life remaining, assuming a 20-year business-as-usual equipment life. In order to simplify the demonstration of this criterion, the CDM Methodology indicated that the eligibility would be restricted to those chillers that have been installed after 1995;
c. Chillers to be replaced must be currently be in use and located in the Philippines
d. **New Chillers:** To be eligible for the grant incentive under the Project, the new chiller must meet the eligibility criteria of approved methodology AM0060 (essentially electrically powered and of compression type) of the CDM. The new chillers must be non-CFC-based with specific energy consumption being equal or lower than 0.63 kW /TR at current ARI condition or at the site condition confirmed during commissioning.
e. Size of Chillers:
   - Old Chiller: the size of the old chiller, in terms of cooling capacity, must be 100 tons refrigeration (TR) or above.
   - New Chiller: the size of the new chiller must be the same as that of the old chiller, plus or minus 5%. If less than the old chiller, the incentive will be proportionately less. If more than the old chiller, the incentive will remain unadjusted.
   - Starting Date: Replacement projects will be eligible as to starting date if

[17] depending on actual costs
[18] These conditions are based on the approved CDM methodology AM0060.

replacement chillers are installed on or after January 15, 2010.

- Ending Date: Replacement projects will be eligible as to ending date if replacement subprojects are completed on or before December 30, 2018.

f. Payment of the incentive to the chiller owners: Chiller owner's willingness to participate the Project, proof of adequate financing for the remaining cost of investment (85% for option 1 and 100% for option 2) of new chillers and the dismantling and destruction of the replaced main chiller parts.

34. The Coordinating Entity (CE) may enter into one or more agreements, on terms and conditions acceptable to the World Bank, in order to attain a common basis for cooperation with chiller manufacturers/suppliers and energy service companies and facilitate effective market penetration of the Project. This agreement may be in a form of a Memorandum of Agreement (MOA) with chiller suppliers and energy service companies, pursuant to which chiller suppliers and energy service companies may be required to assist in identifying potential Beneficiaries, disseminate Project offerings to potential Beneficiaries, and assist them in the preparation of their submissions to the Project Implementing Entity, implement terms and conditions for baseline power measurement, and monitoring of performance of new chillers, and supply new chillers and monitoring equipment in accordance with general specifications established by the Project.

35. Procurement of new energy efficient, non-CFC chillers will be carried out by project participants (chiller owners), based on prevailing commercial practice. Since financial incentives will only be a certain percentage of the total investment cost, chiller owners will seek the remaining funds from other sources including their own cash resources; arrangements with leasing companies, special financing plans that may be offered by chiller manufacturers, commercial loans, ESCOs, and etc.

36. The Project also requires that CFCs extracted from retired units must be inventoried, stored and managed properly and can be used only for servicing other RAC equipment in-site or destroyed, as per specified guidelines. Chiller owners will bear cost for environmentally-sound management of CFCs as part of the cost for a new chiller. Recovery of CFCs will be carried out by a certified technician from chiller manufactures or suppliers and the process of recovery needs to be witnessed and certified. These requirements and monitoring arrangements are detailed in the Environment Management Framework of the Project, and will be included in the agreements to be signed with chiller owners.

Component 2: Measurement, Monitoring and Verification (MMV)

37. As per the methodology approved by the CDM EB, the program is required to measure and monitor data related to the power-output function of the inefficient chiller to be replaced, electrical consumption of the new chiller, and cooling output. It necessitates a database to be established to keep track of all the data generated from the individual

replacement activities and to be used to generate the reports that would support the CER claims.

38. A measurement and monitoring consultant will be contracted by DENR for the following activities:

i). measuring energy consumption of baseline and new equipment;
ii). monitoring performance of new chillers by collecting performance parameters of new chillers on an on-line basis; and
iii). analyzing the data collected during the lifetime of the Project.

39. All new chillers will be equipped with data loggers and connected to a centralized management information system (MIS) through data transmitters. The MMV consultant will validate these data on a regular basis. The Project will finance the acquisition of the transmitters, in accordance with the CDM methodology. Each chiller will have a data logger installed directly by the chiller suppliers. The data will be collected and processed by an MIS operated and maintained by the PMC. The MIS will be used, among others, as the tool for generating all technical reports required by the Project, and for estimating the emission reductions to be verified by a third party prior to submission to the CDM EB for certification.

40. As required by the CDM process, verification of emission reduction will be done on an annual basis and is the requirement for the Project to claim for CDM payments. The verification of emission reductions will be carried out by a Clean Development Mechanism Designated Operating Entity (CDM DOE) to be selected by the CE among those recommended by the KfW , which must be selected from the pool of firms accredited by the CDM EB. Verification will be conducted throughout the project implementation period, in this case until 2020 as per the terms of the ERPA.

Component 3: Technical Assistance

41. The objectives of this component are to enhance the knowledge and build capacity of project participants (chiller owners, government regulators, chiller manufacturers/suppliers/contractors), on the following: (1) significant rate-of-return on investment of chiller replacement and other potential low-cost and/or no-cost energy conservation measures in large buildings, (2) the total ban of CFC consumption by January 1, 2010, (3) different MM&V requirements and the financial assistance offered by the Project, (4) replacement and maintenance of new chillers to remove chiller owners' perceived technology risks, (5) adopting environment-friendly, energy efficiency technologies, practices and methods including the implementation of the Environmental Management Framework. To ensure sustainability, it will help build capacity of relevant stakeholders in energy conservation measures and refrigerant management. The following activities will support the implementation of the Project:

Sub-component 3.1: Policy Review and Revision

42. The Project shall initiate the review of related policies vis-à-vis the gaps, issues and concerns identified during the course of project implementation.

Sub-component 3.2 Training, Workshops, Materials on Project Awareness and Public Awareness

43. While the main objective of the Project is to promote the early replacement of energy efficient chillers, the Project will also explore opportunities to expand its coverage to other energy conservation options in large buildings and industries. The Project will utilize experience and expertise of US EPA's Energy Star Programs and those of chiller manufacturers and suppliers of ancillary equipment. A financial analysis tool has been developed by USEPA to support participants in making decisions with regard to the two options being offered and will be introduced to the Project.

44. A launch workshop will be undertaken jointly by DENR and the World Bank to inform the public of the commencement of the project and to invite interested parties to participate. This will be followed by project-cycle workshops, undertaken on a regular basis to inform new participants about project requirements, processes, eligibility and funding criteria. Technical workshops will also be undertaken to inform participants about well maintenance of new chillers, measurement, monitoring, and verification of power consumption, energy savings and accounting for emission reductions.

45. This sub-component will also finance production of additional materials to support implementation and will serve to generate interest of the public. Such materials include pamphlets, brochures, advertisement, radio spots, case studies, and any other materials to be determined during project implementation.

Sub-component 3.2: Performance Standards and Recognition Program

46. To assist instituting energy efficiency as an industry practice for chiller owners, the project will promote the adoption of an appropriate set of performance standards for new non-CFC chillers. It will establish guidelines that will provide a set of operational protocol to sustain good performance. The project will support the development and adoption of an appropriate policy framework and incentive mechanisms to promote good practice in the operation and maintenance of energy efficient, non-CFC chillers.

47. In this regard, annual recognition awards will be presented to those chiller owners that are able to sustain high performance of their chillers through proper operations and maintenance. These awards will also encourage project participants to closely monitor performance of their chillers, which will maximize CDM revenues for the project in a sustainable manner.

Component 4: Project Management

48. DENR will implement this Project with support of a Project Management Contractor (PMC), a private entity contracted by DENR. The PMC will carry out day-to-day project management activities, including marketing activities, organizing workshops, coordination with chiller suppliers and manufacturers, review of Sub-project proposals, supervision of Sub-projects, preparing supporting documents for DENR's disbursement of proceeds of the GEF, and CDM revenues accruing on account of each Sub-project, management of reporting, verification and auditing requirements, and coordination with other agencies on any policy and regulatory issues that may arise. The PMC will be staffed according to an agreed Staffing Plan. The Project will finance the PMC's service and Incremental Operating Costs that DENR will incur for this Project.

49. The procedures of project implementation, requisite institutional framework for implementation and monitoring of project activities, the formats for monitoring and reporting, and funds management and disbursements are delineated in a Project Implementation Plan. All financial data and disbursements under the Project will be managed by DENR through a database. A grievance handling mechanism will be set up by DENR to allow feedback from the chiller owners and potential stakeholders.

50. Performance audits will also be carried out under this component. DENR will hire a consultant to carry out performance audits in the beginning, middle and the end of the Project.

D. Lessons Learned and Reflected in Project Design

51. The Project is closely in line with the Philippines' existing ODS phase-out program and builds on the lessons learned after a decade of involvement in this program. This includes recognition of the advantages of performance-based programmatic approach, importance of a supportive policy environment, need for sound institutional arrangements and for strengthening capabilities for implementation and monitoring. Similar findings have been documented in the World Bank GEF Energy Efficiency Portfolio Review, including need for comprehensive and holistic market assessments and simple and flexible program design.

53. The results of a World Bank commissioned India Chiller Sector Study undertaken in 2002 and a similar project in India were used as a reference in preparing the initial design of the project. The market barriers were quantified and employed as a basis for establishing the level of funding requirement for this project, whereas the chiller manufacturers' database of existing installations of CFC-based chillers supported project design with regard to chiller population and market assessment. Project design flexibility is achieved through national-level implementation arrangement that takes into account prevailing business and commercial practices to make it as market-oriented as possible.

54. A series of meetings with stakeholders and chiller owners at the national and global levels were conducted to obtain relevant inputs for the project design. The key messages from these meetings were that, for the project to be successful, the design had to be kept simple, and any transactions or actions required by building owners, chiller suppliers, and financiers should approximate existing commercial practices and/or existing business models as much as possible. The project design has also benefited from experience and lessons learned from demonstration projects in Mexico, Thailand and Turkey (Annex 2).

E. Alternatives Considered and Reasons for Rejection

55. Do nothing and let the market resolve the problem. Country studies and findings from the pilot projects have shown that replacement of CFC-based chillers will not happen at the rate needed if left to market forces. The India Chiller Sector Study found that chiller owners, in effect, apply a discount rate of about 30% to potential returns from chiller replacement projects. This would suggest that inefficient CFC-based chillers would continue to be in operation until 2025. Under this scenario, the Philippines will continue to rely on CFCs for a long time perhaps even 15 years beyond the mandatory complete phase-out date of 2010 as stipulated by the MP. This is clearly not a desirable option, as this could encourage illegal trade and a continued demand of these substances in the servicing sector (with related emissions), which would undermine the goals of the MP. In the Philippines, several pure financing options (with no grants) were provided by financial institutions and ESCOs to encourage investments on energy efficiency including that for chillers but there is a very low number of enterprises which have availed of said financing due to several reasons including competing priority investments, lack of technical guidance for the design, operation and maintenance of large equipment. In the end, the do-nothing option would also continue to drain energy when taking into account the relative inefficiency of the existing stock of chillers.

56. Embark upon a sophisticated recovery, recycling and banking project. Developing countries are reluctant to pursue this approach due to high transaction costs, difficulty in monitoring and the lack of adequate administrative infrastructure to implement such a program successfully. The poor level of success of CFC recovery and recycling schemes in developing countries is well documented.

57. Enhance awareness of diminishing CFC supply, increased cost of servicing and potential impact on maintaining existing RAC equipment. Business owners are unwilling to make large up-front investments for replacing RAC equipment, including chillers, despite the forecasted shortage, increased prices and cost of maintenance. The potential for energy savings and short payback period is also not a sufficient catalyst for stimulating the required level of chiller replacements.

58. Implement a programmatic CDM Project (without the GEF / MLF components). Given the high transaction costs of registering projects with the CDM EB, a project cannot be implemented unless a number of chillers are bundled together or using a programmatic approach. However, the project poses significant risks if it were to

be implemented from CDM resources alone as follows: (i) there is little carbon finance intermediation capacity in the Philippines (ii) the risks of monetizing carbon revenues upfront are significant given the delivery risks and (iii) carbon finance revenues alone could not overcome the project and delivery risks.

III. IMPLEMENTATION

A. Partnership Arrangements

59. The Project is designed on the financial partnership which includes the three international financial instruments (GEF, MLF and CDM), and the Bank as an implementing agency of the GEF and MLF and the KfW as the Carbon buyer. This financial partnership model is consistent with the GEF-4 Strategy for Climate Change, as well as decision made by the Parties at the 20th Anniversary of the Montreal Protocol, and could serve as an innovative financial arrangement model for future climate related projects.

60. The Project is innovative in its approach involving the use of a CE which is the DENR to reduce the per unit transaction costs involved in a carbon finance operation, thereby allowing many small individual entities to access the carbon market which otherwise would not be possible.

B. Institutional and Implementation Arrangements

61. DENR will have the primary responsibility for project implementation on behalf of the government of the Philippines. The principal organizational units and entity for implementation are summarized below.

62. The DENR Secretary is the CDM-Designated National Authority (CDM DNA), with the EMB as Secretariat, who will approve the CDM project by issuing a Letter of Approval (LoA). DENR shall enter into an Emission Reduction Purchase Agreement (ERPA) with the KfW. The KfW has provided some financing to prepare the CDM Program of Activities (PoA) and already indicated the intent to purchase 1 million tons of certified emission reductions from the Project. Further, the DENR shall endorse to the Department of Finance (DOF) the MLF and GEF Grant Agreements. The designated Undersecretary or Assistant Secretary shall sign the contracts for goods and consultancy services procured under the project.

63. The DENR- Foreign-Assisted and Special Projects Office (FASPO) will be acting as the Coordinating Entity (CE) to oversee the implementation of the Project. The CE shall have the main responsibility to communicate with the CDM Executive Board (CDM EB). Likewise, it shall perform the following functions:

- It will engage a private consulting firm, with staff complement acceptable to DENR and the Bank, who will act as the PMC for the duration of the Project. The PMC's responsibilities are listed in the next Paragraph.

- It will establish and maintain for the duration of the Project a Project Steering Committee chaired by the DENR and co-chaired by the Department of Energy. The members of the PSC shall be composed of representatives from (i) the DENR and any other agencies as may be deemed necessary by the co-chairs of such Committee; (ii) the Project Director; and (iii) members of civil society and the private sector which shall provide operational guidance and oversight to the Project.
- It will enter into procurement contracts with goods suppliers (except for new chiller suppliers) and consultant services contractors.
- It shall adopt a Project Implementation Plan acceptable to the World Bank, giving details of guidelines and procedures agreed with the World Bank for the implementation, supervision, and monitoring and evaluation of the Project, including: (i) institutional and staffing arrangements; (ii) reporting requirements; (ii) performance indicators (iii) financial management procedures and audit procedures; (iv) procurement procedures; (v) details of the Environmental Management Framework; (vi) procedures for the identification and selection of Beneficiaries, and terms and conditions governing approval and award of Financial Incentives; (vii) procedures for the reallocation and utilization of CDM revenues foregone; and (viii) details of the Governance and Accountability Action Plan.
- It shall monitor and assess the Project's compliance with grant conditionalities, contracts and other similar instrumentalities;

64. The Financial Management Service (FMS) of the DENR has overall responsibility for the financial management of the project. DENR-FMS shall maintain two separate Designated Accounts for the MLF and GEF funds and one Project Bank account dedicated for the CDM funds. It shall have the authority to process disbursements of these three accounts.The FMS shall certify the availability of funds for contracts,POs, and all other claims. FMS shall likewise prepare regulatory financial reports and other reports required by the international financing institutions i.e. WB, GEF, KfW.

65. The Environmental Management Bureau (EMB), which is a line bureau of the DENR, will establish a Project Management Unit (PMU) that will ensure the effective and timely implementation of the project. The Project Management Contractor (PMC) will report to the PMU on a regular basis. The EMB-PMU shall oversee the day-to-day activities of the Project Management Contractor. It shall maintain supervision and coordination of the project's implementation including financial and procurement management. It will be responsible for the review, acceptance and endorsement of payments. It will enter into the Sub-grant Agreement with the Chiller Owner, which incorporates the Emission Reduction Transfer Agreement (ERTA), acceptable to the Bank, with the eligible beneficiary chiller owners.

66. **Project Management Contractor.** DENR will engage a PMC by contracting with a private entity under terms of reference acceptable to the World Bank. The PMC

will be headed by a full time Project Manager/Team Leader with skills, qualifications and experience satisfactory to the DENR and the World Bank and assisted by full time staff with adequate skills and resources and in sufficient numbers. The PMC will be responsible for the day-to-day operations of the Project. The MLF funds and CDM revenues will be used to finance the PMC to cover its administrative and management costs. The hiring of the PMC is a condition of negotiation. The PMC will carry out the following activities:

a. Marketing and effective outreach to target chiller owners to enhance project participation. The Project will rely on chiller manufacturers/suppliers and ESCOs as its major marketing force to promote chiller replacement Finalization of a Project Operation Manual for chiller owners' use
b. Preparing SGAs/ ERTAs which will describe terms and conditions including the level of funding, disbursement schedules, transfer of certified emission reduction rights, and obligations of chiller owners pertaining to this Project;
c. Screening of potential candidates, review of sub-project proposals, undertaking sub-project processing procedures with identified project participants, and supervision of sub-projects;
d. Preparing annual chiller replacement plan with identified chiller owners in every December;
e. Perform the financial management function for the project under the direct supervision of the FMS division of DENR, which includes the maintenance of the project's books of accounts in accordance with generally accepted accounting principles, preparation of project disbursement vouchers and financial reports for review and approval by DENR FMS division and FASPO, etc.
f. Preparing TORs and supervising consultancy services for measurement, monitoring and auditing purposes;
g. Preparing technical specifications and supervising goods procurement;
h. Supervising the operation performance of the MM consultant on a regular basis;
i. Reporting on various components as per the requirements of the Bank, MLF, GEF, and CDM;
j. Coordinating with DENR and other agencies on any policy and regulatory issues that may arise;
k. Assisting the CE and the PMU in validation and registration of the PoA and the first CPA
l. Assisting the CE and the PMU in validation and registration of all subsequent CPAs
m. Assisting in CDM-DOE's (Designated Operational Entity) verification of CERs
n. Assisting the DENR in facilitating implementation of the technical assistance component under the Project.

67. MM Consultant. A MM consultant will be contracted by the DENR to carry out Component 2 and validate the information in the Management Information System (MIS) of the PMU that will contain data generated by the data loggers and transmitters. The MIS will monitor on-line the energy savings, measuring energy consumption of baseline equipment and of new equipment, monitoring performance of new chillers by collecting performance parameters and analyzing the data in accordance with the MM&V protocols

agreed with KfW. The MIS will generate all the technical reports for verification for the purpose of CDM payments.

68. Other Contractors to the DENR. Other possible contractors of the project may include suppliers of data loggers and transmitters, consultant firms for production of marketing materials, the MIS development, the performance audits and other Specialists that may be identified during project implementation.

69. The KfW, (the German Reconstruction Bank) has committed to be the Carbon buyer of the project and has assisted in the preparation of the project's Program of Activities (PoA) Design Document (DD) for submission to the CDM Executive Board.

C. Monitoring and Evaluation of Outcome/Results

70. Monitoring and evaluation of the Project will be undertaken at two levels: the sub-project level (PMC) and the project level (PMU). At the sub-project level, a system will be established for measuring energy consumption of baseline equipment and of new equipment and for monitoring performance of new chillers using performance parameters such as flow rate of chilled water, inlet and outlet temperatures of chilled water, inlet temperature of condensing water, electricity input, etc. Data loggers and transmitters will be installed for collection of continuous data and an Management Information System (MIS) will be developed for storing and processing all data generated by data loggers. Appropriate software will be developed to analyze relevant data and to determine actual energy savings and emission reduction will be developed. This software will generate all the technical reports summarizing performance of each individual chillers and performance of the overall program.

71. At the Project level,the PMC will assist the PMU in monitoring the Project performance based on the Results Framework (defined in Annex 3). The Measurement and Monitoring (MM) consultant will be responsible for the measurement and monitoring of sub-projects which will involve technical inspection including power measurements of baseline and new units, and subsequent inspections, if needed, from time to time until 2020 for the purpose of verifying actual energy savings of new chillers.

72. The data used for determining the value of indicators will come from the MIS and from annual carbon emission verification reports prepared by the CDM DOEs. In addition, the data for tracking implementation progress of each project component would also be drawn from progress reports to be prepared by the Project Maangement Contractor (PMC).

73. The PMC will submit to PMU for its periodic assessment a regular progress report on the following intervals: 1) a monthly basis for the first six months, 2) a quarterly basis for the next twelve months, 3) semi-annually for the rest of the project.

74. The World Bank supervision will include field visits to current and prospective participants, and discussion with DENR, the PMC and relevant stakeholders

(manufacturers, owners etc.). Supervision mission visits will monitor subproject implementation, compliance with environmental and safety standards and training, and evaluation of project performance according to established indicators. The Bank will also review progress/audit, and subproject appraisal reports to assess and evaluate the overall progress in implementing national CFC phase-out and carbon emission reduction. The feedback from the grievance handling mechanism will also be reviewed during the missions. During the Mid-Term review which will be undertaken after year 3 or 4, the project financial flows will be revisited to assess how many more inefficient chillers not eligible for CF can be included into the Project and how to sustain the Project after 2018.

D. Sustainability and Replicability

75. Project ownership, an underpinning factor of sustainability, and commitment at the country level is already evidenced in part by the country ratification of both the MP and the KP and the compliance with the scheduled obligations with regard to CFC phase-out. The Project provides fundamental support towards GoP's CFC phase-out strategy. The stringent national regulatory and fiscal framework on ODS, already established by GoP, provides the overarching environment for sustainable project implementation.

76. The Project design incorporates an incentive program to ensure the ongoing commitment of chiller owners. Additionally, since the chiller owners will be responsible for about 85% of the capital cost, it is expected that such a significant financial stake will further ensure their commitment, in particular since the investment can be recovered relatively fast if the energy efficiency is realized.

77. Sustainability in this Project signifies no "backsliding" to the use of equipment which require CFCs and which are less energy efficient by design. The Project will necessitate the removal and destruction of the main component of the old chiller to ensure there is no re-use of the old equipment and thereby no re-emergence of demand for virgin CFCs. This destruction will be verified by the PMC and certified by DENR. The combination of adequate institutional and regulatory capabilities, increased public awareness and understanding, and active and informed chiller owners will ensure project sustainability.

78. The project design requires that the new chillers which will be procured will meet energy efficiency specifications. In addition, they will be equipped with basic data loggers which will automatically monitor their performance, as this is a critical requirement for calculating the carbon emission reduction credits. The Project will also encourage all chiller manufacturers and ESCOs to grant service maintenance contracts with their clients during the project implementation period, all participants will be informed of the energy savings gained by new chillers, which, in fact, are much higher[19] than the subsidy or CDM revenues provided by the Project. Energy efficiency gains from the new chillers are therefore substantial and sustainable.

[19] The simple payback period for an individual chiller owner comes to 2.7 years without the inclusion of carbon revenues.

79. The project has an inherent replication modality, given that the CDM component replicates the GEF and MP components to encourage additional chiller replacements. The sustainability of the Project and market transformation is highly dependent on carbon finance revenues, which can only be assured through registration of the Project with the CDM EB. In the event the that the project fails to attain registration, it will seek to sell verified emission reductions (VERs) in a number of emerging cap-and-trade systems in Australia, Canada, Japan and the United States, The sale of VERs would enable the project to implement the revolving fund concept and achieve the PDO.

E. Critical Risks and Possible Controversial Aspects

80. Potential risks and proposed mitigation measures are summarized below.

Risk factors	*Description of risk*	*Rating[a] of risk*	*Mitigation measures*	*Rating[a] of residual risk*
Operation-specific Risks				
Lack of Interest of chiller owners	Risk of not meeting the targeted number of chiller owners to join the project and/or delays in the chiller owners joining the project due to their inability to put up the 85% financing requirement for the cost of the new chiller.	Moderate	During consultations organized by DENR a large number of chiller owners expressed their strong interest in joining the project. The TA component aims at informing chiller owners of energy savings potential from chiller replacements through on-going discussions and marketing workshops. A financial analysis tool to demonstrate the financial benefits of chiller replacement has been developed to inform chiller owners. The PCEEP intends to utilize MOEF support for attracting the public sector into the project.	Moderate
Performance of new chillers not sustainable.	Performance and energy savings depend not only on the technology but also the quality of the maintenance.	Moderate	The Project encourages chiller owners to acquire maintenance contracts for their new chillers from equipment suppliers or through energy service companies. On-line monitoring program, through data loggers and transmitters, will provide real-time performance of new chillers. This information will be made available to chiller owners.	Low
Financial management	Weak internal controls and adverse opinion on the DENR's agency financial statements rendered by the external auditors due to errors in or unreconciled account balances. Lack of FM staff at DENR to focus on the financial management requirements of the project. Complex and highly technical nature of the project with three funding sources that may create risk of mixing use of funds.	Substantial	A PMC with a financial management staff experienced in government accounting and reporting will be hired for the project. Separate bank accounts shall be opened and maintained for each funds source (GEF, MLF & CDM). Separate books of accounts shall be maintained for the project and periodic financial reports shall be required to be submitted both to DENR and the Bank. An Operations Manual shall be adopted prior to grant becoming effective to describe the detailed policies and procedures under the project and the responsibilities of the PMC, FASPO, FMS division, etc. Performance audit shall be performed under the project under terms of reference acceptable to the Bank.	Moderate
Procurement	Procurement of MM consultancy and equipment by DENR and procurement of	Moderate	The transparency issue will be dealt with by asking DENR and project beneficiaries to make necessary advertisement in the widely published National Daily News	Moderate

Risk factors	*Description of risk*	*Rating[a] of risk*	*Mitigation measures*	*Rating[a] of residual risk*
	chillers by project participants may have transparency issues or may have delays, which will then impact project sustainability		paper for inviting bid and award of Contract - debriefing in the news paper and their web site. DENR will monitor the delay of the beneficiaries and report to the bank for remedial action if any required. Since DENR will follow the Bank's Procurement Guidelines for hiring MM Consultancy and equipment contract, it will be monitored by the Bank through supervision mission and or through a periodical progress report submitted by PMU/DENR.	

F. Grant/Credit Conditions and Covenants

81. Conditions for negotiation:

a. Initiate hiring of the PMC to assist DENR in the implementation of the project, which should include a financial management staff with adequate experience in government accounting and reporting.
b. DENR designating focal FM person at FMS division to coordinate with the PMC and facilitate the financial management processes within DENR for the Project.
c. Format of the IFR agreed with the Bank
d. Template of a sub-grant agreement agreed with the Bank.
e. Comprehensive procurement plan agreed with the Bank

82. Effectiveness conditions:

a. Signed contract of PMC
b. Adoption of a Project Implementation Plan by DENR.
c. Adoption of an Operations Manual which should include a section on the project financial management policies and procedures adopted for the project.
d. The Recipient has established the Project Management Unit and the Project Steering Committee.
e. For the GEF Grant Agreement, the OTF Grant Agreement has been executed and delivered, and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals thereunder (other than the effectiveness of this Agreement) have been fulfilled.
f. For the OTF Grant Agreement, the GEF Grant Agreement has been executed and delivered, and all conditions precedent to its effectiveness or to the right of the Recipient to make withdrawals thereunder (other than the effectiveness of this Agreement) have been fulfilled.

83. Legal Covenants:

a. Compliance with the Environmental Management Framework, and collection and compilation of reports on status of compliance with the EMF for submission to the World Bank on a six-monthly basis reports.
b. The project shall maintain an adequate financial management system with appropriate books of accounts in accordance with generally accepted accounting principles.
c. Unaudited Interim Financial Reports (IFRs) within 45 days after the end of each calendar quarter, which shall consist of the: (a) financial reports consisting of the following: (i) statement of financial position; (ii) statement of sources and uses of funds which should include the current and cumulative data compared with plan & by fund source; and (iii) bank reconciliation statements, both dollar and all peso project bank accounts; (b) physical progress report and (c) procurement status report. The physical accomplishment report must be linked to the financial report. The IFR should also be accompanied by a narrative explanation of the progress of the project and the significant variances between actual against planned and financial against physical accomplishments.
d. Annual audited project financial statements, which shall consist of the statement of financial position, statement of financial performance, statement of changes in net assets/equity, and cash flow statement together with the notes to the financial statements and a copy of the management letter reflecting the auditor's findings and recommendations, shall be submitted to the Bank no later than 6 months after the end of each fiscal year. The auditor for this project is COA. The Audit Certificate to be issued shall be the based on the Bank's pro forma audit certificate.
e. Copy of the internal audit report shall be submitted by DENR-Internal Audit Service (IAS) to the Bank sixty (60) working days after the end of each calendar year.
f. An independent performance review by a consulting firm, with terms of reference acceptable to the Bank, shall be conducted at Mid-term and the report submitted to the Bank sixty (60) days after mid-term.
g. Within 6 months from grant signing, DENR shall adopt a grievance monitoring system.
h. For the Project duration, the Recipient shall, within twelve (12) months from issuance of each external audit report for the project, implement the recommendations arising from such external audits, all in a manner satisfactory to the World Bank.

IV. APPRAISAL SUMMARY

A. Economic and Financial Analyses

84. The Project will have a positive impact on the environment, locally and global, by reducing the emission of greenhouse gases, ODS and other polluting gases such as NOx, CO and SOx. Although the economic analysis is limited due to the lack of reliable baseline and quantifiable data on the valuation of human health and impact of climate changes to the livelihood of the Philippine population, it is clear that the economic

benefits from reducing greenhouse gases and ODS emissions through energy efficiency interventions substantially exceed the costs associated with implementation of this project.

85. A financial analysis of the Project, taking into account the five sources of funds (GEF, MLF, GoP, USEPA and CDM), technical and administrative expenses, and the incentives for early replacement of chillers, is discussed in detail in Annex 9. There are two types of financial incentives. Under Option 1, the Project will share 15% the cost of the new efficient chiller, initially valued at a normative price of US$ 400/TR and multiplied by the rated cooling capacity of the baseline unit. In Option 2, 80% of CDM revenues generated from the actual energy savings caused by the new chillers will be paid to the chiller owners. Annual payments will commence one year after installation and commissioning of the new chillers and upon the successful issuance of CERs by the CDM EB. It is assumed that most chiller owners, around 80%, will prefer Option 1.

86. The Project intends to replace 375 chillers in ten years, from 2010 to 2019. Depending on the continuity of the carbon market, the Project could continue to support additional chiller replacements beyond 2019. With an estimate of improving energy efficiency by 0.45 kW/TR from the new chillers, the total energy consumption of the chiller owners will be reduced by 341 GWh annually. Thus, 59 MW of future power generating capacity requirements could be avoided – an investment saving of US$ 110 million for the country.

87. The total GHG emission reduction from the Project up to 2020 would approximately be 705,498 tCO2 of which 284,848 tCO2 could be attributed to GEF and MLF resources.

88. Under an environment of hard resource constraints, chiller replacement projects have been given less priority due to other competing investment priorities. In other words, mission-critical projects are given priority over mission-marginal projects such as chiller replacements and other energy efficiency products. The mission marginality of the investment, coupled with the higher up-front cost, and the perceived technology risks constitute a formidable barrier to more widespread adoption of the energy-efficient chillers. According to the India Chiller Sector Strategy study financed by the Multilateral Fund and carried out in 2001 and 2002 by the World Bank, the cost of advancing chiller owners' decisions to replace their chillers, or cost of barrier removal, is up to 30% of the initial cost of new chillers. After incorporating the cost of barrier removal as an incremental investment cost, the Economic Internal Rate of Return (EIRR) of the Project at plant level is 59%.

89. The cost effectiveness analysis in Annex 9 demonstrates also the benefits of replacing chillers under the Project 5 years early from the chiller life expectancy period of 20 years. The total GEF and MLF funding that would yield global environmental benefits in the form of GHG reductions is equivalent to US$ 3.50 per tCO2 abated. On the other hand, the Effective Net Economic Benefit of the Project could reach US$ 180 per tCO2 abated.

B. Technical

90. The basic technology utilized by chiller systems has been the same for over 50 years, namely a vapor-compression cycle, the requirements of the MP and also an increased focus on energy efficiency standards, the technology for chillers has made significant strides in reducing potential for leakage and in improving its energy efficiency performance, resulting in an improvement of more than 30% in less than 20 years. The proposed technology is, therefore, state-of-the art and well proven with thousands of existing installations globally. Consequently, there are no significant technical issues with the proposed technology, but there will be numerous technical issues associated with each replacement activity. These will be addressed as part of project implementation as they are typical issues related to equipment replacement and facilities management and through service contracts with manufacturers and ESCOs.

91. The use of alternative refrigerants - HFC-134a[20] and HCFC-123[21] - in replacement chillers could pose an interesting dilemma that could evoke controversy if not well understood. While HFC-134a has a lower ODP[22], but is a greenhouse gas under the Kyoto Protocol (KP) due to its Global Warming Potential, it is considered a good alternative refrigerant that offers the advantage of early movement away from CFC-based technology with associated positive impacts, including increased energy efficiency and reduced hazards (reduction of use of poisonous or flammable/explosive gases). A joint working group of technical experts (KP and MP) examined this issue and recommended that the use of HFC-134a be supported by the MLF because the benefits far outweigh the small, but still negative contribution, to global warming. Furthermore, the new chillers using this refrigerant are much more robust and refrigerant losses have been drastically reduced.

92. HCFCs (such as HCFC-123) are a controlled substance under the MP. In 2007, the Meeting of the Parties of the MP decided to bring-forward the phase-out schedule of HCFCs, in order to synergize efforts on reducing GHGs as required under the KP. Developing countries are now mandated to phase-out consumption and production by 2030. Therefore replacement chillers using HCFCs can be procured now, and given that the useful service life of chillers is about 20-25 years, this will not incur any imminent financial hardship for the owner. This project therefore is not a policy invoking instrument and thus respects the full range of technical options that are in compliance with international requirements. If technology emerges to replace HCFC-based chillers with more environmentally-friendly alternatives, these are likely to be eligible for the program, provided they can also meet the energy efficiency criteria.

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[20] Hydrofluorocarbon 134a (1,1,1,2-Tetrafluoroethane) is an inert gas, similar to CFC-12, but with a lower ODP, used primarily as a "high-temperature" refrigerant for domestic refrigeration and automobile air conditioners.

[21] Hydrochlorofluorocarbon 123 (2,2-Dichloro-1,1,1-trifluoroethane) is considered as an alternative to CFC-11in low pressure RAC systems, with a lower ODP.

[22] The ozone depletion potential (ODP) of a substance is the ratio of the impact on ozone of a chemical compared to the impact of a similar mass of CFC-11, which has an ODP of 1.0.

C. Fiduciary

Financial Management

93. Overall, the financial management system of DENR would be able to meet the financial management requirement as stipulated in OP/BP 10.02, subject to the implementation of agreed actions and mitigating measures detailed below. Significant weaknesses noted were as follows: (i) books of accounts are still maintained manually which caused considerable delays in the generation of consolidated financial statements, errors in account balances, and inadequate and deficient records of fixed assets, inventory, accounts receivables, among others; (ii) non-compliance with basic internal controls such as no bank reconciliation statements for some bank accounts, physical count of fixed assets and inventories not reconciled with accounting and property records; and (iii) absence of an Internal Audit Service (IAS) unit functioning in accordance with international standards. These factors, among others, caused the Commission on Audit (COA) to issue an adverse opinion on the 2007 and 2006 financial statements of DENR. The actions to address these issues are covered under time bound plans and other activities implemented and monitored under another existing Bank-assisted project with DENR. DENR is currently implementing several investment projects and trust funds. The ratings of some of these projects are below satisfactory due to certain FM implementation issues. DENR is working on the agreed actions to improve the FM performance ratings of these projects.

94. The assessed financial management risk of the project before the mitigating measures is considered substantial and the residual risk after mitigation is moderate. The agreed actions and mitigating measures include the following: (a) A project management contractor (PMC) shall be hired under the project to assist DENR in the implementation. The PMC shall be required to: (i) Have at least one finance staff dedicated to the project, who has adequate experience in government accounting and reporting; (ii) Maintain separate books of accounts for the project in accordance with generally accepted accounting principles; and (iii) Prepare the FM policies and procedures of the project as part of the project Operations Manual, acceptable to the Bank; (b) The grievance monitoring system shall be developed and put in place within 6 months from grant signing; (c)The Internal Audit Service (IAS) of DENR shall include the project in its scope of work at least once a year, with a copy of the report submitted to the Bank sixty (60) working days after the end of each fiscal year; (d) Separate Designated Accounts shall be maintained for GEF and MLF funds and a dedicated project bank account for the CDM fund, which shall be managed by the DENR-FMS. Disbursements out of these three bank accounts shall be approved and signed by DENR. Withdrawal applications shall be prepared by PMC but reviewed and signed by DENR; (e) DENR shall appoint a focal person Financial Management Service (FMS) before negotiation to coordinate and facilitate the PMC in the financial management requirements of the project, such as the processing of the payment vouchers, contracts, withdrawal applications and financial reports; (f) Unaudited interim financial reports (IFRs) shall be submitted 45 days after the end of each calendar quarter to the Bank and to COA, for COA to do progressive audit to ensure timely submission of the audited project financial statements; (g) A performance

audit shall be conducted mid-term during the life of the project under terms of reference acceptable to the Bank. The report should be submitted to the Bank 60 days after mid-term to timely address issues and improve project implementation; and (h) A brief orientation on Bank policies and procedures on financial management, procurement and disbursement shall be conducted to PMC with the participation of the focal staff at DENR FASPO and FMS.

Procurement

95. The DENR will be the lead agency and will be responsible for the procurement of goods (data loggers and transmitters) and services. The agency has now a Procurement Unit with sufficient number of trained and qualified staff who can handle the procurement under the project following Bank procedures. However, bulk of the procurement in respect to chillers replacement will be undertaken by the chiller owners, who will obtain the best value for their money.

96. The earlier procurement capacity assessment found inherent weaknesses and inefficiencies in DENR procurement. While there were good developments through the establishment of a Procurement Unit (PU) in Foreign Assisted Projects Office (FASPO) and the implementation of the DENR Procurement Improvement Program there is no evidence yet of remarkable improvement in procurement processing. Also, the PU in FASPO, with trained and qualified staff who can handle the procurement of existing portfolio following Bank procedures, has limited procurement capacity in comparison with the increasing number of DENR projects. Also, it is anticipated that the current PU capacity will be overstretched because of the technical complexity of the project and the sheer number of transactions for chiller replacement.

97. Most of the procurement under the project will be the replacement of new chillers including installation, maintenance and performance guarantees (as required) shall be undertaken by the beneficiary chiller owners as follows: (i) Government owned chillers will be in accordance with the Government's PBD for goods as agreed with the Bank or Bank's ICB procedures as necessary, and (ii) private sector owned chillers according to commercial practices acceptable to the Bank. As the major portion of the chiller cost is borne by the beneficiary, it is in the interest of the beneficiaries to obtain the best value for their money. Beneficiaries have the option to choose the best conditions in terms of product, cost and financing and will select one or more chiller suppliers who can develop a sub-project(s) to optimize the beneficiary benefits and in line with the project requirements. Pro-forma the agreement covering important conditions like warranty, performance parameters, annual maintenance, performance guarantee, service to measure and maintain the promised energy consumption and other performance parameters including the Bank's Fraud and Corruption and audit right provision shall be developed and required for use by the beneficiaries.

98. Commercial Practices. Goods estimated to cost less than US$ 5 million equivalent per contract and to be financed in part under financial incentives to private sector

beneficiaries under Part 1 of the project, may be procured in accordance with commercial practices acceptable to the Bank.

99. Procurement Planning. A plan for the procurement of chillers by the private sector beneficiaries, which shall include contract cost estimates, contract packaging, and applicable procurement procedures, shall be furnished to the Bank for its review and approval prior to the issuance of the invitation to bid. Such plan shall be updated on an annual basis or as needed always covering the next 18 months period of project implementation. Any revisions proposed to the Procurement Plan shall be furnished to the Bank for its prior approval.

100. Advance Procurement Action and Retroactive Financing. The Grant is planned to be presented to the World Bank Board by March 31, 2010, and declared effective by April 15, 2010. Selection of the consulting services for the Project Management under the program, estimated at US$ 0.85 million, which is required to commence at the start of the project, has been initiated. Hence to accelerate project implementation, the DENR proceeded with the initial steps of procurement before signing the related Agreement with the Bank. In such a case the procurement procedures, including advertising, shall be in accordance with the Bank procurement guidelines in order for the eventual contracts to be eligible for Bank financing, and the normal review process by the Bank shall be followed. Accordingly continuing audit for CERs, which is eligible for financing under the project, is expected by the middle of 2011. Retroactive Financing is estimated at US$ 520,000 under the GEF grant and $200,000 under the OTF grant.

101. A detailed description of the procurement methods to be carried out under the Project for goods and services, as well as the assessment and mitigation measures are presented in Annex 8.

D. Social

102. The project will not involve the acquisition of land and the displacement and relocation of people. Neither will it affect ancestral domains or communities of indigenous peoples. None of the World Bank social safeguard policies will be triggered as a result. Also, the project will not cause any associated social impacts such as the loss of employment of chiller operators and maintenance personnel. Instead, the project will upgrade skills of existing chiller operators and maintenance personnel and the emergent energy service industry through capacity building.

E. Environment

103. The project will directly contribute to global environmental benefits by reducing/ avoiding carbon emissions and ozone depleting substances to atmosphere.

104. The project is a Category B in accordance with the Bank’s Safeguards Operational policies because of the need to address the potential worker and building occupant safety risks and the potential environmental risks during installation and major

building renovations/retrofitting and disposal of old CFC chillers and refrigerants as well as health and safety issues in handling non-ODS chemicals for the new chillers. An Environmental Management Framework (EMF) which consists of an Environmental Management Plan (EMP), among others, was developed to address these risks and its attendant mitigating measures to minimize if not prevent any impact that may be brought about by the replacement of the old chillers. Other attendant documents supporting the EMF are the project's Operational Monitoring Plan, Manual of Protocols and the Operations Manual. The project's Operations Manual states that the new chillers should comply with ASHRAE 15-2007 (Safety Standard for Refrigeration Systems) with ANSI/ASHRAE 34-2007 (Designation and Safety Classification of Refrigerants specifies safe design, construction, installation, and operation of refrigeration systems. This standard establishes safeguards for life, limb, health, and property and prescribes safety requirements) and the applicable local regulations. In the event that the non-CFC refrigerants for the proposed new chillers are not applicable to local conditions, then alternatives will be sourced. The chiller owners will seek DENR's approval of a Chillers Dismantling, Destruction and Disposal plan and the recovery and surrender of the CFCs from the old dismantled chillers the procedures for which are also contained in the Operations Manual.

105. Project participants (chiller owners and manufacturers/suppliers, and/or CFCs storage facilities) will be obliged to meet established environmental and safety requirements related to decommissioning of baseline chillers, refrigerant management and installation of new chillers. Chiller owners must allow access to the chiller throughout the lifetime of the Project for monitoring purposes.

106. While functioning chillers have a very limited impact on the environment, improper management of old chillers at the time of servicing and decommissioning or leakages from poorly maintained chillers can result in emissions of ODS based refrigerants, which have the following impact on the global environment:

a. Depletion of the ozone layer through emissions of ODS.
b. Adverse impact on global climate through emissions of fugitive refrigerants with high GWPs.
c. Consumption of large amounts of energy and associated emissions of GHGs by old poorly functioning chillers.

107. Additionally, in an indirect manner, the energy required to run a chiller during its lifetime can result in creation of pollutants such as particulate matter, Nitrous and sulfur oxides (NOx, SOx), carbon monoxide, lead, airborne toxic chemicals, and ground level ozone. Health risks from these pollutants include lung cancer, chronic pulmonary disease, pulmonary heart disease, and bronchitis, which are leading causes of sickness and death in developing countries. These pollutants also cause economic damage to buildings and environmental and economic damage to vegetation, animals, and natural resources.

108. The project is classified as a Category B[23] and has developed an Environmental Management Framework (EMF) to address the potential environmental risks associated with the replacement of old CFC-based chiller systems. To mitigate the adverse impacts of chiller replacement, the following components and mitigation measures have been identified in the EMP:

a. **Installation of non-CFC chillers:** Chiller suppliers are required to abide by international safety standards for the installation of new chillers[24]. This standard is directed towards safety of persons and property on or near the premises where refrigeration facilities are located.

b. **Disposal of the baseline equipment:** All project beneficiaries have to prepare an Equipment Destruction and Disposal Plan to ensure that existing CFC chillers, particularly compressors, will be dismantled and rendered unusable in an environmentally sound manner. Installation, testing, operations and maintenance of new non-CFC chillers, and disposal of baseline CFC equipment and systems must strictly follow internationally recognized procedures and practices.[25]

c. **Recovery and Inventory of Refrigerant from the Decommissioned Units**: The recovery of refrigerants must be undertaken by a certified technician, using a recovery and recycling machine and the process of recovery of refrigerant gas from retiring chillers needs to be witnessed and certified. Typically, refrigerants recovered from old chillers would be contaminated and therefore, these would need to be reclaimed or re-used .As per the Ozone Rules, all enterprises that stock or recycle recovered CFCs need to register with the Philippine Ozone Desk (POD).

d. **The quantity of CFCs and HCFCs recovered** from retiring/decommissioned chiller units must be recorded to ensure that the recovered refrigerant gases can be monitored and tracked. The chiller owners have the options of storing the recovered HCFCs to service their existing stock of HCFC-based chillers. CFCs will be surrendered to POD for stockpiling while they have the option of selling or handing over all recovered HCFCs to chiller manufacturers/suppliers at any time[26].

e. **Destruction of CFC**s: Typically at the end of their useful life-time, CFCs will need to be destroyed in an environmentally sound manner. As per the CDM methodology, destruction has to be undertaken by a method approved under the government's regulations pursuant to the Montreal, Kyoto or other Protocol that may in the future apply. The ultimate responsibility for the destruction of the CFC

[23]The World Bank's Environmental Assessment policy and recommended processing are described in Operational Policy (OP)/Bank Procedure (BP) 4.01: Environmental Assessment.
[24] ANSI/ASHRAE 15-1994 Safety Code for Mechanical Refrigeration
[25] ASHRAE Guideline 3 – "Reducing Emission of Halogenated Refrigerants in Refrigeration and Air Conditioning Equipment and Systems".
[26] As per the Ozone Rules, sale of recovered or recycled CFCs can be sold by registered sellers. Registration can be obtained from the POD.

inventory maintained by this project will be the POD. However, since this technology is currently not available domestically, this issue will be revisited during the Mid-Term Review of the Project.

F. Safeguard Policies

109. The project triggers Operational Policy 4.01 on Environmental Assessment (EA). The key safeguard issues are related to proper installation of new chillers and refrigerant management as described above. Mitigation measures are outlined in detail in Annex 10.

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[ ]	[X]
Pest Management (OP 4.09)	[ ]	[X]
Physical Cultural Resources (OP/BP 4.11)	[ ]	[X]
Involuntary Resettlement (OP/BP 4.12)	[ ]	[X]
Indigenous Peoples (OP/BP 4.10)	[ ]	[X]
Forests (OP/BP 4.36)	[ ]	[X]
Safety of Dams (OP/BP 4.37)	[ ]	[X]
Projects in Disputed Areas (OP/BP 7.60)	[ ]	[X]
Projects on International Waterways (OP/BP 7.50)	[ ]	[X]

G. Policy Exceptions and Readiness

110. There is no policy exception for the Project. The following elements outline the readiness of the Project by May 20, 2010:

a. The Project Implementation Plan (PIP) will have been clearly defined and can be put in place relatively quickly by DENR to enable implementation to commence immediately after project effectiveness.
b. PMC will have been selected and will complete project preparation work before April 15, 2010.
c. Measurement and Monitoring protocols have been prepared by the KfW and ready for use since January 1, 2010.
d. Fifty chillers, self-financed by the owners, are in the pipeline for replacement as the first batch of CPAs. Energy audits for these chillers have been completed by March 31, 2010.
e. The dismantling and destruction of the replaced inefficient chillers will be done by the chiller owners and certified by DENR before the subsidy is released to the chiller owner. To prevent the chiller owner from 'backsliding' to once again use of the old chiller, the compressor and all other parts essentially using CFCs to produce chilled water will be destroyed while the reusable dismantled parts of the old chiller can be recycled as spare parts for other uses or sold as scrap materials. The chiller owner will surrender the recovered CFCs to DENR for storage and future destruction.

f. Aside from self-financing, other financing sources available to the chiller owners will come from government financial institutions, commercial banks, ESCOs, leasing companies, credit lines extended by chiller manufacturers/suppliers. The project will provide a list of more than twelve (12) names of financing sources committed to participate in the project.

Annex 1: Country and Sector/ Program Background
PHILIPPINES: PH - Chiller Energy Efficiency Project

A. Country Background

1. The Philippines has made great progress in phasing out the consumption of chlorofluorocarbons (CFCs) (used in chillers for refrigeration and air-conditioning as refrigerant and in foam production as blowing agent) over the last ten years since 1999 in accordance with its obligations to the Montreal Protocol (MP) on Substances that Deplete the Ozone Layer**.** As of the end of 2007, the Philippines has phased out 2**,**886.5 MT of CFC, or 94% of its baseline consumption. It also intends to meet the MP total CFCs consumption phase-out deadline in January 2010.

2. The Philippines is neither a producer nor an exporter of CFCs. It has banned CFC-11 imppration since 2005 and presently imports CFC-12. Because use of stockpiled or recycled CFCs in the refrigeration servicing sector is not controlled under the MP, stockpiled or recyled CFCs can be used in servicing old CFC based chillers beyond 2010. However, the average chiller manufactured today uses about 35% less electricity than chillers produced just two decades ago. With the best technology available, operated on HCFC-123 or HFC-134a, new chillers can use up to 50% less electricity than an average chiller from 1976.[27] In addtion, due to poor maitenance practice of chillers in the Philippines, younger non-CFC based chillers installed in late 1990s and early 2000s are also consuming high energy than expected. Energy efficiency savings is therefore a primary environmental consideration and potential economic incentive for conversion to non-CFC and efficient chillers.[28] Replacing non-efficient including CFC-based chillers also contributes to reduced greenhouse gas emissions, both from an energy consumption perspective and from reduced emissions of CFCs which have high global warming potential[29]. Naturally, the choice of non-CFC refrigerants will affect the aggregate greenhouse gas emissions impact of the substitute technologies.

3. Despite the clear benefit to chiller owners of opting for non-CFC energy efficient (EE) chillers through dramatic savings in energy costs, early replacement is not taking place because of financial, technology, and information barriers. In an environment of competing investment opportunities and resource constraints, chiller replacement which requires high capital expenditures is not a priority of building owners. This situation is aggravated by other barriers including weak regulatory capacity, the longer-term achievement of the additional benefits of the investment compared with other less costly business upgrades with apparently better rates of return, access to capital, and perceived risks in operating new non-CFC chillers. With the exception of access to capital, these

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[27] Report of the TEAP Chiller Task Force, Technical and Economic Assessment Panel of the Montreal Protocol, May 2004.

[28] Ibid. While some alternatives (HFCs) do possess Global Warming Potential (GWP), refrigerants on the whole do not contribute to global warming unless released into the atmosphere. Properly maintained chillers of modern design emit less than 1% of their refrigerant charge each year. The dominant global warming effect caused by chiller operation is therefore, the carbon dioxide emitted during combustion of fossil fuels used to generate the electricity required to drive them.

[29] CFC-11 has a GWP of 5000, while CFC-12 has a GWP of 8500

barriers can be considered as a high opportunity cost. This means that investors would have to pay high upfront costs and postpone significant profits which has been identified in the chiller sector study as a formidable barrier to early adoption of the EE alternative. Results from demonstration projects funded by the MP's financial mechanism, the Multilateral Fund (MLF) and the Global Environment Facility (GEF) in Thailand and by the MLF in Mexico and Turkey, as well as a comprehensive MLF-World Bank chiller sector study in India, confirm this finding. The MLF Executive Committee agreed that the results of the mathematical/business model used in the India Chiller Sector Strategy was applicable to all Article 5 countries by underlying in its decision to fund chillers stating that "total funding per investment will be determined using an accessible mathematical and/or business model, taking into account relevant decisions of the Executive Committee." The decision was preceded by the confirmation that, "a mathematical model for establishing funding levels for individual chillers, as developed by the World Bank, had been accepted by the implementing agencies and the Secretariat, and UNDP and UNIDO." The chiller sector study also found that, based on the relationship between the age of chillers and energy consumption, maintenance costs, and down-time (all impacting operating costs), the opportunity costs incurred for replacing a chiller of 10-25 years in age is approximately 20-30% of the initial cost of a new chiller.

4. The proposed Project is developed within the context of the Medium-term Philippine Development Plan 2004-2010 (MTPDP) which states that there is a need to manage natural resources and protect the environment to improve the quality of life of Filipinos and endorses systems conversion to ozone depleting substances (ODS) friendly technology, products and equipment. The project will contribute to the Government of the Philippines' ongoing efforts to meet its obligations under the MP by reducing demand for new CFC. It complements the MLF-financed National CFC Phaseout Plan which deals with all consumption subsectors except for chillers. Given that chiller replacement will generate significant energy savings and carbon emission reductions, it is ideal for financing from the GEF and CDM, considering that the MLF alone could only support approximately 25 replacements. Using the combined funding from the three sources - MLF, GEF and CDM, a total of 300 inefficient chillers can be provided with a 20% subsidy. out of around 500 chillers based on equipment suppliers' records. A national inventory is being conducted to update the baseline information of the whole chiller population in the country.

B. Sector Background

5. The refrigeration and air-conditioning sector accounted for roughly 66 percent of CFCs used in the Philippines. Chiller-based cooling is the predominant cooling method used in large commercial and industrial buildings and facilities. Chillers produce chilled 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. Heat removed from buildings is then released into the environment through a cooling tower for water-cooled chillers or through fan-coil condensing units for air-cooled systems. Air conditioning for building comfort (A/c comfort) is the predominant application, followed by air conditioning for industrial process purposes (A/c process) where temperature and

humidity control are critical requirements (e.g. textiles). There are some relatively few refrigeration applications in the large-chiller segment, with vapor-compression refrigeration cycle being the most widely used. Compression refrigeration chillers use mechanical energy to cool the refrigerant. Common types of compression chillers are centrifugal and positive displacement (the latter including reciprocating, screw, and scroll chillers). Compression refrigeration chillers are manufactured in capacities of approximately 7 kW to over 35,000 kW. For a cooling load of 300 tons of refrigeration (TR)[30] and above, centrifugal compressor chillers is the most efficient technology.

6. Compression refrigeration chillers traditionally used chlorofluorocarbons CFC-11 and CFC-12 refrigerant, both of which are ozone depleting substances. Current chillers use replacement refrigerant, principally hydrochlorofluorocarbons (HCFCs) or hydrofluorocarbons (HFCs). HFCs do not release chlorine or bromine upon degradation, and consequently have an ODP of zero. The ODP of substances that do release chlorine or bromine upon degradation is the ratio of its impact on the ozone layer to the impact of a similar mass of CFC-11 (the most common ODS), the ODP of which is set at 1.0 as a benchmark. Most refrigerants have ODP that range from 0.01 to 1.0 (EPA 2002). GWP is the ratio of the global climate impact caused by a substance relative to a similar mass of CO2, the most common GHG, the GWP of which is set at 1.0 as the benchmark for other GWP values. The GWP of HCFCs and HFCs range from 93 to 12,100. The following table presents the ODP and GWP for commonly used refrigerants.

Table A1.1: ODP and GWP for Commonly Used Refrigerants

Refrigerant[31]	**ODP**	**GWP**[32]	**Formula**
CFC-11	1	4,000	CCl_3F
CFC-113	0.8	5,000	$C_2F_3Cl_3$
CFC-114	1	9,300	$C_2F_4Cl_2$
CFC-115	0.6	9,300	C_2F_5Cl
CFC-12	1	8,500	CCl_2F_2
HCFC-123	0.02	93	$C_2HF_3Cl_2$
HCFC-22	0.055	1,700	CHF_2Cl
HFC-134a	0	1,300	$C_2H_2F_4$
HFC-236fa	0	6,300	$C_3H_2F_6$
R-500	0.738	6,310	CCl_2F_2 + CH_3CHF_2
R-502	0.33	5,490	C_2F_5Cl + CHF_2Cl

Source: US EPA, 2002.

[30] One ton of refrigeration is equivalent to 12,000 BTU/hr (British Thermal Units per hour).

[31] When any of these substances is used as a refrigerant, it is generally referred to as “refrigerant gas X” or “R-X.” For example, CFC-12 would be referred to as R-12 when used as a refrigerant. R-500 is a blend of CFC-12 and HFC-152a . R-502 is a blend of CFC-115 and HCFC-22

[32] GWPs are commonly calculated over 20, 100, or 500 year time frames. The GWPs referred to here are for a 100-year time horizon.

7. Chillers used in buildings are often the most significant single user of energy in a large commercial building (15-20% of total building energy use for buildings with water-cooled centrifugal chillers). This energy use is either direct or use of electricity, which is usually generated through a mixture of fuels with a high representation of fossil fuel combustion in many countries. In either case, significant greenhouse gases (GHGs) are emitted into the atmosphere, as shown in Table A1.2 below for several representative chiller types and efficiencies.

Table A1.2: Chiller Energy Use Warming Impact for Different Chiller Types

Chiller Type	kW/RT	COP	Tons CO_2/year	Lifetime CO_2 emissions (tons)
Centrifugal water-cooled chiller	0.50	7.03	130	3,250
Centrifugal air-cooled chiller	0.95	3.70	247	6,175
Water-cooled rotary screw chiller	0.58	6.06	151	3,770
Air-cooled screw chiller	0.94	3.74	244	6,110
Direct-fired gas absorption chiller	3.41	1.03	257	6,436
Indirect-fired gas absorption chiller	2.88	1.22	217	5,434

Source: ICF Study "International Chiller Sector Energy Efficiency and CFC phaseout"

8. Chiller energy efficiency has improved significantly over the last 20 years, outlining efficiency in terms of kW/ton, and kW refrigeration / kW electric input. According to the Air-Conditioning and Refrigeration Institute (ARI), this increase in energy efficiency has reduced power consumption in the US by 7 billion-kilowatt hours per year (enough to provide the annual electrical needs of approximately 740,000 households), saving $480 million in energy costs and avoiding emissions of 4 million tons of CO_2 by power plants.[33] It is notable that the gap between high and average efficiency levels has grown from 5-7% in the 1980s and early 1990s to 22-23% in recent years. While efficiency levels in developing countries have increased since the late 1990s, and even more since prior to that time when levels in developing countries were 0.8 kW/ton or more, the efficiency gap is even greater in developing countries, as shown in the table below for average efficiencies.

[33] ARI 4/11/01 press release (www.ari.org).

Table A1.3: Chiller Efficiencies by Country[34]

Country	Average efficiency (kW/ton)[35]	Efficiency Gap[36]	Above-average efficiency gains[37]
Argentina	0.71	48%	-
Bangladesh	0.74	54%	-
Brazil	0.70	46%	8%
China	0.73	53%	7%
India	0.71	48%	5%
Indonesia	0.66	37%	6%
Malaysia	0.68	42%	9%
Mexico	0.66	38%	9%
Philippines	0.71	47%	5%
Russia	0.69	43%	-
Thailand	0.71	48%	7%
Venezuela	0.67	40%	-
Vietnam	0.71	49%	-
Dominican Republic	0.64	34%	-
Average	**0.71**	**48%**	**4%**
Worldwide average	**0.60**	**25%**	**3%**
Best efficiency	**0.48**	**-**	**7%**

9. As the table above shows, chiller efficiency levels in most developing countries tend to be significantly lower than the highest efficiency chillers available, as well as lower than average levels (0.71 kW/ton versus 0.60 worldwide average and 0.48 best available). This indicates that there is significant potential to promote sales of more energy-efficient chillers in those countries.

10. Based on an international study commissioned by the World Bank in 2005, the following table was developed which what the total global environmental, local environmental, and economic benefits would be if an estimated 12,500 CFC chillers currently in service were converted to energy-efficient, non-CFC chillers (for illustrative

[34] Extracted from International Chiller Sector Energy Efficiency and CFC phaseout, ICF, Jan 2005

[35] Calculated from energy efficiency, chillers sales, and market share data provided by Ozone Protection Units and chiller manufacturers for the period 1996-2001. Breakdowns by manufacturer and year are not shown in order to protect data confidentiality.

[36] Calculated as the percentage difference between average efficiency and the best efficiency level. Since the highest efficiency levels may not be technically available or economically feasible for all applications, this should not be taken as an accurate indicator of absolute energy savings potential. It is however a good indicator of relative potential for increased sales of energy-efficient chillers.

[37] Improvement in average efficiency 1996-2001. Calculated decreases in efficiency are not shown, since these were believed to be largely due to lack of full sales and efficiency data.

purposes, an equal number of HCFC-123 and HFC-134a chillers). The extract of the table below provides some of the key figures:

Table A1.4: Total Prospective Environmental and Economic Benefits of Developing Country CFC Chiller Replacement

Number of chillers = 12,500 **Annual impact**	**Per Chiller**	**Total**
ODS emissions reductions (ODP kg)	160	1,999,500
Refrigerant cost savings	$1,001	$12,512,500
Energy use savings (kWh)	200,000	2,500,000,000
Energy use cost savings	$12,000	$150,000,000
Total cost savings	$26,431	$330,387,500
TEWI reduction (MTCE)	4,611	57,641,625
Local pollution reduction (metric tons):		
NOx	0.8	10,185
N20	0.002	25
Sox	10.6	132,696
PM	5.0	61,959
Lifetime impact		
ODS emissions reductions (ODP kg)	2,399	29,992,500
Refrigerant cost savings	$15,015	$187,687,500
Energy use savings (kWh)	3,000,000	37,500,000,000
Energy use cost savings	180,000	2,250,000,000
Total cost savings	396,465	4,955,812,500
TEWI reduction (MTCE)	69,170	864,624,375
TEWI reduction (tons CO_{2e})	253,623	3,170,289,375
Local pollution reduction (metric tons):		
NOx	.03	368
N20	159	1,990,446
Sox	74	929,392
PM	0.21	2,611

11. As the above calculations show, if 12,500 inefficient CFC chillers could be replaced with energy efficient non-CFC chillers then:

- Approximately 2,000 tons per year and 30,000 tons total of ODS use would be eliminated;
- Peak electric power demand would be reduced by 1.25 gW avoiding US$1.6 billion in new generation investment;
- Approximately $1.6 billion (Net Present Value) in operating costs would be saved;
- Over 2.9 million tons of local air pollution would be avoided; and
- 3.2 billion metric tons of carbon dioxide emissions would be avoided.

12. It should also be noted that the avoided investment in new power supply and transmission capacity is equal to two-thirds of the total projected investment cost for the new non-CFC, energy-efficient chillers. [38]

C. Chiller Population in the Philippines

13. A national survey of chillers was carried out in August 2008. The following summarizes the chiller population in the Philippines.

1. Population Count and Characteristics

14. Being a tropical country, the Philippines has largely been an importing nation when it comes to major equipment particularly on chillers used for air conditioning and refrigeration even during the start of their popular use today. After the world war, the task of nation building became paramount to the government and with the help of business, started the rehabilitation of some major establishments. Entertainment was primary to the population and soon enough, packaged chillers began appearing in buildings, particularly the State and Roman Super Cinerama theaters, with the former using the pioneering R-500.

15. In the 1970's, major chiller manufacturers were represented by big buying houses or distributors like AG&P, Emcor, EEI, Koppel (Subsidiary of Herdis Group), and Concepcion Industries which handled the promotion and marketing of name brands like American Standard (which late became Trane) York and Carrier. At that time, high capacity chillers above 100 tons are seldom incorporated by consultants in their designs. The RAC equipment which are mostly prevalent in use were packaged and window types (using various types of compressors) coupled with air distribution fans. By the 1980's, big chillers normally using R-11 began to make their appearance in unison with the rising infrastructure especially within Metro Manila and in major cities of the archipelago.

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[38] Per chiller values shown are averaged between sample HCFC-123 and HFC-134 chillers. Economic benefits do not include the health benefits of pollution reduction, which can be significant. Savings include energy cost (at $0.06/kWh) and refrigerant savings. Labor costs are not included, but are assumed to be substantially unchanged. Equipment installation cost is net of scrap value of old chiller. Chiller scrap value and refrigerant prices are estimates based on data collected in 2001 in India. Refrigerant prices do not include tariffs and taxes since these vary significantly by country and should in any case not be included in an analysis of economic benefits, since they represent transfer payments and not true economic costs. Net present value figures are discounted at a real rate of 6% per year. Voided power cost is based on data collected in Thailand (US$1.25 investment per watt capacity), but is believed to be representative for other developing countries as well. Lifetime calculations are based on a 15 year remaining lifetime for the CFC equipment replaced. The benefits shown in this table do not include the energy and investment cost savings achievable through overall building energy efficiency gains that allow reduced building cooling loads and a smaller chiller that uses less energy. Including the savings from the whole building approach would allow for additional energy and energy cost savings of up to 20% or more.

Likewise, major manufacturers began to establish marketing offices complete with service divisions to handle after sales and warehouse assemblies to provide assembly, installation and repairs. Included in this category are brands like York, Carrier, Trane, Dunham Bush, etc. With the advent of the shopping malls and large hotels proliferating the metropolis and the provinces in the 1990's and into the 21st century, high capacity chillers using R-12, R-22 and later on, R-123 were de facto in the design, installation and commissioning particularly in air conditioning applications. Big shopping malls number more than 50 alone in Metro Manila, each with installed capacity of at least 3000 TR. It will also be noted that the three biggest shopping malls in the world are located here. We surmise that there are more than two thousand chillers (2,000) in Metro Manila alone with capacity above 100 Tons (of Refrigeration) utilizing the aforementioned refrigerants. And this is just a conservative estimate.

16. The construction boom after the people power revolution in the late 1980's to the mid 1990's was not concentrated in Metro Manila alone but was significantly advanced also in other major cities in Bulacan, Pampanga, Pangasinan and Tarlac in Luzon, Cebu, Bacolod, Iloilo and Bohol in the Visayas, and finally in Davao, Cagayan De Oro, and General Santos City in Mindanao. With the concentration of shopping malls, hotels, resorts and industries in these locations, it is but natural that air conditioning becomes part of the building plans.

2. Age distribution

17. The chiller population 13 years and younger comprises 80% of the total chillers surveyed with 57% using HCFC while 23% are already using HFC. 15% of the population comprises the 14 years and older chillers needing replacement and which are still using CFC while the 4% are already utilizing natural refrigerants.

18. As of 2008, major mall operators and hotel chains have begun phasing out some of their old chillers and replacing them with HCFC chillers but a significant number are still lined up for the coming years. This will become noteworthy upon the start of the HCFC phase-out in the year 2013.

Table A: Age Distribution

Age of Chillers	% of Chiller Population
0 – 13	3% CFC
0 – 13	55% HCFC
0 – 13	23% HFC
0 – 13	4% Natural
14 & above	6% CFC
14 & above	9% HCFC 100%

2. Size and Refrigerant Distribution

19. Based on the total quantity of the chillers surveyed against the refrigerant used and the cooling capacity, R-22 chillers dominate the list with 49% and having an average size of 240 Tons of Refrigeration (TRs). The average size for all chillers is 500 TR. Below is the tabulation of the chillers in the survey:

Table B: Size and Refrigerant Distribution

Refrigerant	Average Cooling Capacity, TR	Quantity	% Total
R-11	400	18	5
R-12	400	10	3
R-22	240	164	49
R-123	570	55	16
R-134a	500	77	23
Natural	655	11	4
Total		**335**	**100**

3. Compressor type

20. Of the total count in the survey, there are 36% centrifugal chillers and 40% are screw chillers. Centrifugal chillers have capacities starting from 100 TR up to 1280 TR while screw chillers have capacities ranging from 50 to 655 TR. Scroll chillers are in the small category, starting at 60 TR up to 300 TR. Based on refrigerant use coupled with the compressor type, R-22 has a wider range utilizing centrifugal, screw, scroll and reciprocating compressors.

Table C: Compressor Type and Quantity

COMPRESSOR TYPE	R-11	R-12	R-22	R-123	R-134a	NATURAL	TOTAL QTY	% OF TOTAL
CENTRIFUGAL	17	1	19	38	45	0	120	36
SCREW	1	9	69	17	27	11	134	40
RECIPROCATING	0	0	39	0	0	0	39	11
SCROLL	0	0	37	0	5	0	42	12
ABSORPTION	0	0	0	0	0	2	2	1
	18	10	164	55	77	13	337	100

21. The exercise of choosing the most appropriate compressor type of chiller will depend on varying circumstances following the mechanical design consultant's recommendations. While technically, centrifugal chillers offer higher efficiency ratings, screw chillers likewise offer very good part load efficiencies resulting to lower energy expenses. It can thus be said that various factors affect the choice of the chiller compressor type and ultimately will depend on the owners' decision, vision and deep pockets.

5. Chiller life

22. Depending on the compressor type and heat transfer cooling, chillers can last from a minimum of 10 years to a standard maximum norm of 20 years. Water cooled types often show durability and sturdiness against air cooled types. The survey even shows a chiller with a 24 year operation track. However, the thrust of the survey is to identify younger chillers and disseminate the information to chiller owners of the impending phase-out of HCFC and the total ban on CFC, as well as potential carbon revenue, thus the survey results show only 14% (48 units) of chillers which are 14 years and older while majority (82% or 276 units) are 13 years and younger. 4% of the total or 13 units are already using natural refrigerants.

23. During the course of the survey, we also found out that chiller owners realize that operating old chillers: (a) are wasteful and energy inefficient (b) are prone to repairs and unplanned maintenance (c) cannot be running for prolonged and extended usage (d) must have back-ups and (e) are expensive to replace.

24. Normally, open type screw chillers are comparable with centrifugal chillers which can last for 30 years or more. We however, will not dwell on unique circumstances and stories of one-of-a-kind chillers still operating after all these years but rather focus on the task at hand, that of replacing chillers with energy efficient ones which can bring about immediate savings in their operation (lower electricity bills) and lessen their carbon footprint ultimately contributing to a safe environment.

6. Energy Efficiency

25. Chillers are not exempted from technology obsolescence and like what scientists have found out, going back to the use of natural refrigerants was a knee jerk reaction in slowing down global warming. Old chillers become generally inefficient once the standard cycle has been breached. A compilation of energy consumption for various types of chillers versus the age profiles are as shown below:

Table D: Age vs. Compressor Type Specific Energy Consumption

FIVE (5) YEARS AND YOUNGER ENERGY CONSUMPTION IN kW/TR

	Centrifugal	Screw	Scroll	Recip
Open	0.65	0.68	-	0.68
Semi Herm	0.70	0.75	0.78	0.73
Full Herm	0.80	0.85	0.88	0.8

FIVE (5) TO TEN (10) YEARS ENERGY CONSUMPTION IN kW/TR

	Centrifugal	Screw	Scroll	Recip
Open	0.79	0.80	-	0.8
Semi Herm	0.84	0.98	1.01	0.86
Full Herm	1.04	1.23	1.28	1.06

ABOVE TEN (10) YEARS ENERGY CONSUMPTION IN kW/TR

	Centrifugal	Screw	Scroll	Recip
Open	0.94	0.96	-	0.95
Semi Herm	1.09	1.11	1.12	1.1
Full Herm	1.18	1.36	1.40	1.21

26. Judging from these figures, an incremental increase in savings can be obtained in comparison with baseline performance values of new chillers, e.g. R-123 chillers at 0.48 kWe/TR, R-134a chillers at 0.52 kWe/TR and R-717 (NH3) chillers at 0.55 kWe/TR. Replacing the old chillers at the threshold cut-off year of 13 will benefit the chiller owners of saving energy in excess of 40%.

7. Alternative Technologies

a. ***Compressor type***

27. Choosing the best fit chiller in a particular application will involve design consultants as downstream equipment and pipeline systems might be affected during its replacement. A change in refrigerant from CFC to HCFC or HFC and even a natural refrigerant like ammonia will mean revisions which the chiller owner might not be prepared to handle technically and financially. For this reason a careful review in selection must be coordinated between the chiller owner and the chiller supplier depending on the chiller package size.

b. Refrigerant

28. With the phase-out of HCFCs starting in 2013, it is with this in mind that a careful assessment should be made on this basis. Selection should be based on energy efficiency and not on zero ODP as carbon emission is likewise minimized at the power plant level.

8. Chiller Supply Capacity and Market Demand

29. As mentioned earlier, the Philippines had been importing chillers ever since, particularly compressor and compressor parts. There are companies who are also licensed by foreign manufacturers to assemble and fabricate chiller packages. Presently, chiller suppliers and manufacturers are represented either by regional offices, authorized distributors and manufacturer’s representatives.

30. The government also recognized the fact that chillers used in air conditioning and refrigeration is essential in major business undertakings whether commercial, industrial and residential. For example, the existing tariff duty of chillers is a low 3%. Air conditioning is the norm in all businesses which will utilize both labor and electronic devices in a building, whether rented, leased or owned.

31. Free enterprise is also practiced in the country and thus, no monopoly or cartel exists in the market. The presence of major suppliers from the USA, Europe and Asia are one in saying that they can sufficiently meet the required supply for this project.

32. Since the production of CFC chillers will cease in 2010, chiller owners will now find it difficult to source out their maintenance parts and charging refrigerant and thus will ultimately lead to replacement. Continuous education should also be the thrust in informing not only the chiller owners but also their engineers of the benefit in replacing old chillers with energy efficient ones and the contribution they make in the environment. We have also identified ESCOs, whose business is related to upgrading existing equipment through a performance-based incentive with chiller owners and chiller suppliers. It is therefore the objective of this Project to create the impetus in the market that CFC chiller replacement is the better way to go with the benefits far outweighing the costs and risks, more so since financial incentives shall be extended to early adopters as this will be on a first-come first-served basis.

9. List of Potential CFC Chillers for Replacement during the First Year of the Project

33. A list has been developed, but it will not be made public given that the information is confidential.

D. Barriers to Market Transformation

34. The Project is to tackle the numerous barriers to the adoption of commercially-available energy efficient non-CFC chiller technology through an offer of an innovative financial incentive that has been determined significant enough to overcome the barriers, particularly the high upfront cost. The level of incentive represents an aggregation of the opportunity costs through the model developed by the chiller study (see last section of the Annex I) and is intended to catalyze market coversion by replacing not only CFC-based chillers but all inefficient chillers. The project will assist a significant number of enterprises in the private and public sectors (around 330 chillers) - industrial, commercial, service and institutional establishments to bring about a massive shift in the market to adopt energy efficient, non-CFC chiller technology countrywide. On a macroeconomic level, the project will showcase to building owners that making investment choices towards selecting enregy efficient, environment-friendly technologies for their business solutions make good business sense.

35. There are many barriers to early replacement of energy-efficient and ODS-free chiller in both developed and developing countries. These include:

i). *First cost versus life-cycle cost.* While the conceptual difference between the initial cost of equipment and the life-cycle cost, (total cost of ownership), is understood, it is often not thoroughly investigated or intentionally ignored. Determining life-cycle cost is not easy, and even if the life-cycle cost is believed to be better for more energy-efficient products, it is not always possible to make the best long-term choice. Pressure to stay within budgets or limited borrowing capacity may outweigh long-term benefits.

ii). *Split Incentives.* If the owner or manager of a building passes energy costs to tenants, there is little incentive to invest in more efficient equipment.

iii). *Lack of decision-making ability*. Even where facility managers understand options for improved energy efficiency, financial decision makers may not be aware of or interested in options for investing in it. Management staff often come from a financial and/or sales background, and therefore tend to focus on what are perceived as more important business issues. Internal accounting procedures may increase the difficulty of obtaining management approval for purchases of new, energy-efficient chillers, since investment in building equipment is viewed as a controllable cost that should be minimized, while energy use is an uncontrollable cost that must be accepted.

iv). *Perceived Risk.* Many organizations sacrifice energy savings to avoid the perceived risks of changing technology, disrupting occupants, incurring debt, or entering into complicated agreements outside of core business areas.

v). *Awareness*. The key issue from the manufacturer perspective is to make the customer understand the impact of chiller purchase decisions to the bottom line. Financial managers make the decisions on purchase, but often don't realize the effect that energy efficiency makes on their electricity bill. Customers are however receptive to arrangements that can defray the incremental cost of higher efficiency through energy savings, if awareness and other barriers can be overcome. When chiller efficiency or ODS are discussed, many customers assume that the motivation of chiller manufactures is selling more expensive equipment to generate a higher commission.

vi). *Unfavorable macroeconomic conditions*. In conditions of financial crises, investments that can be delayed are typically put off until business conditions or financial stability improved.

vii). *Doubt about appropriateness of technology*. Building owners may be particularly reluctant to acquire new technologies, due to lack of familiarity and the fear that replacement parts or servicing will be difficult to obtain, expensive, or altogether unavailable.

viii). *Incentives to over-size chiller capacity*. Lack of designers trained in energy-efficient building design generally leads to a lower of level of energy efficiency in overall building systems. This can lead to an increase in building cooling loads, and ultimately to the specification of a chiller that is larger in capacity than required. The result is an excess use of energy to run the over-sized systems.

ix). *Data Issues*. The data needed to analyze the return on a chiller replacement are either unavailable or not collected. Older chillers do not have internal logging functions. This means that an accurate financial analysis of a chiller replacement is not possible until after a customer has started thinking about a new chiller.

E. Issues to be Addressed by the Project

36. The Project proposes to assist the Philippines to promote early replacement of non-efficient chillers (CFC-based chillers will be considered at the project later stage as they are too old to be eligible for carbon revenue) to energy efficient ones by:

i). Removal of market and techno-economic barriers of early adoption of more energy efficient chillers through provision of financial incentives directly to chiller owners in order to lower their opportunity costs and up-front capital costs, with priority given to the replacement of CFC chillers;

ii). Establishment of an in-country mechanism to support a significant transformation of the chiller market in the Philippines by availing CDM revenues and strengthening national capacity for carbon finance intermediation;

iii). Increased awareness of chiller owners and the public of the upcoming ban of CFC consumption and production; and

iv). Removal of chiller owners' perceived technology risks by demonstrating significant rate-of-return on investment of chiller replacement and other potential low-cost and/or no-cost energy conservation measures in large buildings.

F. Background to the Reasoning for the Amount of the Financial Incentive to overcome Opportunity Cost for Chiller Replacement[39]

37. The India Chiller Sector Strategy financed by the Multilateral Fund and carried out in 2001 and 2002 by the World Bank aimed to quantify opportunity costs of replacing CFC chillers in India. This chiller sector strategy which developed a mathematical model for establishing funding levels for individual chillers had been accepted by the implementing agencies and the Secretariat, and UNDP and UNIDO and confirmed by the MLF Executive Committee (ExeCom). The MLF ExeCom agreed that the results of the mathematical/business model used in the India Chiller Sector Strategy was applicable to all Article 5 countries by underlying in its decision to fund chillers stating that "total funding per investment will be determined using an accessible mathematical and/or business model, taking into account relevant decisions of the Executive Committee." In the India Chiller Sector Strategy, a national survey was conducted to identify all CFC chillers that were still in operation at that time. The survey also included interviews with building owners and chiller suppliers in India to determine performance characteristics and age distribution of the CFC chillers. Efforts were spent on determining the relationship between the age of chillers and energy consumption, maintenance costs, and down-time as these parameters constitute operating costs of chillers.

[39] Taken from the World Bank's note to the 46th MLF Executive Committtee Meeting, "Opportunity Cost Model for CFC Chiller Replacement." This note is based on the India Chiller Replacement Study completed in 2003.

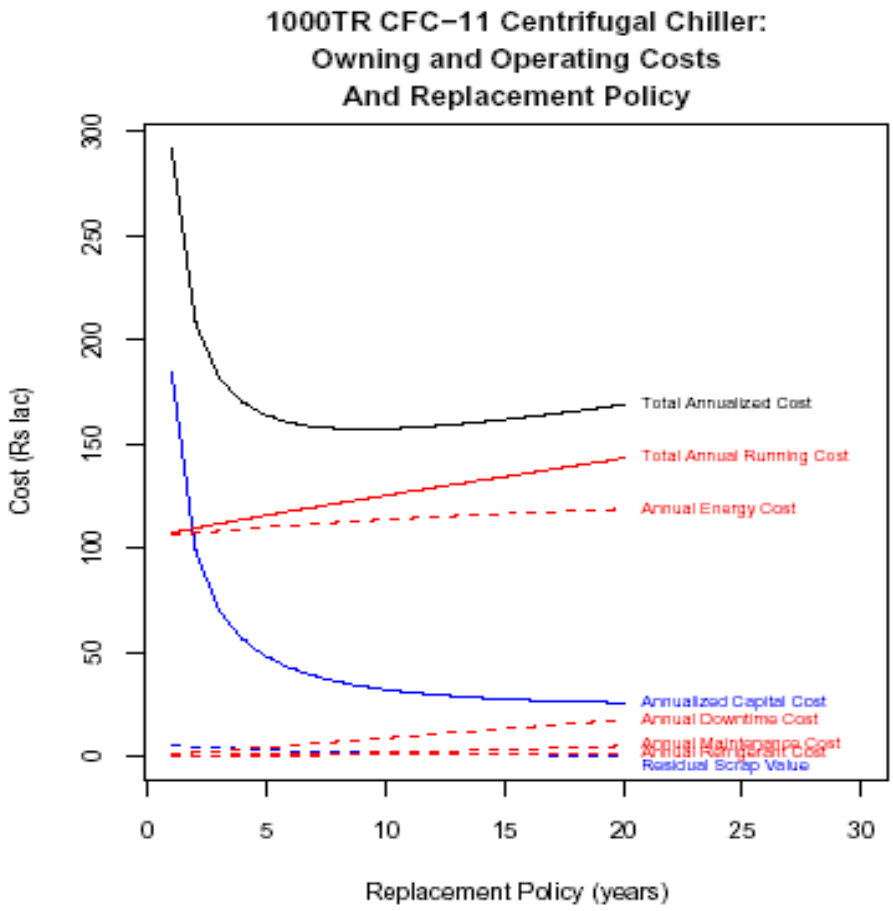
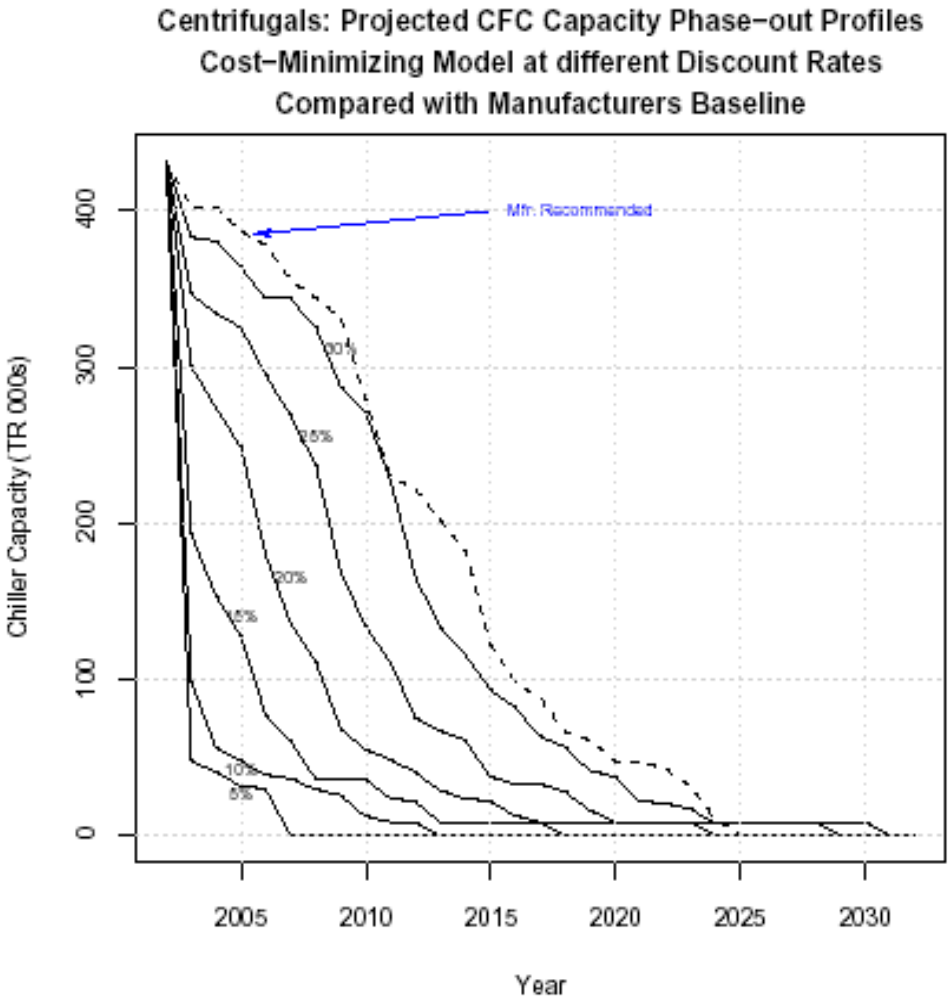


Figure 1: Replacement policy for a 1000 ton CFC chiller based on the total owing cost

38. The model assumes that chiller owners will decide to replace their equipment when the owning cost or total annualized cost, comprising of annualized capital cost and running cost, passes its minimum value. As running costs represent additional cash outflows in the future, the stream of cash outflows in the future is discounted to reflect the time value of the money. In Figure 1 above, a discount rate of 15% was applied to all streams of recurrent costs. Based on this replacement policy model with a 15% discount rate, the optimal time for replacing a 1,000 ton CFC chiller is when it has aged more than 12 to 15 years. Replacement would take place later if the discount rate became higher.

39. According to the survey finding, chillers are, on average, replaced when they are more than 30 years old. Based on a 30 years-replacement policy, a CFC chiller phase-out schedule for India was determined.



40. Figure 2: Phase-out scenarios of CFC centrifugal chillers in India

41. In Figure 2, the vertical axis "chiller capacity" represents the total cooling capacity of CFC centrifugal chillers installed in India. The chiller capacity at any given year is determined by adding the cooling capacity of each CFC centrifugal chiller that are still in operation. Based on the manufacturer's recommended chiller life or the 30 years-replacement policy, CFC chillers will be replaced over time from 2002 to 2030. Replacement or retirement of CFC chillers will result in the reduction of the total installed cooling capacity. CFC chiller phaseout is therefore represented by the broken line in Figure 2.

42. To model how chiller owners decide to replace their CFC chillers, a replacement model based on individual units described in Fig. 1 was applied to each of the 1,500 units installed in India. Different values of discount rates were used in order to determine the level of opportunity costs that is acceptable by the Indian private sector. According to Fig. 2, the discount rate that best reflects the 30 years replacement policy is about 30%.

43. Since most chillers in Article 5 countries are normally replaced when they are more than 30 years old, it is reasonable to assume that the same discount rate or opportunity costs would be applicable for all Article 5 countries.

Analysis of Opportunity Cost of Chillers Replacement

44. To demonstrate the relationship between the opportunity cost and the investment decision of chiller owners, a case study on replacing an existing 500 TR CFC chiller with a new non-CFC chiller of the same capacity is shown below.

Table 1: Replacement of 500 TR CFC chillers with new non-CFC chiller

	Existing Chiller	**New Chiller**
Cooling Capacity (TR)	500	500
Energy Consumption (kW/TR)	1.0	0.63
Electricity Cost (US$/kWh)	0.07	0.07
Operating Hours (hrs/day)	16	16
Operating Days (days/month)	30	30
Energy Consumption (kWh/year)	2,880,000	1,814,400
Cost of New Chiller (US$)		200,000
Annual Cost of Energy (US$)	198,720	125,194
Carbon Emission [0.22kgC/kWh] (tC)	13,090.91	8,247.27

45. Existing CFC chillers, which are more than 10 years old, would typically consume energy within the range of 0.85 to 1 kW/TR while it is common to find new chillers offered in the market today that have an energy consumption rate of less than 0.6 kW/TR. For this analysis, 1.0 kW/TR is used as energy consumption of the existing CFC chiller and 0.63 kW/TR for the new non-CFC chiller. Based on the operating conditions described above, this proposed replacement results in an energy consumption reduction by over a million kWh per year. This will result in an annual energy cost saving of $73,526. This annual energy cost saving represents the constant cash inflow for the next five years after installation of the new non-CFC chiller.

Table 2: Cash-flow analysis for replacing a 500 TR chiller

Year		**Opportunity Cost of 30%**
0	Capital Investment	200,000
1	Inflows	56,558
2	Inflows	43,507
3	Inflows	33,467
4	Inflows	25,743
5	Inflows	19,803
		(20,922)

46. Without taking the time value of the money into consideration, the annual savings of $73,526 would result in a return on investment within less than 3 years. However, in the view of investors, the future stream of cash inflows has a much lower value as demonstrated by the India Chiller Sector Strategy. Investing $200,000 in a new chiller would require investors to postpone investment in other activities that could generate a faster return on investment. When the opportunity cost of 30% is applied to future cash inflows, investment in the new chiller becomes undesirable as the net present value of this investment becomes negative. To make this investment desirable, or to cover all opportunity costs, capital investment should be reduced by $20,922. This could be considered as the incremental cost of replacing this CFC centrifugal chiller.

47. The opportunity cost of replacing CFC chillers would be higher for younger chillers, particularly those with lower energy consumption per ton of refrigeration. For example, replacement of a 500 TR CFC chiller with energy consumption of 0.83 kW/TR would incur an opportunity cost of more than $100,000.

Table 3: Opportunity cost of replacing 0.83 kW/TR 500 ton CFC chiller

Year		Opportunity Cost of 30%
0	Capital Investment	200,000
1	Inflows	30,572
2	Inflows	23,517
3	Inflows	18,090
4	Inflows	13,915
5	Inflows	10,704
		(103,201)

48. For older chillers whose energy consumption is higher than 1.0 kW/TR, replacement of such chillers would be desirable without incurring any additional opportunity cost. In fact, such a replacement decision would result in an internal rate of return of more than 30%. This is shown in Table 4.

Table 3: Opportunity cost of replacing 0.83 kW/TR 500 ton CFC chiller

Year		Opportunity Cost of 30%
0	Capital Investment	200,000
1	Inflows	71,845
2	Inflows	55,265
3	Inflows	42,512
4	Inflows	32,701
5	Inflows	25,155
		27,478

49. This study shows that energy savings from replacing chillers alone is not sufficient to promote chiller replacement or CFC phase-out in this sector unless all costs including opportunity costs are addressed. Opportunity costs can be determined on the basis of a

30% discount rate. The actual opportunity costs (in dollar terms) can vary depending on the operating environment (cost of energy, operating hours, and energy consumption rate). Phasing out medium-age CFC chillers (in the range of 10–25 years) will result in opportunity costs to chiller owners at approximately 10-30% of initial cost of new chillers. Costs would be higher in case of younger and more efficient CFC chillers. For older chillers where energy consumption is higher than 1.0 kW/TR, energy savings generated from their replacement would offset any opportunity costs. These results provide Article 5 countries with several options to address the whole range of CFC chillers remaining in their countries.

Annex 2: Major Related Projects Financed by the Bank and other Agencies

PHILIPPINES: PH - Chiller Energy Efficiency Project

A. General experience from GEF-financed Energy Efficiency Projects Worldwide[40]

1. An important feature of many GEF-financed energy efficiency (EE) projects in recent years is the market transformation approach that seeks to improve market uptake of EE products, services and practices. Key issues associated with market transformation efforts include: technology credibility; the nature of financial incentives; limited capacity to enforce standards/codes; weak laboratories and; lack of credibility of products labels, among others. Lessons learned suggest that the success and sustainability of this type of projects hinge on a supportive policy framework for EE programs, strong institutional ownership of programs, properly aligned incentives for all program agencies, products and business models based on market principles or market-oriented, up front market campaigns to generate demand for energy-efficient products, and, finally, adequate attention to financial sustainability of the program.

2. Experience from GEF's overall EE portfolio suggests that, even in countries where the local financial market is deep and liquid, consumers and investors may have limited access to local funds for EE projects due to perceptions of high risk, high transaction costs, lack of awareness regarding technologies and their technical and financial performance characteristics. With regard to the risk perceptions and high transaction costs, the India chiller sector study has quantified costs of removal of these perceptions or barriers through a comprehensive life-cycle cost analysis of the entire CFC-based chiller population. This life-cycle approach has enabled the quantification of these barriers in financial terms.

3. Lessons learned from specialized EE Fund experience worldwide highlight the importance of transparency of Fund management procedures, the need to rely on existing market participants, emphasis on projects with high rates of return, bundling of small projects, pro-activity of the Fund Manager, and integration of financial and technical expertise for the development of a sound project portfolio. Well-defined project term sheets can be an effective tool in improving the transparency of fund management procedures. Involvement of market participants, including financial institutions, equipment suppliers, and equipment owners, in development of term sheets can ensure that the project design and implementation should be simple and commercially-oriented.

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[40] Based on "World Bank Energy Efficiency Portfolio Review and Practitioners Handbook", World Bank Environment Department, Climate Change Team, January 2004.

4. A recent GEF Working Paper suggested a number of fundamental design principles for market transformation programs. These include: target both supply and demand sides; take a holistic view of the market; leverage competitive market forces when possible; build flexibility into program design; consider vehicles for technical assistance and transfer of know-how that will be workable; emphasize standards, labeling, and building codes; allocate a portion of the program budget for activities that support replication and dissemination of results; and begin monitoring and evaluation early.

B. Specific experience from EE projects worldwide

5. There is a rapidly growing volume of international experience with innovative EE projects. A sample of projects is provided below as an illustration of recent and current activities in this growth area.

6. Efficient Lighting Initiative: The ELI program promoted the growth of markets for energy-efficient lighting in seven countries and was implemented in Argentina by one of the three large utilities in the Buenos Aires metropolitan area (EDESUR – owned by Spain's Ends). The program worked to address three main barriers to penetration of efficient lighting in the main consumption sectors: information, product availability and quality, and financing. The program involved information and training activities, certification of efficient lamps (CFLs), market aggregation to reduce equipment cost, and equipment financing for EDESUR consumers. The program achieved a penetration of about 15% in the residential market of EDESUR and lesser penetration in the rest of the country. However, the program impact and sustainability was hampered by several factors:

- The 2002 economic crisis reduced consumer affordability and the financial viability of CFLs;
- The program could not achieve implementing regulatory changes and tariff incentives for efficient lighting because of the on-going electricity distribution concession renegotiation,– a situation compounded by the temporary shadowing of the regulatory entity (ENRE);
- The program focused mostly on EDESUR customers; and
- The program was limited to lighting – admittedly a significant contributor to electricity consumption and peak demand.

7. Three utilities in total participated in the ELI program. Additional barriers for expanding the program to involve more utilities are the lack of financing to sell CFLs in installments, perceived high transaction costs by small utilities and electric cooperatives, lack of a well recognized certification and labeling system for CFLs, and lack of information for customers who are not buying CFLs or are buying lamps of very low quality.

8. Argentina Efficient Street Lighting Program: This was a technical assistance program funded by the GEF with a grant of $736,250. The International Finance Corporation (IFC) was the GEF Implementing Agency and the Program was

implemented in 1999 - 2001 by the International Institute for Energy Conservation (IIEC). The Program collaborated with municipal and provincial governments, electric distribution utilities, banks, and engineering and contracting firms in Argentina. Through a range of technical assistance activities conducted with all parties, the Program supported development, structuring and financing of municipal street-lighting (SL) projects which use efficient lighting technologies in order to improve public SL services, save energy and money, and reduce the emission of greenhouse gases. The Program's legacy of innovative model and tools for developing SL projects is summarized in a guidebook, which has been distributed to interested parties and available on key websites. Thus, Argentine municipalities, distribution utilities, ESCOs, professional associations, government agencies, and university departments can continue to apply the Program's methods to develop and implement efficient SL projects.

9. China Efficient Industrial Boilers: This project is designed to reduce greenhouse gas emissions by adapting high efficiency technologies to local conditions for small and medium-sized coal-fired industrial boilers. To assist the dissemination and effective use of efficient technologies, the project would also strengthen China's industrial-boiler engineering, operations, production management and marketing capabilities, and improve boiler technology exchange domestically. As long-term measures for barrier removal, the project supports related technical and policy studies, public awareness/information dissemination, and strengthened environmental standards for the industrial boiler sector. An important lesson learned from this project is the importance of the project design to base on market principles and leveraging the benefit of market forces in promoting EE products.

10. Sri Lanka Energy Service Delivery: This project encourages participation of the private sector, NGOs and cooperatives in the provision of grid and off-grid energy services, and strengthens public and private institutional capacity to deliver energy services through renewable energy technologies and demand-side management (DSM). One of its activities includes payment for first-cost subsidies for a solar home system. A microfinance organization in Sri Lanka provides consumer credit to reduce the amount of monthly payments by a share of the subsidy. Project implementation started in 1997 and completed in 2002.

11. The success of the project is attributed to its demand driven and commercially oriented project design coupled with well coordinated technical and policy support to provide enabling and empowering environment appropriate to respective stakeholders to overcome technical, financial and institutional barriers. A lesson learned from this project is that even with improved access to capital through subsidies provided by the project, customers may still be difficult to line-up during early part of project implementation. Hence, an upfront pipeline development is critical to the design of the successful project. One of the major reasons for the success of this project was that project design was flexible enough to allow different approaches and changes as and when required.

12. Thailand Building Chiller Replacement Program: The project aimed at removing barriers preventing the widespread replacement of low energy efficiency building chillers

with highly energy efficient non-CFC chillers. This was pursued through a project approach that dealt with two global environmental issues, climate change and stratospheric ozone layer depletion. In view of the potential for dual benefits, joint GEF – MLF financing was proposed to address perceived risks associated with chiller replacements under tropical conditions, to cover increased initial transaction costs and to resolve access to credit problems. The project successfully demonstrated credibility of technology and established technical procedures for capturing and monitoring energy savings and performance of building chillers. During its lifetime, the project succeeded in replacing 17 chillers, nearly achieving the target of 24 as listed in the original PAD. In addition, there was evidence at the time of project completion that more than 50 additional chillers had been replaced through project activities using private funding sources. There is high potential for these procedures to be further simplified and replicated in other projects of a similar nature. Another important lesson learned from this project is that the administrative costs of operating a revolving fund can be very high and a limited in-country delivery channel of GEF financial support could make the project less attractive. It is clear that the project design would have been more effective with the use of more competitive market forces in the supply of EE products and in the mobilization of project financing from private sector sources or from the CDM, which was not available at the time.

13. Mexico CFC-Based Chillers Replacement Project: Mexico is currently implementing a small-scale chiller replacement project with the financial support from the MLF. FIDE, a non-profit NGO, acts as the fund manager of the resources provided by the Multilateral Fund. Financial support is provided to building owners to support replacements of CFC chillers on a concessional loan basis. Loan repayment is then used to replace additional chillers. On average, it takes about 36 months to recover the investment (average payback period from energy cost savings). By the end of 2005, approximately 13 chillers were replaced, with the resulting reduction in consumption of 7.8 ODP tons. The lessons learned from Mexico, among others, include the need for more support from equipment suppliers in terms of monitoring of performance and maintenance of new chillers as loan repayment is predicated on performance guarantees and penalties if energy savings are not realized.

14. Turkey Chillers Replacement Project**:** The chiller program in Turkey offered 75% as an interest-free loan and 25% as a grant. The loan must be paid back in 5 installments. Difficulty has been experienced in convincing chiller owners to come on board. There has also been concern expressed associated with the need for a high initial investment. The major lesson learned from this Project is the need to undertake a holistic assessment of the market in order to identify and to a certain extent quantify financial resources required to remove existing barriers.

15. India Chiller Sector Study**:** The study revealed that chiller replacement decisions are not driven simply by calculations of internal rate of return or financial payback considered in an unconstrained abstract sense. Replacement decisions are made under an environment of hard resource constraints. Chiller replacement projects have been given less priority due to other competing investment priorities. In other words, mission-

critical projects must obviously be given priority over mission-marginal projects. Chiller replacements, similar to other energy efficiency products, are often considered as mission-marginal projects.

16. The mission-marginality of the investment, coupled with the higher first cost, together constitute *a formidable barrier* to more widespread adoption of the energy-efficient chillers. The study, based on a full life-cycle cost analysis carried out for a large sample of chillers in India, concluded that Indian chiller owners, in effect, apply a discount rate of about 30% to chiller replacement projects. Without any intervention, it is estimated that unconstrained phase-out of CFC centrifugal chillers would not be completed until 2025. It is thought that the unconstrained phase-out dates for other developing countries would be similar to India.

17. India Chiller EE Project: The chiller program offered GEF and MLF as grant funds to provide for incentives for inefficient chillers, with priority given to CFC chillers, in the initial phase of project implementation (until grant funds are exhausted). Additional units will be replaced through revenues generated by carbon credits. In the initial phase, chiller owners will have the following two choices of incentives which they must decide upon as soon as they join the program:

c. Up-front grant subsidy of 20% of the normative cost of new non-CFC based energy efficient centrifugal chillers; or
d. Future carbon finance revenues to be generated by energy savings from replacing old chillers with new non-CFC based energy efficient centrifugal chillers.

18. The proposed Project is a replication of the India Chiller EE Project in the Philippines.

C. Other Relevant Experience in Chiller Sector

19. Thus far, the Bank is the only agency that has any experience in implementing energy efficiency chiller projects. Only recently have other agencies, namely UNDP and UNIDO, received funding from the MLF. Countries targeted by these two agencies include: Brazil, Dominican Republic, Jamaica, Trinidad and Tobago, Colombia, Cuba, Croatia, the Former Yugoslav Republic of Macedonia, Romania, Serbia and Montenegro, and the Syrian Arab Republic. However, none of the projects in these countries including the GEF Projects in Brazil and Colombia have entered into the implementation stage.

Annex 3: Results Framework and Monitoring
PHILIPPINES: PH - Chiller Energy Efficiency Project

A. Results Framework

PDO /GEO	Outcome Indicators	Use of Outcome Information
Reduce GHG emissions by replacing inefficient chillers including both old CFC-based chillers and non-CFC-based chillers.	1.195 inefficient chiller replacements (average of 330 TR) undertaken by 2012 and 375 inefficient chiller replacements (average of 330 TR) by 2019 2.Reduction of CFC consumption (target of 22 tonnes ODP) 3.Carbon emission reduction: • Direct CO_2 Benefits Targeted, including GWP of CFC = 560,0000 metric tonnes CO2Eeq.) • Indirect CO_2 Benefits targeted at up to 2M metric tonnes CO_{2e} over 20 years (emissions produced during the production of the fossil fuel and transporting it to the power plant that supplies electricity to the power grid) 4.Energy consumption will be reduced by 341 GWh annually in the next 20 years and demand for installed capacity will be reduced by 59 MW	Yr 1 - Yr 3: Measure effectiveness of project design and implementation arrangement Annually: verification report identifying quantity of emission reductions certified Yr 2: Strategic Assessment of Overall Program Uptake and Financial Position Yr 3: Mid-term review of carbon credit earned and contribution of decreasing demand of CFC in the chiller sector to countries' compliance with the Protocol Yr 6: Forward-looking reassessment and business realignment for other EE products opportunity
	Results Indicators for Each Component	**Use of Results Monitoring**
Component One: Investment in Chiller Replacement	Number of new energy efficient chillers installed	YR 1 – YR 3 Determine effectiveness of the financing scheme and implementation modalities of the Project by considering the success rate between the number of proposals and number of successful sub-grant

		agreements YR 3 Mid-term review to identify needs for any modifications to the project design and financing
Component Two: Measurement, Monitoring and Verification	A MIS to keep track of data generated from the individual chiller replacement and to generate the reports to support the CER claims.	YR 1 – YR 3 Measure effectiveness of the technical assistance activities undertaken by the Project YR 3 Mid-term review of penetration of replacement market in comparison with overall chiller market in respective countries and identification of needs for further capacity building or market development.
Component Three: Technical Assistance	Increased awareness of chiller replacement Number of recipients of the Project participating in the recognition program Number of trainings and workshops	YR 1 – YR 3 Measure effectiveness of the technical assistance activities undertaken by the Project YR 3 Mid-term review of penetration of replacement market in comparison with overall chiller market in respective countries and identification of needs for further capacity building or market development.

B. Arrangement for Results Monitoring

Outcome Indicators	Target Value											Data Collection and Reporting		
	YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9	YR10	total	Frequency and Reports	Data Collection Instrument	Data Collection Responsibility
195 inefficient chiller replacements (average of 330 TR each) undertaken by 2012	70	140	170	195	220	255	295	325	350	375	324 chillers	Annual	Verification Reports and MM&V MIS	DENR
ODP Consumption Phase-out due to replacement of Chillers[41]	4	7	9	11	13	15	16	18	20	22	22 ton ODP	Annual	Linked directly to chiller replacement	DENR
Cumulative Carbon emission reduction as direct benefits from the project[42]	13816	41448	61176	72023	81894	93732	80907	66700k			700k tCO2 until 2017	Annual	Verification Reports and MM&V MIS	DENR

[42] This is calculated in terms of the cumulative number of chillers replaced every year and by 2017

Outcome Indicators	Target Value											Data Collection and Reporting		
	YR1	**YR2**	**YR3**	**YR4**	**YR5**	**YR6**	**YR7**	**YR8**	**YR9**	**YR10**	**total**	**Freque -ncy and Report s**	**Data Collection Instrument**	**Data Collec -tion Respo n- sibility**
MWh savings & MW demand reduction	10	50	100	150	170	190	216	216	216	216	216 GWh over 20 years; 26 MW	Annual	Linked to Chiller replacement	DENR
Component One: Number of new energy efficient chillers installed	70	140	170	195	220	255	295	325	350	375	195 by 2012	Every Six Months	Progress Reports and MM&V MIS	DENR
Component Two: Data MIS for CER claims		100%									100%		Verification Reports and MM&V MIS	DENR (MM agency contra cted by DENR)
Component Three: Number of project recipients	5	10	15	20	25	30	35	40	45	50	50	Annual	Progress Reports and MIS	DENR

Outcome Indicators	Target Value											Data Collection and Reporting		
	YR1	YR2	YR3	YR4	YR5	YR6	YR7	YR8	YR9	YR10	total	Freque -ncy and Report s	Data Collection Instrument	Data Collec -tion Respo n- sibility
participating in the recognition program Number of trainings and workshops	2	2	2	2	2	1	1	1	1	1	15			

Annex 4: Detailed Project Description

PHILIPPINES: PH - Chiller Energy Efficiency Project

1. The project proposes to include the following components: (i) investment in chiller replacement; (ii) measurement, monitoring and verification, (iii) technical assistance (marketing activities); and (iv) project management. The flow-chart depicting the source and flow of funds is provided in Diagram 4.1

Component 1: Investment in Chiller Replacement

2. As part of the effort to remove market and techno-economic barriers of early adoption of more energy efficient chillers, the project proposes to assist chiller owners to lower their opportunity costs and up-front capital costs by providing financial incentives to subsidize costs of replacement of inefficient chillers in advance of the natural attrition rate of the existing equipment. Priority will be given to those baseline chillers that are inefficient and eligible for CDM in order to generate enough CF revenue for the next round replacement. The project will replace CFC-based chillers at a later stage as most CFC-based chillers in the Philippines are old with residual lifetime less than 5 years.

3. The primary targeted chillers for replacement under this project are chillers with an average cooling capacity of 330 TR and above. The project will support replacement of this baseline equipment to non-CFC chillers with energy consumption at full load conditions of not more than 0.63 kW/ TR. Baseline chillers to be replaced must be currently in use, located in the Philippines and must have a residual technical life of more than 5 years, assuming a 20-year business-as-usual equipment life. In order to simplify the demonstration of this criterion, the CDM Methodology indicated that the eligibility would be restricted to those chillers that have been installed after 1993. If evidence surfaces during the implementation of the project to confirm that chillers have a longer life than 20 years, a deviation would be sought for the CDM methodology from the CDM EB.

4. Replacing units must be non-CFC based technologies and installed after January 15, 2010. Their cooling capacity must be within 5% of the baseline capacity. Financial incentives will be given on a first-come-first serve basis. The project will offer two financial incentive options in order to meet different operating environment of chiller owners in the private and public sectors. The two options are:

i. Up-front grant subsidy of 15% of the cost of new efficient chillers based on a normative price of US$ 400 /TR multiplied by the rated cooling capacity of the baseline unit and additional incentives described in the Operations Manual;
ii. Annual subsidy of 80% of CDM revenues to be generated from actual energy savings achieved by the new chillers. Payment

will be made one year after installation and commissioning of new chillers have taken place and every year thereafter until 2019 upon successful issuance of CERs by the CDM EB.

5. For Option 1, payment will be made immediately after new non-CFC chillers are installed and commissioned, and existing baseline chillers are rendered unusable as defined below. For Option 2, annual payments for CDM revenues in the previous calendar year will be made by July 1 of the following year. The payment amount will be calculated on the basis of the findings from independent verification, which will be conducted on an annual basis. The independent verification will be carried out based on the actual performance of selected units (about 100% of the total number of chillers financed by the project).

6. Chiller owners opting for Option 1 are obliged to transfer any future carbon credits to be generated by their new chillers to the project. They will not receive any additional financial support from the project. For those opting for Option 2, they would have to share up to 20% of CDM revenues with DENR. The 20 % of CDM revenues will be used for covering the costs for administration, financial management, sub-project processing, reporting, marketing and other CDM related costs. Since the Project offers only up to 15% of the cost of new chillers up front and other incentives described in the Operations Manual, it is the responsibility of chiller owners to secure necessary financial arrangement (e.g., chiller owners' own cash resources, arrangements with leasing companies, special financing plans that may be offered by chiller manufacturers, commercial loans, ESCOs, and etc.) to cover the remaining costs of chillers.

7. Decommissioning of baseline chillers and installation of new chillers must be done by certified engineers. Refrigerants must be recovered from baseline units and could be retained for servicing remaining chillers as required, or should be properly disposed. Compressors of baseline chillers must be physically destroyed and certified by chartered engineers, while other parts could be retained as spare parts.

8. Project participants must allow DENR to access to their baseline and new chillers replaced by the project in order to undertake technical inspection including power measurements of baseline and new units, and subsequent inspections, if needed, from time to time until 2020 for the purpose of verifying actual energy savings of new chillers. Costs associated with verification and monitoring will be borne by the project. To ensure complete and long-term cooperation by chiller owners, it is recommended that service and maintenance contracts be established with the chiller supplier.

9. While the project offers two subsidy options, it is expected that about 80% of chiller owners would prefer to choose Option 1. Option 2 is likely to be selected mostly by chiller owners in the public sector. Since no CDM revenues could be generated until new chillers are installed and in operation for at least one year, resources required to support implementation of Option 1 during the first two years of the project would come mainly from GEF and MLF. While any chillers financed by Option 2 will not require

financial support up front they will also qualify for other incentives. No GEF funding will be used to provide a financial subsidy for Option 2.

10. Once the first emission reduction verification is carried out within 12 – 18 months after the launch of the Project, CDM revenues will be generated. CDM revenues will be deposited in a separate dedicated account. These revenues will be used for financing additional chiller replacements, payments to chillers replaced under Option 2, financing cost of annual independent verifications, and other administrative costs of the Project. An average investment cost per chiller replacement is estimated at a normative price of US $400 per TR, or about US $132,000 per chiller with an average of 330 TR each. Hence, the total investment cost of this project is about US $ 42 million with a total of 375 chillers replaced by 2020 (195 chillers by 2012).

11. The project participants (chiller owners and manufacturers/suppliers, and/or CFCs storage facilities) will also be obliged to meet established environmental and safety requirements related to decommissioning of baseline chillers, installation of new chillers and refrigerant management.

Component 2: Measurement, Monitoring and Verification (MMV)

12. As this Project is the second chiller replacement project that seeks emission reduction credits from CDM, the methodology for determining emission reduction levels developed based on the India chiller replacement project has been approved by the CDM Board and can be used for this Project. As per the methodology approved by the CDM EB, the program is required to measure and monitor data related to the power-output function of the inefficient chiller to be replaced, electrical consumption of the new chiller, and cooling output. It necessitates a database to be established to keep track of all the data generated from the individual replacement activities and to be used to generate the reports that would support the CER claims.

13. A measurement and monitoring (MM) consultant will be contracted by DENR for the following activities: measuring energy consumption of baseline equipment and of new equipment, monitoring performance of new chillers by collecting performance parameters of new chillers (i.e., flow rate of chilled water, inlet and outlet temperatures of chilled water, inlet temperature of condensing water, electricity input, etc.) on an on-line basis, and analyzing all the data collected. This consultant will be responsible for ensuring proper recording of the required data and proper functioning of data collection equipment, which will be attached to all new chiller units replaced by the Project. Specifications on the format of the data and frequency of data collection will be developed for the project.

14. The consultant will assist DENR to develop general specifications for new chillers including technical specification for ports or connection points to be equipped with chiller units in order to allow easy attachment of data loggers and transmitters. The consultant will assist DENR in carrying out energy consumption of baseline equipment in accordance with the protocol developed under the CDM methodology.

15. An MIS for storing and processing of all data generated by data loggers will be established and maintained by the MM consultant. The MIS will analyze relevant data and to determine actual energy savings and emission reduction. It will generate all the technical reports summarizing performance of each individual chillers and performance of the overall program. Reports from the MM consultant will form a basis for verification for the purposes of CDM payments.

16. The MM consultant will develop specifications for data loggers and data transmitters to be installed on new chillers. The Project will finance the acquisition of these data loggers and data transmitters. Data loggers and transmitters will be procured by DENR and installed directly by chiller suppliers or by the MM consultant.

17. As required by the CDM process, verification of emission reduction will be done on an annual basis. Verification of emission reduction is the requirement for the Project to claim for CDM payments. This task will be carried out by a Designated Operational Entity (DOE) to be appointed by the KfW. The DOE must be selected from the pool of firms approved by the CDM EB for energy efficiency. Verification will be conducted throughout the project implementation period, in this case until 2020 as per the terms of the Emission Reductions Purchase Agreement (ERPA). The verification cost will be financed by the Project.

Component 3: Technical Assistance and Marketing

18. The objectives of this component are to enhance the knowledge of project participants (1) significant rate-of-return on investment of chiller replacement and other potential low-cost and/or no-cost energy conservation measures in large buildings, (2) the upcoming ban of CFC (newly-produced) consumption in the ACR sector by January 1, 2010, (3) different MM&V requirements and the financial assistance offered by the Project, (4) replacement and maintenance of new chillers to remove chiller owners' perceived technology risks. To ensure sustainability, it will help build capacity of relevant stakeholders in energy conservation measures and refrigerant management. The following activities will support the implementation of the Project:

Sub-component 3.1: Training, Workshops and Materials on Project Awareness and Public Awareness

19. While the main objective of the Project is to promote the early replacement of energy efficient chillers, the Project will also explore opportunities to expand its coverage to other energy conservation options in large buildings and industries.

20. To create awareness of chiller owners of energy saving opportunities from chiller replacement, the United States Environment Protection Agency (US EPA) would like to provide a financial analysis tool with a user-friendly interface to demonstrate significant

rate-of-return on investment of chiller replacement and support participants in making decisions with regard to the two options being offered. USEPA's experience from its Energy Star Program particularly with regard to low cost and/or no cost measures would be introduced through reproduction of US EPA materials. Both the computerized marketing tool and printed materials will be made available freely to chiller owners, suppliers, ESCOs, and other stakeholders through direct mails and at workshops financed by the Project.

21. This financial analysis tool will produce a quick and simple financial analysis report in the format that would be expected by facility managers contemplating a major capital expenditure, by using standard financial analysis concepts. It would also provide an analytical model reflecting the specific financing options offered by the project, which include both up-front subsidy assistance and downstream financial subsidy as a result of carbon finance. This tool will also be utilized as a standard financial communication vehicle between chiller owners and chiller suppliers/vendors.

22. This financial analysis tool provides decision makers with the key financial parameters including:

a. internal rate of return (IRR);
b. net present value (NPV);
c. simple payback;
d. comparative lifecycle costs;
e. cash flow (with visual representation) reflecting change over time, and incorporating any downstream carbon finance payments; and
f. gross estimates of environmental impacts based on average country-specific generation/fuel mix (e.g., avoided Sox, NOx, particulates, carbon, etc.)

23. Moreover, USEPA's experience from its Energy Star Program particularly with regard to low cost and/or no cost measures would be introduced through reproduction of US EPA materials. Both the computerized marketing tool and printed materials will be made available to chiller owners, suppliers, ESCOs, and other stakeholders through direct mails and at workshops financed by the Project.

24. USEPA's TA is covered by funding support provided by US EPA. It is anticipated that further refinement of these tools (computer software and printed materials) will be required during project implementation for the Philippines. Practical experiences gained during implementation will be incorporated. Costs of refinement of these tools during the project implementation phase will be financed by the MLF and GEF resources.

25. This Sub-component will include a series of following training and workshops:

a. Launch workshop to inform chiller owners, ESCOs, chiller suppliers of the commencement of the Project and to invite interested parties to participate in the Project.
b. Project cycle workshops to inform interested parties of all the project requirements, eligibility and funding criteria and flows;
c. Technical workshops to raise awareness of chiller owners of the importance of proper chiller maintenance;
d. Technical workshops on measurement, monitoring, and verification of power consumption and energy savings in line with the CDM requirements; and
e. Training and workshops to disseminate lessons learned and success attained by the Project.

26. During the first two years of the project implementation, the focus will be on workshops to raise awareness of chiller owners of the financial assistance offered by the Project. The financial analysis tool developed by USEPA will be used extensively as a basis for training. Chiller owners and other interested parties will be shown the tool and supported in its utilization, which will help them in making decision regarding the most favorable option to choose. In addition, participants will be informed of terms and conditions and will be informed of the project proposal template and project cycle, eligibility criteria and obligations under the project. Participants will also be informed of the recent decision of the GoP to completely phase out new-CFC consumption by 1 January 2010 and its implications in the domestic economy. It is expected that at least one familiarization workshop in year 1 to 4 of the project implementation will be organized by PMC with support from EMB-PMU and the Philippine Ozone Desk.

27. Technical workshops to raise awareness of chiller owners of the importance of proper chiller maintenance, one for each year of the project, will focus on managers and technicians of buildings or companies that participate in the project. They will be trained on proper maintenance of their new chillers. Moreover, technicians of those facilities will be trained on how to monitor key operational parameters in order to ensure that their new chillers are functioning at the designed performance. Chiller owners and technicians will be informed of the measurement, monitoring, and verification of power consumption and energy savings as defined by the Project's requirements. Training will be jointly organized by DENR, chiller manufacturers, and ESCOs. The project will also undertake training for technicians who will recover the refrigerant gas from old chillers which are being decommissioned. This will build on activities already undertaken under an existing GOP program on national CFC consumption phase-out.

28. After the third year of the project implementation when the results of emission reduction achieved are independently verified, case studies summarizing lessons learned and success from replacement sub-projects will be made. Workshops to inform the public and future beneficiaries of the project of these successes and lessons learned will be organized in key cities where there are large populations of inefficient CFC-based and non-CFC-based chillers. These case studies will also be posted on the website to be established by DENR as part of its management information system (MIS) of the Project.

29. The various training programs and workshops will be carried out throughout the project implementation period. At initial phase of project, the emphasis will be on the familiarization workshops. During the project implementation, the emphasis will shifted towards the technical workshops as once chiller suppliers and ESCOs are familiar they would be able to provide direct training and awareness raising to their own clients. Funding for these activities would initially come from the GEF and MLF resources. For later part of the project implementation when CDM revenues start flowing into the project account, costs of these activities will be covered by part of the CDM revenues.

30. As mentioned above, this sub-component will also produce additional materials to support implementation and will serve to generate interest of the public. Such materials include pamphlets, brochures, advertisement, radio spots, case studies, and any other materials to be determined during project implementation.

Sub-component 3.2: Performance Standards and Recognition Program

31. The objectives of the project are to overcome perceived technology risks that chiller owners in the Philippines may have; and to promote proper maintenance of chillers in order to sustain the designed performance of the equipment. To overcome the perceived technology risks that energy savings may not be able achievable in the Philippines, where servicing quality may not be as good as in developed countries and where operating conditions may be more severe than those in developed countries, the Project will assess those barriers and address those concerns. In this regard, the Project proposes to carry out annual recognition awards (by Certificates) to honor those chiller owners that properly maintain their chillers and able to sustain high performance of their chillers. These awards will provide good incentives to all project participants to closely monitor performance of their chillers, which will maximize CDM revenues for the Project in a sustainable manner.

32. As per the requirements of the Monitoring Protocol, 100% of chiller replacements will be subject to online monitoring and annual verification by an independent auditor or DOE. Based on performance, individual chillers will be candidates for annual recognition awards.

33. To assist instituting energy efficiency as an industry practice for chiller owners, the project will promote the adoption of an appropriate set of performance standards for new non-CFC chillers. It will establish guidelines that will provide a set of operational protocol to sustain good performance. The project will support the development and adoption of an appropriate policy framework and incentive mechanisms to promote good practice in the operation and maintenance of energy efficient, non-CFC chillers.

34. This activity will consist of three tasks: (i) identify candidates for the award based on performance as indicated in the annual DOE report; (ii) chiller plant audit and evaluation; and (iii) an annual event to award the winners. Considerations should be given to performance of their chillers as mentioned and their efforts in initiating other

energy conservation measures beyond the scope of the Project. The DENR will carry out this activity with support from the PMC and the MM consultant. More detailed criteria for these awards will be developed in close consultation with chiller manufacturers and chiller owners during project implementation.

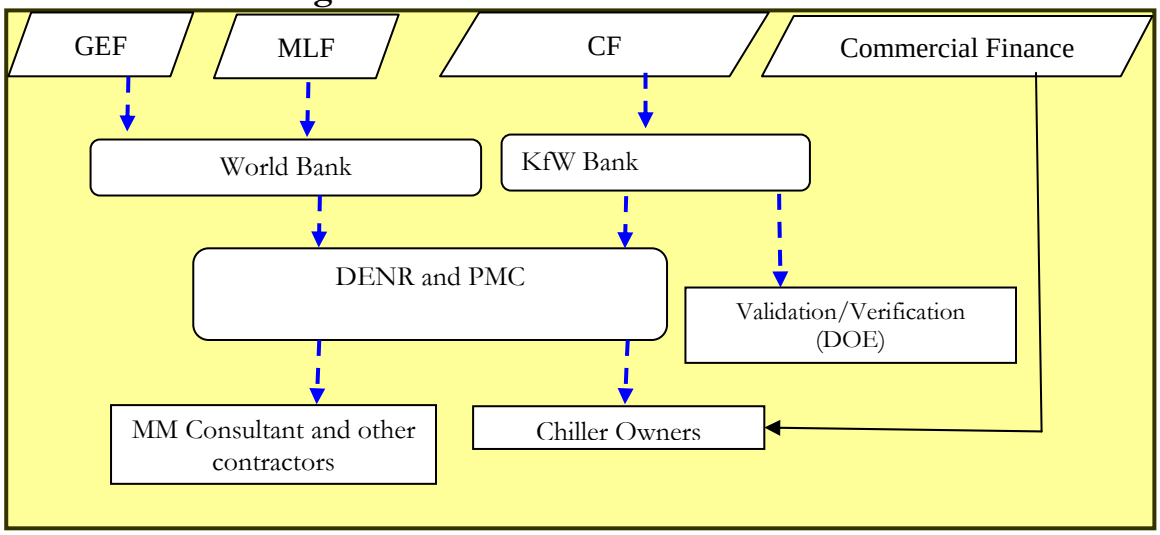
Component 4: Project Management

35. DENR will implement this Project with support of a Project Management Contractor (a private entity) contracted by DENR. The PMC will carry out day-to-day project management activities, including marketing activities, organizing workshops, coordination with chiller suppliers and manufacturers, review of Sub-project proposals, supervision of Sub-projects, preparing supporting documents for DENR's disbursement of proceeds of the GEF, MLF and CDM revenues accruing on account of each Sub-project, management of reporting, verification and auditing requirements, and coordination with other agencies on any policy and regulatory issues that may arise. The PMC will be staffed according to an agreed Staffing Plan.

36. The procedures of project implementation, requisite institutional framework for implementation and monitoring of project activities, the formats for monitoring and reporting, and funds management and disbursements are delineated in a Project Implementation Plan. All financial data and disbursements under the Project will be managed by DENR through a database. A grievance handling mechanism will be set up by DENR to allow feedback from the chiller owners and potential stakeholders.

37. Performance audits will also be carried out under this component. DENR will hire a consultant to carry out performance audits in the beginning, middle and the end of the Project.

Diagram 4.1: Sources and Flow of Funds



Annex 5: Project Costs

Philippines: Chiller Energy Efficiency Project (CEEP)

Table A5.1: Project Cost

Project Components	*US$*
Component 1: Investment in Chiller Replacement	**43,844,810**
Option 1	36,108,600
Option 2	7,736,210
Component 2: Measurement, Monitoring & Verification	**1,821,218**
Baseline Measurement	225,000
Data Logger and Transmitter	468,750
Monitoring Cost	220,000
Validation and Verification Costs	470,000
PDD Costs	9,500
Repayment of Advances from KfW	159,500
Total CDM Registration and Issuance Fees	124,718
CDM Secretariat Application Fees	43,750
DMFIS	100,000
Component 3: Technical Assistance	**204,000**
Trainings and Workshops	
Project Awareness	4,000
Technical Workshop	11,000
Public Awareness	3,000
Recognition Program	11,000
Training Support & Logistics	125,000
USEPA Tools & Technical Support	50,000
Component 4: Project Management	**1,816,534**
PMC Fees (Staff & Operating Costs)	1,150,000
Program Setup & Supervision	200,000
Incremental Operating Costs	400,534
Performance Audit	66,000
Contingency	**213,836**
Total	**47,900,398**

Table A5.2: Project Financing

Project Components	*GEF*	*MLF*	*GoP*	*USEPA*	*CDM*	*Industry*	*Total*
Component 1: Investment in Chiller Replacement	**2,600,000**				**2,349,542**	**36,619,769**	**43,844,810**
Incentive to Chiller Owners (Option 1)	2,600,000				3,538,000		6,138,000
Incentive to Chiller Owners (Option 2)					1,087,041		1,087,041
Contributions by Chiller Owners (Option 1)						29,970,600	29,970,600
Contributions by Chiller Owners (Option 2)						6,649,169	6,649,169
Component 2: Measurement, Monitoring & Verification		**581,847**			**1,239,371**		**1,821,218**
Baseline Measurement		98,412			126,588		225,000
Data Logger and Transmitter		212,500			256,250		468,750
Monitoring Cost		40,000			180,000		220,000
Validation and Verification Costs		110,000			360,000		470,000
PDD Costs					9,500		9,500
Repayment of Advances from KfW					159,500		159,500
Total CDM Registration and Issuance Fees		12,768			111,950		124,718
CDM Secretariat Application Fees		8,167			35,583		43,750
DMFIS		100,000					100,000
Component 3: Technical Assistance		**29,000**	**125,000**	**50,000**			**204,000**
Trainings and Workshops							
Project Awareness		4,000					4,000
Technical Workshop		11,000					11,000
Public Awareness		3,000					3,000
Recognition Program		11,000					11,000
Training Support & Logistics			125,000				125,000
USEPA Tools & Technical Support				50,000			50,000
Component 4: Project Management		**389,153**	**200,000**		**1,227,381**		**1,816,534**
PMC Fees (Staff & Operating Costs)		250,000			900,000		1,150,000
Program Setup & Support			200,000				200,000
Incremental Operating Costs		127,153			273,381		400,534
Performance Audit		12,000			54,000		66,000
Contingency					**213,836**		**213,836**
Total	**2,600,000**	**1,000,000**	**325,000**	**50,000**	**7,305,629**	**36,619,769**	**47,900,398**

Annex 6: Implementation Arrangements
PHILIPPINES: PH - Chiller Energy Efficiency Project

Implementation Arrangements

DENR will have the primary responsibility for project implementation on behalf of the government of the Philippines. The principal organizational units and entity for implementation are summarized below.

The DENR Secretary is the CDM-Designated National Authority (CDM DNA), with the EMB as Secretariat, who will approve the CDM project by issuing a Letter of Approval (LoA). DENR shall enter into an Emission Reduction Purchase Agreement (ERPA) with the KfW. The KfW has provided some financing to prepare the CDM Program of Activities (PoA) and already indicated the intent to purchase 1 million tons of certified emission reductions from the Project. Further, the DENR shall endorse to the Department of Finance (DOF) the MLF and GEF Grant Agreements. The designated Undersecretary or Assistant Secretary shall sign the contracts for goods and consultancy services procured under the project.

The DENR- Foreign-Assisted and Special Projects Office (FASPO) will be acting as the Coordinating Entity (CE) to oversee the implementation of the Project. The CE shall have the main responsibility to communicate with the CDM Executive Board (CDM EB). Likewise, it shall perform the following functions:

- It will engage a private consulting firm, with staff complement acceptable to DENR and the Bank, who will act as the PMC for the duration of the Project. The PMC's responsibilities are listed in the next Paragraph.
- It will establish and maintain for the duration of the Project a Project Steering Committee chaired by the DENR with representation from (i) the Department of Energy; (ii) other implementing agencies; (iii) the Project Director; and (iv) members of civil society and the private sector and shall provide operational guidance and oversight to the Project.
- It will enter into procurement contracts with goods suppliers (except for new chiller suppliers) and consultant services contractors.
- It shall adopt a Project Implementation Plan acceptable to the World Bank, giving details of guidelines and procedures agreed with the World Bank for the implementation, supervision, and monitoring and evaluation of the Project, including: (i) institutional and staffing arrangements; (ii) reporting requirements; (ii) performance indicators (iii) financial management procedures and audit procedures; (iv) procurement procedures; (v) details of the Environmental Management Framework; (vi) procedures for the identification and selection of Beneficiaries, and terms and conditions governing approval and award of Financial Incentives; (vii) procedures for the reallocation and utilization of CDM revenues foregone; and (viii) details of the Governance and Accountability Action Plan.

- It shall monitor and assess the Project's compliance with grant conditionalities, contracts and other similar instrumentalities;

The Financial Management Service (FMS) of the DENR has overall responsibility for the financial management of the project. DENR-FMS shall maintain two separate Designated Accounts for the MLF and GEF funds and one Project Bank account dedicated for the CDM funds. It shall have the authority to process disbursements of these three accounts.The FMS shall certify the availability of funds for contracts,POs, and all other claims. FMS shall likewise prepare regulatory financial reports and other reports required by the international financing institutions i.e. WB, GEF, KfW.

The Environmental Management Bureau (EMB), which is a line bureau of the DENR, will establish a Project Management Unit (PMU) that will ensure the effective and timely implementation of the project. The Project Management Contractor (PMC) will report to the PMU on a regular basis. The EMB-PMU shall oversee the day-to-day activities of the Project Management Contractor. It shall maintain supervision and coordination of the project's implementation including financial and procurement management. It will be responsible for the review, acceptance and endorsement of payments. It will enter into the Sub-grant Agreement with the Chiller Owner, which incorporates the Emission Reduction Transfer Agreement (ERTA), acceptable to the Bank, with the eligible beneficiary chiller owners.

Project Management Contractor. DENR will engage a PMC by contracting with a private entity under terms of reference acceptable to the World Bank. The PMC will be headed by a full time Project Manager/Team Leader with skills, qualifications and experience satisfactory to the DENR and the World Bank and assisted by full time staff with adequate skills and resources and in sufficient numbers. The PMC will be responsible for the day-to-day operations of the Project. The MLF funds and CDM revenues will be used to finance the PMC to cover its administrative and management costs. Initiate the hiring of the PMC is a condition of negotiation. The PMC will carry out the following activities:

a. Marketing and effective outreach to target chiller owners to enhance project participation. The Project will rely on chiller manufacturers/suppliers and ESCOs as its major marketing force to promote chiller replacement Finalization of a Project Operation Manual for chiller owners' use

b. Preparing SGAs/ ERTAs which will describe terms and conditions including the level of funding, disbursement schedules, transfer of certified emission reduction rights, and obligations of chiller owners pertaining to this Project;

c. Screening of potential candidates, review of sub-project proposals, undertaking sub-project processing procedures with identified project participants, and supervision of sub-projects;

d. Preparing annual chiller replacement plan with identified chiller owners in every December;

e. Perform the financial management function for the project under the direct supervision of the FMS division of DENR, which includes the maintenance of the project's books of accounts in accordance with generally accepted accounting principles, preparation of project disbursement vouchers and financial reports for review and approval by DENR FMS division and FASPO, etc.
f. Preparing TORs and supervising consultancy services for measurement, monitoring and auditing purposes;
g. Preparing technical specifications and supervising goods procurement;
h. Supervising the operation performance of the MM consultant on a regular basis;
i. Reporting on various components as per the requirements of the Bank, MLF, GEF, and CDM;
j. Coordinating with DENR and other agencies on any policy and regulatory issues that may arise;
k. Assisting the CE and the PMU in validation and registration of the PoA and the first CPA
l. Assisting the CE and the PMU in validation and registration of all subsequent CPAs
m. Assisting in CDM-DOE's (Designated Operational Entity) verification of CERs
n. Assisting the DENR in facilitating implementation of the technical assistance component under the Project.

MM Consultant. A MM consultant will be contracted by DENR to carry out Component 2 by implementing a Management Information System for storing and processing all data generated by data loggers and transmitters. The MIS will on-line track energy savings, measuring energy consumption of baseline equipment and of new equipment, monitoring performance of new chillers by collecting performance parameters and analyzing the data in accordance with the MM&V protocols prepared by the KfW Bank. The MIS will generate all the technical reports for verification for the purpose of CDM payments.

Other Contractors to the DENR. Other possible contractors to the DENR will include suppliers of data logger and transmitter, consultant firms for production of marketing materials, the MIS development, the performance audits and others if necessary and identified during project implementation.

The KfW, (the German Reconstruction Bank) has committed to be the Carbon buyer of the project and has assisted in the preparation of the project's Program of Activities (PoA) Design Document (DD) for submission to the CDM Executive Board.

The World Bank. The World Bank will undertake supervision missions, in collaboration with MoEF, to monitor subproject implementation, compliance with environmental and safety standards and training, and evaluation of project performance according to established indicators. It will review progress/audit, and subproject appraisal reports to assess and evaluate the overall progress in implementing national CFC phase-out and carbon emission reduction and guide PMU activities on an ongoing basis. It will ensure that timely disbursements following compliance with agreed performance targets.

Project Implementation Plan

The Project will be implemented over ten years, i.e., from 2010 – 2020. Installation of new chillers will end in 2019. The following table shows the implementation plan of the Project.

Table 6-1: Project Implementation Plan

Project Activities	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Hiring of measurement and monitoring (MM) consultant	X										
Development of MIS	X	X									
Baseline measurement	X	X	X	X	X	X	X				
Procurement, replacement and installation of new chillers	X	X	X	X	X	X	X	X	X	X	X
Procurement and installation of data loggers and transmitters	X	X	X	X	X	X	X				
Monitoring of new chiller performance	X	X	X	X	X	X	X	X	X	X	X
Energy savings and emission reduction verification by DOE hired by the KfW Bank together with the CE		X	X	X	X	X	X	X	X	X	X
Project Awareness Workshops	X	X	X	X							
Technical		X	X	X	X	X	X	X	X	X	X

workshops											
Public Awareness (Recognition)		X	X	X	X	X	X	X	X	X	X
Materials for Public Awareness	X	X	X	X	X	X	X	X	X	X	X
Project management	X	X	X	X	X	X	X	X	X	X	X
Performance audits		X				X					X

As the PMC has been selected and the following preparatory work will need to be completed before project effectiveness expected to be in March 2010.

Preparatory Tasks	**November 2009**	**December 2009**	**January 2010**
PMC selected by DENR	X		
Project Implementation Manual finalized and adopted by DENR	X	X	X
Project negotiation and legal documents signed		X	

Annex 7: Financial Management and Disbursement Arrangements
PHILIPPINES: PH - Chiller Energy Efficiency Project

Executive Summary

1. **Overall conclusion** – In 2006, a financial management review was carried out at the Department of Environment and Natural Resources (DENR), the executing agency (EA), in accordance with the Financial Management Practice in World-Bank Financed Investment Operations issued by the Financial Management Sector Board on November 3, 2005. The financial management review was updated in June 2009 with the objective of ensuring that there is in place an adequate financial management (FM) system that satisfies the Bank's OP/BP10.02 requirements for the proposed project. According to the requirements of OP/BP 10.02, the borrower and the project implementing entities should maintain financial management systems — including accounting, financial reporting, and auditing — adequate to ensure that they can provide accurate and timely information regarding project resources and expenditures and provide reasonable assurance that the proceeds of the grant are used for the purposes intended. The review included (a) updating of the assessment carried out in 2006 and the inherent FM risks in the country; and (b) review of the results of the FM implementation reviews for Bank-assisted projects implemented by DENR.

2. On the overall, the financial management system of DENR will meet the financial management requirement as stipulated in OP/BP subject to the implementation of agreed actions and mitigating measures.

3. The assessed financial management risk of the project is considered **substantial**. The residual risk would be **moderate** after the proposed mitigating measures enumerated below are effectively implemented and have shown the expected impact. The factors supporting this conclusion and the significant observations and related existing and proposed mitigating measures are summarized below.

4. **Internal controls and internal audit** – The Commission on Audit (COA) issued an adverse opinion on the DENR's financial statements for the years 2006 to 2008 on account of possible misstatements of accounts balances largely due to non-compliance with internal controls and procedures such as the following among others: (i) property, plant and equipment accounts general ledger accounts showed significant variance with the total of the subsidiary records and do reconcile with the physical count report, certain transactions without adequate supporting documents, etc.; (ii) non-compliance with inventory management procedures such as physical count and maintenance of subsidiary ledgers and reconciliation resulting to understate met of inventory balances; (iii) long outstanding payable accounts with no valid claimants; and (iv) net overstatement of cash in bank account and unliquidated cash advances to officers and employees, other national agencies, local government units, and others. DENR's Internal Audit Service (IAS) has been assessed to be weak in view of the lack of adequate experience and training of staff to carry out the internal audit function in accordance with international standards.

5. **Accounting system** – The budgetary controls, accounting procedures and internal controls prescribed by COA under the New Government Accounting System (NGAS) are not considered adequate because there are certain internal controls that are found only in various COA memoranda and circulars, and laws and regulations. The bookkeeping segment of NGAS is computerized and is referred to as electronic NGAS (eNGAS). Due to the absence of an integrated financial information system in government, subsidiary records for inventories, property, plant and equipment, advances to officers, employees, and others are not properly

maintained and reconciled with the general ledger resulting to the various discrepancies in account balances reported by COA as mentioned above.

6. **Financial management performance of existing Bank-assisted projects** – DENR is currently implementing several investment projects and trust funds**.** The ratings of some of these projects are below satisfactory due to the following issues among others: (a) certain agreed actions such as the following are still in progress: (i) reconciliation of the project disbursement records against the statement of expenditures submitted to the Bank and the adjustment/refund of disallowed expenditures in the project books, (ii) physical inventory count of fixed assets acquired under the project and reconciliation of the results against the accounting and property records, and (iii) physical implementation issues that may result to financial issues; (b) delayed and/or incomplete submissions of quarterly unaudited interim financial reports; (c) delayed submission of utilization of loan proceeds due to the delays by the field offices in the submission of statement of expenditures to central office; and (d) delay in the implementation of the some agreed actions defined in the Project Appraisal Document (PAD) of the loan project such as: (i) hiring of qualified independent firm to provide capacity building to IAS, and (ii) action plan on the resolution of the issues reported by COA. The DENR top management together with the Foreign Assisted Special Projects Office (FASPO) has demonstrated significant actions in the last six months to address these issues in order to improve the FM performance rating of these projects in the next fiscal year.

7. **Country issue** – The perceived high corruption risk in the country puts any investment project in a certain degree of risk.

8. **Nature of the project –** The project is to tackle the numerous barriers to the adoption of commercially-available energy efficient non-CFC chiller technology through an offer of an innovative financial incentive that has been determined significant enough to overcome the barriers, particularly the high upfront cost. The project will assist a significant number of enterprises in the private and public sectors (around 375 chillers) – industrial, commercial service and institutional establishments to bring about a massive shift in the market to adopt energy efficient, non-CFC chiller technology countrywide. The project will have the combined funding from three sources –MLF, GEF and Clean Development Mechanism (CDM). Using this combined funding, a total of 195 inefficient chillers by 2012 and at least an additional 180 chillers by 2019 can be provided with a 15% subsidy. The project implementing agency is DENR and will be assisted by a Project Management Contractor (PMC) in carrying out the various responsibilities under the project and the Clean Development Mechanism Program of Activities (PoA). In particular, the PMC will assist DENR in monitoring the implementation of the Environmental Management Framework (EMF), conduct of stakeholders consultation, preparation of project implementation manual, financial and legal agreements, coordination with other oversight agencies, marketing and networking, administration of the project funds and the project financial management system of the project in coordination with the DENR financial management services (FMS), EMB-PMU and Foreign Assisted Special Projects Office (FASPO).

The following risks are identified: (a) Adequacy of the PMC's financial management capacity, in terms of number, qualification, and knowledge of government accounting of finance officer and staff and PMC's accounting system, has still not been determined as the PMC has still to be hired; (b) Long delays to process payments to suppliers and contractors including sub-grantees at DENR as experienced in the other Bank-assisted projects it currently implement. DENR will still be involved in the disbursement processing because the government is the grant recipient and thus the Designated Accounts will still be under the name of DENR; (c) The readiness of DENR to operationalize this new system where a PMC is handling almost all of the activities, except for

the signing of the payment vouchers and checks; (d) The readiness of the criteria in the selection of sub-grantees and the grievance monitoring system; (e) The readiness of the operations manual that would clearly define the duties and responsibilities of each government agency and unit/office within DENR in the project; (f) The absorptive capacity of DENR, FASPO and EMB-PMU in particular to handle the responsibilities of this project; and (g) Complex conditions in granting subsidy/incentive to sub-grantees and the less certainty in the additional funding source to replace more chillers since a proportionate cost of administration, subproject processing, finance and administration, etc. would be sourced from the CDM revenues.

9. **Mitigating measures** – The mitigating measures that DENR has undertaken and committed to undertake to reduce the risks described above are as follows:

a. A PMC shall be hired under the project to assist DENR in the implementation. The PMC shall be required to: (i) Have at least one finance staff dedicated to the project, who is knowledgeable on government accounting and supervised by a qualified finance head; and (ii) Assist in the preparation of documents supporting financial transactions, maintenance of separate books of accounts for the project in accordance with generally accepted accounting principles and preparation and submission of project financial reports. Initiate hiring of PMC shall be a condition for negotiation.

b. The grievance monitoring system shall be developed and put in place within 6 months from grant signing.

c. The Internal Audit Service (IAS) of DENR shall include the project in its scope of work at least once a year, with a copy of the report submitted to the Bank sixty (60) working days after the end of each fiscal year.

d. A Separate Designated Accounts shall be maintained for MLF and GEF and a dedicated project bank account for the CDM fund, all of which shall be managed by the DENR-FMS. Disbursements of funds shall be approved by DENR FASPO upon recommendation of the EMB-PMU based on documents prepared by the PMC. Withdrawal applications to be sent to the Bank shall be prepared by PMC but reviewed and signed by DENR.

e. DENR-FMS shall appoint a focal person for the project before negotiation to coordinate and facilitate the financial management arrangements of the project, part of which are to be performed by the PMC such as the preparation of the payment vouchers and other supporting documents that maybe required by the FMS, FASPO and PMU.

f. Unaudited interim financial reports (IFRs) shall be prepared and submitted jointly by DENR-FMS and FASPO forty five (45) working days after the end of each calendar quarter to the Bank and to COA. The COA shall perform progressive audit to ensure timely submission of the audited project financial statements. The IFR format shall be agreed before grant negotiation.

g. An independent performance review by a consulting firm, with terms of reference acceptable to the Bank, shall be conducted at Mid-term and the report submitted to the Bank 60 days after mid-term.

A brief orientation on Bank policies and procedures on financial management, procurement and disbursement shall be conducted by the WB and attended by the DENR-FASPO, FMS, EMB-PMU and PMC.

The following actions to address the issues affecting DENR as a whole are already in the various stages of implementation and are being monitored in other Bank-assisted investment and grant funded projects:

a. Strengthening of the Internal Audit Service (IAS) of DENR by completing the staff complement of the unit and engaging an independent qualified audit firm to conduct capacity building.

b. DENR-FMS to prepare action plan to address/resolve the issues raised by COA in its audit of the DENR's financial statements.

c. FASPO to prepare action plan to resolve and monitor the issues disclosed during the implementation review missions of the various existing Bank-assisted projects currently under implementation by DENR.

Country Financial Management Issues

10. **Perceived high corruption in the country** - The international institutions monitoring corruption have rated the country's corruption as high. This perception of the existence of high corruption in the country puts any investment in a certain degree of risk.

11. **PEFA PFM Assessment for fiscal years 2003 to 2006** - It is intended to serve as an objective measure for benchmarking countries PFM capacities and facilitate tracking of improvements in specific areas of PFM over time. The PEFA report indicates that progress in implementing PFM reforms has been somewhat limited. The PEFA report indicates that progress in implementing PFM reforms has been somewhat limited. Relative to FM some of the most important problematic areas include (i) Inadequate budget formulation, expenditure prioritization and expenditure control systems; (ii) Absence of accountability mechanisms that fueled large scale corruption and misuse of public funds within the budget execution process, and (iii) Weak oversight functions.

12. To assist the President in the campaign against graft and corruption, the Presidential Anti-Graft Commission (PAGC) was created. In accordance with PAGC's mandate to formulate national anti-corruption plans and strategies, PAGC organized an anti-corruption workshop which had as its main output the Integrity Development Action Plan (IDAP). IDAP is composed of specific anti-corruption measures and is now being implemented by 135 government agencies, including DSWD. An Anti-Corruption Scorecard is also used as a measurement tool to assess the impact or effectiveness of the anti-corruption reforms, with the special focus on the IDAP. The scorecard validates the ratings of the IADP implementing agencies, which were based on the 5-point rating scale of the set of IDAP indicators measuring efficiency. The scorecard considers the results of the assessment by the accountable persons and those of the rank and file employees of the agency, its stakeholders, the client/customers and the results of local corruption related surveys. PAGC monitors the IDAP of the agencies on a quarterly basis together with the Office of the Ombudsman, and the Commission on Audit.

Risk Analysis

13. A summary of the financial management assessment risk ratings as they affect the project is provided in the table below together with the detailed discussion of each subject.

Category of Risk (Issues/Factors)	Risk Rating	Risks Mitigating Measures In Place or to be Adopted	Residual Risk	Condition of Negotiations, Board of Effectiveness (Y/N?)
Inherent risk Country level 1. Perceived high corruption in the country	S	1. Strengthening of the internal audit functions in government agencies is currently in progress. 2. The PMC to be hired by DENR to perform most of the activities under the project with DENR oversight. This arrangement would provide additional controls and complement the weak internal control environment at DENR. Hiring of the PMC is a condition for grant negotiation.	M	N Y - Negotiation
Entity 1. Weak internal control environment at DENR as evidenced by the various issues reported by COA in its audit of the agency's accounts. In addition, there is also the issue of absorptive capacity of the agency especially FASPO and FMS to handle additional project.	S	1. Hiring of PMC will address this issue of absorptive capacity and weak internal controls, with a qualified FM staff having adequate experience in government accounting. 2. FMS to appoint a focal person to coordinate with PMC and facilitate the processing of project documents. This should be a condition for negotiation.	M	Y - Negotiation Y - negotiation
Project 1. Highly complex due to the technical nature of the project and also the existence of three funding source, with choices by sub-grantees on timing of receipt of incentives. 2. Three funding source with one dependent on the generation of carbon credits creates potential of confusion on when and which fund to use. Control over the sale and proceeds of the carbon credits generated from the chillers that funded from the grant might not be adequate.	S	1. An Operations Manual, acceptable to the Bank, shall be adopted as a condition for grant effectiveness. The OM should clearly define the use of each fund. 2. An independent performance review by a consulting firm, with terms of reference acceptable to the Bank, shall be conducted at Mid-term and the report submitted to the Bank 60 days after mid-term.	S	Y - Effectiveness Y – Effectiveness (TOR)
Control risk	**S**		**M**	
Budget 1. The Department of Budget and Management (DBM) issues automatic allotment release orders (ARO) for grants. 2. Generally, the ARO is equal to the amount drawn from the grant. Obligations that could be entered by the agencies are	M	1. DENR to arrange with DBM for the issuance of ARO at least equal to the annual work and financial plan at the start of each. Fiscal year.	M	N

Category of Risk (Issues/Factors)	Risk Rating	Risks Mitigating Measures In Place or to be Adopted	Residual Risk	Condition of Negotiations, Board of Effectiveness (Y/N?)
limited only to the amount of ARO. This risk the issue of inadequate ARO for planned activities.				
• Accounting 1. Accounting policies & procedures contained in NGAS, government laws and regulations, etc. not fully adhered to by DENR as reported by COA in its observation and recommendations memorandum.	S	1. PMC to maintain separate books of accounts for the project to facilitate the preparation of financial reports and for the project not to be burden with the outstanding issues reported by COA on the agency's accounts. 2. PMC shall have s finance staff dedicated for the project with adequate experience in government accounting and reporting to finance head.	M	N Y - negotiation
• Internal controls 1. COA reported several weak implementations of the internal controls and procedures prescribed in NGAS, for inventories, cash advances, bank reconciliation and property plant and equipment. 2. Internal audit unit not fully functioning in accordance with international standards.	S	1. Project financial management policies and procedures shall be included in the project Operations Manual, acceptable to the Bank, shall be developed and adopted under the project. 2. The strengthening of the internal audit function and the action plan on the resolution of internal controls and accounting issues reported by COA are addressed and monitored under an existing Bank-assisted investment project. 3. The internal audit services shall cover the project in its annual scope of work with report due to the Bank within four months after the end of each fiscal year. 4. Adoption of a grievance monitoring system within 6 months from the signing of the grant agreement.	M	Y - effectiveness N N Dated covenant

Category of Risk (Issues/Factors)	Risk Rating	Risks Mitigating Measures In Place or to be Adopted	Residual Risk	Condition of Negotiations, Board of Effectiveness (Y/N?)
• Funds flow 1. Grant proceeds take long period before it is credited into the Designated Account from the Central Bank of the Philippines. Delays will create risk of unnecessary delays in the release of funds to project beneficiaries. 2. Existence of three fund source opens risk of wrong fund source used for certain activity. 3. Control over the proceeds of the sale of the carbon credits generated from the chillers funded by the subsidy under this grant.	M	1. The promptness of the deposit into the Designated Account for the loan proceeds should be discussed with DBM and the DOF. 2. The operations manual should clearly describe the criteria in the usage of each fund source and the monitoring and accounting of the proceeds from the sale of the carbon credits. The operations review could also be a form of check into this aspect of the project. 3. The quarterly IFR shall show the receipts and disbursements under each fund source.	M	N See above N
• Financial reporting o Inaccurate financial reports as discussed above due to the non-compliance with certain accounting policies and internal controls and procedures, and also caused by maintaining the accounts manually in a number of offices.	S	1. The project will require unaudited interim financial reports (IFRs) on a quarterly basis, which is due 45 days after each calendar quarter. Format of the IFR shall be agreed before grant negotiation. 2. Annual audited project financial statements shall be required and due no later than 6 months after the end of each fiscal year.	M	See above N
• Auditing Some COA auditors may not be familiar with the Bank's policies and procedures on FM, procurement and disbursement and therefore may not be able to report to the Bank certain non-compliance thereof.	M	The COA auditors will also be invited to attend the brief orientation on FM, procurement and disbursement that the Bank will hold for the PMC and focal persons at DENR,	L	N
Overall Risk Rating –	**S**		**M**	

14. **Strengths and weaknesses –** The significant strengths of DENR FASPO and FMS is the familiarity with the Bank policies and procedures and reporting requirements. Such familiarity was acquired from the implementation of Bank-assisted projects and the various orientation workshops provided by the Bank. The significant weaknesses and the corresponding corrective actions are discussed in detail in the risk analysis table above.

Financial Management Arrangements for the Project

15. Significant portion of the FM functions of the project shall be carried out by the PMC. Final approval of contracts, payment vouchers, withdrawal applications and other financial reports of the project shall be the responsibility of DENR, in particular the FMS and FASPO.

16. **Budgeting** – The PMC together with the EMB-PMU shall prepare an annual work and financial plan together with disbursement projection to be submitted to the Bank before the start of each fiscal year.

17. **Accounting** – The books of accounts of the project shall be maintained using the new government accounting system. The DENR FMS with the assistance of the PMC FM staff shall be responsible for the maintenance of the books of accounts of the project, monitoring the Designated Accounts, and prepares the project financial reports. There shall be separate bank accounts for the three funds (GEF. MLF and CDM) and subsidiary records of expenditures per fund source shall be maintained.

18. **Internal controls/Internal audit** – The project shall follow the internal controls and policies found in NGAS, Government Accounting and Auditing Manual, COA and DBM memoranda and circulars, other laws and regulations. Specifically, the following requirements shall be implemented for the project:

a. Subsidiary records should be maintained for each Designated Account (GEF and MLF) and the dedicated project bank account (CDM) and the related expenditures paid from each fund source.
b. Monthly bank reconciliation statements shall be required to be prepared and submitted to the DENR FASPO and FMS every 20th day after end of each month together with the trial balance and cash flow statement.
c. Annual project physical inventory count of fixed assets shall be conducted and results reconciled with the accounting and property records.
d. The project shall be covered by the Internal Audit Service (IAS) review at least once a year with copy of report submitted to the Bank within sixty (60) working days after the end of each fiscal year.

19. **External audit –** COA, the supreme audit institution, shall be the external auditors of the project. DENR shall make the necessary arrangements with COA for the audit of the accounts to ensure timely submission of the annual audited project financial statements.

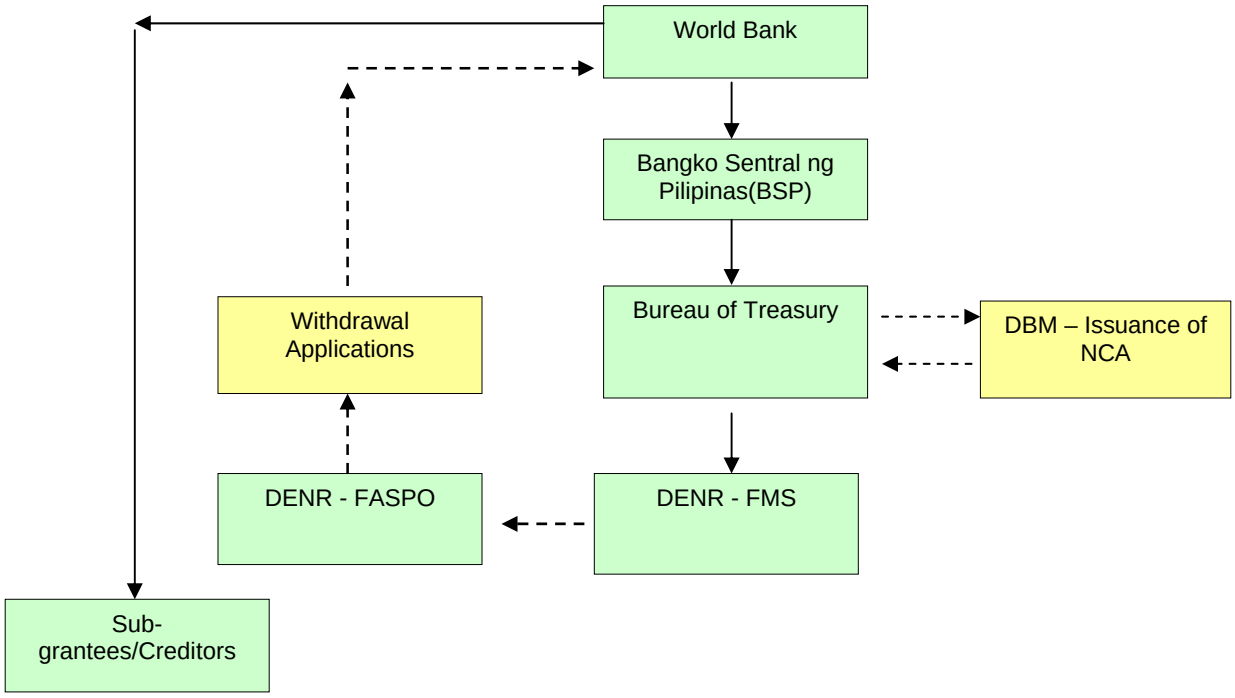
20. **Funds flow/Disbursement Arrangements –** This disbursement of the loan shall be in accordance with the financial plan of the project for the following categories:

Allocation of Grant Proceeds

Category	Amount of the Grant (Expressed in Dollars)			% of Expenditures to be Financed
	GEF	MLF	Total	
1. Financial Incentives under Part 1 of the Project	2,600,000	-	2,600,000	100 % of amount of subsidy
2. Consultants' services, trainings and workshops, incremental operating costs and goods		1,000,000	1,000,000	100%

TOTAL	2,600,000	1,000,000	3,600,000	

The project funds are composed of the MLF, GEF and CDM. The funds from the MLF and GEF will flow from the World Bank to the Bureau of Treasury account and the Central Bank of the Philippines. After the issuance of the Notice of Cash Allotment (NCA) issued by DBM, the funds will be credited to the Designated Account in Dollars, in a government depository bank acceptable to the World Bank, with an allocation ceiling of $200,000 and $520,000 for MLF and GEF, respectively. The funds advanced to the DA shall be liquidated through the submission of Statement of Expenditures. The CDM fund shall come from the proceeds of the carbon credits under the Emission Reduction Purchase Agreement entered into between the DENR and Kreditanstalt für Wiederaufbau (German Reconstruction Bank). Disbursements under the Project shall comply with the Bank policies and procedures on disbursements and financial management as reflected in the Bank's Disbursement Handbook and Financial Monitoring Report Guidelines. The direct payment method shall also be available under this project. DENR shall authorize all expenditures and withdrawal applications of the project based on the paperwork and recommendation of PMC.



21. **Retroactive financing -** Expenditures paid prior to the date of the grant signing but after January 15, 2010 in respect of category 2 shall be eligible for retroactive financing in the aggregate amount of $520,000 from the GEF grant and $200,000 from the OTF grant.

Financial Covenants

22. The financial reports that shall be submitted to the Bank are as follows:

- Unaudited Interim Financial Reports (IFRs) within forty five (45) days after the end of each calendar quarter, which shall consist of the: (a) financial reports consisting of the following: (i) statement of financial position; (ii) statement of sources and uses of funds which should include the current and cumulative data compared with plan & by fund source; and (iii) bank reconciliation statements, both dollar and all peso project bank accounts; (b) physical progress report and (c) procurement status report. The physical accomplishment report must be linked to the financial report. The IFR should also be accompanied by a narrative explanation of the progress of the project and the significant variances between actual against planned and financial against physical accomplishments.

- Annual audited project financial statements, which shall consist of the statement of financial position, statement of financial performance, a statement of changes in net assets/equity, and a cash flow statements together with the notes to the financial statements shall be submitted to the Bank no later than 6 months after the end of each fiscal year. A copy of the auditor's management letter, otherwise known as the summary of the audit observations and memoranda, shall be submitted to the Bank together with the audited financial statements.

- Internal audit review report of the project shall be submitted to the Bank not later than sixty (60) working days after the end of each fiscal year.

23. **Conditions for negotiation**

a. Initiate hiring of PMC to assist DENR in the implementation of the project, which shall include a qualified FM staff dedicated to the project that is knowledgeable of government accounting;

b. DENR designating focal FM person at FMS to coordinate with PMC and facilitate the financial management processes within DENR for the project.

c. Format of the IFR agreed with the Bank.

24. **Effectiveness conditions**

a. Signed consultancy contract of the PMC.

b. Project Implementation Plan and Operations Manual to include a section on the project financial management policies and procedures adopted for the project.

25. **Dated covenants**

a. The project shall maintain an adequate financial management system with appropriate books of accounts in accordance with generally accepted accounting principles.

b. Unaudited Interim Financial Reports (IFRs) within 45 days after the end of each calendar quarter, which shall consist of the: (a) financial reports consisting of the following: (i) statement of financial position; (ii) statement of sources and uses of funds which should include the current and cumulative data compared with plan & by fund source; and (iii) bank reconciliation statements, both dollar and all peso project bank accounts; (b) physical progress report and (c) procurement status report. The physical accomplishment report must be linked to the financial report. The IFR should also be accompanied by a narrative explanation of the progress of the project and the significant variances between actual against planned and financial against physical accomplishments.

c. Annual audited project financial statements, which shall consist of the statement of financial position, statement of financial performance, statement of changes in net assets/equity, and cash flow statement together with the notes to the financial statements and a copy of the management letter reflecting the auditor's findings and recommendations, shall be submitted to the Bank no later than 6 months after the end of each fiscal year. The auditor for this project is COA. The Audit Certificate to be issued shall be the based on the Bank's pro forma audit certificate.

d. Copy of the internal audit report shall be submitted to the Bank sixty (60) working days after the end of each calendar year.

e. An independent performance review by a consulting firm, with terms of reference acceptable to the Bank, shall be conducted at Mid-term and the report submitted to the Bank 60 days after mid-term.

f. Within 6 months from grant signing, DENR shall adopt a grievance monitoring system.

26. ***Supervision Plan*** - The frequency of the FM implementation review missions will be in line with the World Bank FM Practice Manual and EAP FM regional guidelines considering the FM risk rating for this project in any given year during project implementation. The scope of the supervision is left to the professional judgment of the FM specialist. It may cover any of the following, among others: (1) review of the continuous maintenance of adequate FM system by PMC; (2) review of selected transactions, where deemed necessary; (3) follow up of timeliness of FM reporting and actions taken on issues raised by external auditors; (4) review of financials reports of the project; and (5) review of compliance with the financial covenants. In addition, the FM implementation review will include desk review of the quarterly IFRs, internal audit reports, operations audit reports, and audited financial statements and management letter submitted to the Bank.

Annex 8: Procurement Arrangements

PHILIPPINES: PH - Chiller Energy Efficiency Project

A. General

1. Procurement for the proposed project will be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits," dated May 2004 and revised October 2006; "Guidelines: Selection and Employment of Consultants by World Bank Borrowers," dated May 2004 and revised October 2006; and the provisions stipulated in the Grant Agreement. While the new Philippine Procurement Law (RA 9184) is in reasonable harmony with the Guidelines at the NCB level, the Procurement Schedule of the Grant Agreement will include an annex detailing procedures under the national law that are not acceptable to the Bank Other than that, NCB procurement will be conducted according to the Competitive Bidding procedure under RA 9184. The general description of various items under different expenditure categories for the first 18 months are described below and summarized in the attached Procurement Plan. For each contract to be financed by the grant, the different procurement methods, estimated costs, prior review requirements, and time frame are agreed between the recipient and the Bank task team in the Procurement Plan. The Procurement Plan will be a rolling plan that will be updated at least annually or as required to reflect actual project implementation needs and improvements in the institutional capacity of the implementing units.

2. **Procurement of Works**: Procurement of works is not anticipated under the project, and if any, would be for small works. Procurement of very small works costing below US$100,000 may be awarded based on shopping procedures, by comparing price quotations obtained from several contractors, usually at least three, as defined in paragraph 3.5 of the Guidelines.

3. **Procurement of Goods:** The main procurement under the project comprise the replacement of around 324 aging chillers (with around 30% installed in government owned facilities) through provision of subsidy of 15% of the chiller replacement costs. Procurement of new chillers including installation, maintenance and performance guarantees should be undertaken by the beneficiary chiller owners as follows: (i) chillers in government owned facilities estimated to cost US$ 500,000 or more per contract shall be procured through Bank's ICB procedures while those estimated to cost in excess of US$ 100,000 up to US$ 500,000 per contract may be procured following national competitive bidding (NCB) procedures using the Philippine Bidding Document (PBD) as harmonized with the Bank, and (ii) private sector owned chillers estimated to cost less than US$ 5 million per contract may be procured according to commercial practices acceptable to the Bank. Pro-forma agreement covering important conditions like warranty, performance parameters, annual maintenance, performance guarantee, service to measure and maintain the promised energy consumption and other performance parameters including the Bank's Fraud and Corruption and audit right provision shall be developed and required for use by the private sector beneficiaries.

Other goods to be procured include data logger and transmitter, software, office and information technology equipment, furniture, reference materials and books, IEC materials. Procurement will be done using the Bank's SBD for all ICB and PBD, as harmonized with the Bank for NCB. ICB shall be used for procurement of goods estimated to cost US$500,000 or more per contract. NCB may be used for procurement of goods estimated to cost US$100,000 or more but less than US$500,000 per contract where the goods are normally available locally at competitive prices. Shopping may be used to procure goods estimated to cost less than US$100,000 per contract. Specialized equipment and software that are proprietary and obtainable only from one source may, subject to prior agreement with the Bank, be procured though direct contracting procedures.

4. **Selection of Consultants**: Consultant services for the project include project management, baseline, and measurement, monitoring and verification (MMV) including project awareness and marketing. While Quality and Cost Based Selection (QCBS) is the default method for contracts estimated to exceed US$200,000, Quality Based Selection (QBS) and Fixed Budget Selection (FBS) may also apply. Selection based on Consultants' Qualification (CQS) may be used for contracts less than US$200,000 each. Short lists of consultants for services estimated to cost less than $200,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines. Services for assignments that meet the requirements set forth in the first sentence of paragraph 5.1 of the Consultant Guidelines may be procured under contracts awarded to individual consultants in accordance with the provisions of paragraphs 5.2 through 5.4 of the Consultant Guidelines. Services for the validation and verification financed separately through the CDM will be selected by the KFW following its own procedures.

5. **Operating Costs:** Amounts needed to cover activities relating to managing the project, including staff travel and office utilities, and support for project operations should be provided in accordance with existing government prescribed limits and procedures acceptable to the Bank.

6. **Advance Procurement Action.** Selection of the services for the project management consultant (PMC), estimated at US$ 0.85 million, has been initiated. The DENR proceeded with the initial steps of procurement before signing the related agreement with the Bank as commencement of the services by effectiveness date is required. In such a case, the procurement procedures, including advertising, shall be in accordance with Bank's Consultant Guidelines for the eventual contracts to be eligible for Bank financing, and prior review process by the Bank shall be followed.

B. Assessment of the agency's capacity to implement procurement

7. The earlier procurement capacity assessment found inherent weaknesses and inefficiencies in DENR procurement. While there were good developments through the establishment of a Procurement Unit (PU) in Foreign Assisted Projects Office (FASPO) and the implementation of the DENR Procurement Improvement Program there is no

evidence yet of remarkable improvement in procurement processing. Also, the PU in FASPO, with trained and qualified staff who can handle the procurement of existing portfolio following Bank procedures, has limited procurement capacity to respond to the increasing number of DENR projects. Also, it is anticipated that the current PU capacity will be overstretched because of the technical complexity of the project and the sheer number of transactions for chiller replacement.

In addition, the Bank met with one major private sector chiller holders, who own around 30% of the 324 chillers, and found that their procurement follows the philosophy of "best value for money" through competitive bidding process. The procedures, which include prequalification, pre-bid conference, monitoring of performance and blacklisting due to non-performance, were found to be transparent, efficient, economical and fair in accordance with established private sector practices. Also, the chiller owners agree in principle to include the Bank's fraud and corruption and audit right provisions, to publish contract awards, and to use of the Bank's ICB procedures for packages estimated to cost in excess of US$ 5 million, for contracts to be financed in part from the Grant.

8. The key issues and risks concerning procurement for implementation of the project have been identified and include the following:

a. Limited procurement capacity of the Procurement Unit, which may be overstretched as it has few staff to deal with the increasing number of projects;
b. Technical complexity of the project;
c. Possible resistance by the private sector chiller owners to implement the procurement procedures required of the project; and,
d. Transparency issues in processing procurement.

9. The following corrective measures have been agreed to:

a. To mitigate the risk due to limited capacity and technical complexity of the project, a project management consultant (PMC) will be hired to help the DENR. Experience in handling energy efficiency (e.g. energy service company) and chiller projects financed by international financing institutions, as World Bank, ADB, JICA, EU, shall be a major selection criteria. The TOR for the PMC specified that key staff shall include a Procurement Specialist with at least five years of successful experience in handling NCB and ICB procurement of Goods following Banks' procedures.

b. To mitigate delays in the hiring of the PMC, the key DENR Undersecretaries committed that selection of the PMC shall be concluded by negotiations. The award of the contract shall be a condition for the effectiveness of the Grant.

c. To mitigate the risk presented by the highly technical nature of the project, a qualified specialist / TA shall be hired in drafting tender documents (including neutral technical specifications), evaluating offers and managing the contracts. Accordingly, the Bank's Task Team shall mobilize a technical specialist to review the submission by the PMC /DENR, which shall be reviewed and cleared by the Designated Procurement Specialist (DPS).

d. A detailed procurement plan shall be prepared by the PMC as soon as baseline information and needs assessment are established, and the chiller replacement program concluded. A detailed review of the procurement plan for the first 100 chillers should be conducted by a technical specialist to ensure that contracts are packaged in an appropriate and optimum manner. Monitoring will be on the basis of the annual procurement plan. In addition to the prior review, post review at a ratio of 1:5 will be carried out. The ratio will be reviewed and adjusted as required based on performance by PMC / DENR.

e. The private sector chillers owners' agreement for the conduct of competitive bidding acceptable to the Bank shall be a pre-condition to participation to the project. In addition, award of the private sector procurement or commercial practices shall be subjected to Bank's post review at a ratio of 1:5. The ratio should be reviewed and adjusted as required based on the performance of the DENR/ PMC and the recipients.

f. Pro-forma agreement covering important conditions like warranty, performance parameters, annual maintenance, performance guarantee, service to measure and maintain the promised energy consumption and other performance parameters including the Bank's Fraud and Corruption and audit right provision shall be developed and required for use by the beneficiaries.

g. To address issues on transparency. DENR and PMC should witness as observer the opening of bids by the government agencies and private sector beneficiaries.

h. ICB bid opportunities shall be advertized in the UNDB and dgMarket, and other bid opportunities shall be advertized in DENR/PMC website and /or PhilGEPS, as necessary.

i. Within two weeks from contract award, the PMC shall publish (i) ICB contracts in the UNDB online and in dgMarket, and (ii) below ICB contracts in the DENR/PMC website and / or PhilGEPS.

10. The overall project risk for procurement is high, and subject to implementation of the mitigation measures will be reduced to substantial.

C. Procurement Plan

11. DENR, at appraisal, developed a procurement plan for project implementation which provides the basis for the procurement methods. This plan has been agreed between the DENR and the Project Team on December 14, 2009 and is available at FASPO Office, DENR Complex, Visayas Ave., Quezon City. It will also be available in the project's database and in the Bank's external website. The Procurement Plan will be updated in agreement with the Project Team annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

D. Frequency of Procurement Supervision

12. In addition to the prior review supervision to be carried out from Bank offices, the capacity assessment has recommended twice a year supervision missions to visit the field to carry out post review of procurement actions.

E. Details of the Procurement Arrangements

1. Goods, Works, and Non Consulting Services

(a) List of contract packages to be procured following NCB:

1	2	3	4	5	6
Ref. No.	**Contract (Description)**	**Estimated Cost(US$)**	**Procurement Method**	**Review by Bank (Prior / Post)**	**Expected Bid-Opening Date**
Chiller-Goods-001	Data Logger & Transmitter	405,000	NCB	Prior	4-May-10

(b) All ICB and Direct Contracting contracts, and the first NCB level contracts for goods shall be subjected to prior review by the Bank.

2. Consulting Services

(a) List of consulting assignments with short-list of international firms.

1	2	3	4	5	6
Ref. No.	**Description of Assignment**	**Estimated Cost (US$)**	**Selection Method**	**Review by Bank (Prior / Post)**	**Expected Proposals Submission Date**
Chiller-001	Project Management	850,000.00	FBS	Prior	30-Jun-09
Chiller-002	Baseline	294,000.00	QBS	Prior	01-Jun-10

	measurement, monitoring and MIS				
Chiller -03	Performance Audit	48,000.00	CQS	Post	01-Jul-10

(b) Consultancy services to be provided by firms estimated to cost US$ 100,000 or more per contract, consultancy services to be provided by individuals estimated to cost US$ 50,000 or more per contract, and sole-source selection of individuals shall be subjected to prior review by the Bank.

(c) Short lists of consultants for services estimated to cost less than US$200,000 equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

Annex 9: Economic and Financial Analysis

PHILIPPINES: PH - Chiller Energy Efficiency Project

1. The Project will have a positive impact on the environment, locally and global, by reducing the emission of greenhouse gases, ODS and other polluting gases such as NOx, CO and SOx. Although the economic analysis is limited due to the lack of reliable baseline and quantifiable data on the valuation of human health and impact of climate changes to the livelihood of the Philippine population, it is clear that the economic benefits from reducing greenhouse gases and ODS emissions through energy efficiency interventions substantially exceed the costs associated with implementation of this project.

2. A financial analysis of the Project, taking into account the five sources of funds (GEF, MLF, GoP, USEPA and CDM), technical and administrative expenses, and the incentives for early replacement of chillers, is discussed here in detail. There are two types of financial incentives. Under Option 1, the Project will share 15% the cost of the new efficient chiller, initially valued at a normative price of US$ 400/TR and multiplied by the rated cooling capacity of the baseline unit. In Option 2, 80% of CDM revenues generated from the actual energy savings caused by the new chillers will be paid to the chiller owners. Annual payments will commence one year after installation and commissioning of the new chillers and upon the successful issuance of CERs by the CDM EB.

3. Excluding the investment of chiller owners, project funding will come from grants provided by GEF and MLF, from GoP and USEPA contributions, and from CDM revenues earned from carbon emission reductions as measured from the operation of new chillers. These will be used for implementation of the Project's four components: (i) Investment; (ii) Measurement, Monitoring and Verification (MM&V); (iii) Technical Assistance (TA); and (iv) Project Management (PM). Provision is included for contingency equivalent to 2% of the total project cost. Utilization of the five sources of funding would be as follows:

(a) GEF – Investment
(b) MLF – MM&V, TA and PM
(c) GoP – TA and PM
(d) USEPA – TA
(e) CDM – Investment, MM&V, PM and Contingency

4. Cash inflows include grants of US$ 2.6 million from GEF and US$ 1.0 million from MLF, while around US$ 7.3 million will come from CDM revenues calculated from abated CO2 emissions valued at US$ 12 per tCO2 less the CDM Share of Proceeds of US$ 0.20 per tCO2. Contributions from GoP and USEPA will reach US$ 325,000 and US$ 50,000 respectively. Abated CO2 is calculated based on the energy efficiency savings of the Project, the country's emission factor of 0.472 CO2/kWh generated (Philippine Power Generation Industry), less the normal refrigerant leakages of the new

chillers installed. Energy efficiency savings on the year new chillers are installed is based on an average 6 months of operation.

5. The expenditures by project component are:

a. *Component 1 - Investment*: To attract the participation of chiller owners in the replacement program, the Project would offer two incentive options: (i) up-front subsidy of 15% of the cost of chiller will be provided to chiller owners upon commissioning of the new equipment and disposal of baseline equipment; and (ii) annual subsidy based on 80% of the GHG emission reduction achieved by the chiller valued at US$ 12/tCO2 less the CDM Share of Proceeds of US$ 0.20/tCO2. The importation of chiller equipment under the Project would also be duty-free. It is expected that 80% of participants will choose the first option and the remaining 20% will prefer the second option.

b. *Component 2 - MM&V:* This includes the costs of conducting power consumption measurements of baseline equipment, purchasing and installation of data loggers and transmitters, consultant services to monitor the performance of all chillers replaced by the Project, initial validation and annual verifications as per CDM guidelines, and development of Data Monitoring and Financial Information Systems (DMFIS) for the Project. It is expected that data loggers and transmitters will be installed at all chiller replacements under the Project, and that a system for data collection and transmission will be developed for compilation and processing by the DMFIS.

c. *Component 3 - Technical Assistance:* Public awareness and technical workshops, and recognition programs will be conducted throughout the project term, from 2010 to 2020. Combined with capacity building and technical support, these activities are aimed to increase general public awareness of the upcoming ban on CFC consumption and production, to address the chiller owners' perceived technology risk by demonstrating the rates-of-return on investing in chiller replacement, and to promote related energy conservation practices and other potential low-cost and/or no-cost energy conservation measures in large buildings.

d. *Component 4 - Project Management:* Expenditures related to this component include project start-up costs, contractor fees and costs of the PMC, program setup and support, incremental operating costs and professional fees for the annual performance audits.

6. The key parameters and assumptions used in the economic and financial analysis are detailed in Table A9.1. Based on these assumptions and with objective to maximize chiller replacements within the Project's resources, the number of chillers to be replaced

each year from 2010 to 2019 is determined. The cash flow projection in Table A9.2 clearly shows that the Project is viable and sustainable.

7. The Project intends to replace at least 375 chillers in ten years, from 2010 to 2019. Depending on the continuity of the carbon market, the Project could continue to support additional chiller replacements beyond 2019. With an average cooling capacity of 330 TR, a conservative estimate of improving energy efficiency by 0.45 kW/TR from the new chillers, and average operating hours of 5,760 hours per year, the total energy consumption of the chiller owners will be reduced by 341 GWh annually. Thus, 59 MW of future power generating capacity requirements could be avoided – an investment saving of US$ 110 million for the country.

8. The total GHG emission reduction from the Project up to 2020 would exceed 700,000 tCO2, of which 40% would come from chiller replacements funded by GEF and MLF, and 60% would be financed from CDM revenues. With 375 new chillers reducing GHG emissions by more than 70,000 tCO2 annually, the total GHG emission reduction would exceed 1.4 million tCO2 during their equipment life (20 years).

9. Under an environment of hard resource constraints, chiller replacement projects have been given less priority due to other competing investment priorities. In other words, mission-critical projects are given priority over mission-marginal projects such as chiller replacements and other energy efficiency products. The mission marginality of the investment, coupled with the higher up-front cost, and the perceived technology risks constitute a formidable barrier to more widespread adoption of the energy-efficient chillers. According to the India Chiller Sector Strategy study financed by the Multilateral Fund and carried out in 2001 and 2002 by the World Bank, the cost of advancing chiller owners' decisions to replace their chillers by 10 years (from 2025), or cost of barrier removal, is up to 30% of the initial cost of new chillers. After incorporating the cost of barrier removal as an incremental investment cost, the Economic Internal Rate of Return (EIRR) of the Project at plant level is 59%.

Table A9.1. Key Financial Parameters and Assumptions

	UNITS	BASIC	SPECIFIC		
OLD CHILLER TO REPLACEMENT CHILLER			**R-123(HCFC) to R-717(NH3)**	**R-22(HCFC) to R-134a(HFC)**	**R-12(CFC) to R-134a(HFC)**
GRANTS					
MLF	US$	$ 1,000,000			
GEF	US$	$ 2,600,000			
GoP	US$/yr	$ 32,500			
USEPA	US$	$ 50,000			
REVENUE					
Chillers Replaced		375	15	328	32
CDM					
Carbon Credit	US$/tCO2	$ 12.00			
CDM Share of Proceeds	US$/tCO2	$ 0.20			
CDM Secretariat Application Fees	Php/CPA	PHP 5,600.00			
KWH/TR					
Average Cooling Capacity	TR	330	330	330	330
Annual Usage	Hrs/yr	5,760	5,760	5,760	5,760
Hours / day		16	16	16	16
Dys / month		30	30	30	30
Applied Energy Savings	kW/TR	0.45	0.45	0.48	0.48
Energy Performance (10+yo)	kW/TR	1.00	1.00	1.00	1.00
Emission Factor (CO2 Abated)	CO2/kWh	0.472	0.489	0.443	0.410
CO2 Leakage					
Old Chillers					
GWP	of CO2		120	1,700	10,600
Annual leakage rate	%kg	10%	10%	10%	10%
Refrigerant charge size	kg		600	600	600
Replacement Chillers					
GWP	of CO2		0	1300	1300
Annual leakage rate	%kg	1%	1%	1%	1%
Refrigerant charge size	kg		650	600	600
CHILLER REPLACEMENT					
Cost of Chiller	US$/unit		$ 132,000	$ 132,000	$ 132,000
Normative Price	US$/TR		$ 400	$ 400	$ 400
Cost of Installation & Setup	%ofChillerCost	30%			
Owner Incentives (Cost Subsidy)					
Up-Front Subsidy (Option 1)	% of unit	15%			
Annual Subsidy (Option 2)	%ofUS$/tCO2	80%			
MEASUREMENT, MONITORING & VERIFICATION					
Baseline Measurement	US$/unit	$ 600			
Data Logger and Transmitter	US$/unit	$ 1,250			
Monitoring	US$/yr	$ 20,000			
Verification	US$/yr	$ 40,000			
Validation	US$ on 1st yr	$ 70,000			
DMFIS	US$	$ 100,000			
TECHNICAL ASSISTANCE					
Trainings & Workshops					
Project Awareness	US$/T&W	$ 1,000			
Technical Workshops	US$/T&W	$ 1,000			
Public Awareness	US$/T&W	$ 1,000			
Recognition Program	US$/Prog	$ 1,000			
Training Support & Logistics	US$/yr	$ 12,500			
USEPA Marketing Tool Refinement	US$	$ 50,000			
PROJECT MANAGEMENT					
PMC Start-up Costs (Year 1)	US$	$ 50,000			
PMC Fees (Staff & Operating Costs)	US$/yr	$ 100,000			
Program Setup & Supervision	US$/yr	$ 20,000			
Performance Audit	US$/yr	$ 6,000			

Table A9.2 Projected Cash Flow

Replacement Schedule (Total)

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
No. of Chiller Replaced (Total)	Nos.	70	70	30	25	25	35	40	30	25	25	-	375
R-123(HCFC) to R-717(NH3)		3	3	1	1	1	1	2	1	1	1	-	15
R-22(HCFC) to R-134a(HFC)		61	61	26	22	22	31	35	26	22	22	-	328
R-12(CFC) to R-134a(HFC)		6	6	3	2	2	3	3	3	2	2	-	32
Cumulative Number of Chillers	Nos.	70	140	170	195	220	255	295	325	350	375	375	375
Chillers Cumulative (Tot.Pop)	Nos.	70	140	170	195	220	255	295	325	350	375	375	
R-123(HCFC) to R-717(NH3)		3	6	7	8	9	10	12	13	14	15	15	
R-22(HCFC) to R-134a(HFC)		61	122	148	170	192	223	258	284	306	328	328	
R-12(CFC) to R-134a(HFC)		6	12	15	17	19	22	25	28	30	32	32	
Sample Size	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Chillers Cumulative (Sample Size)	Nos.	70	140	170	195	220	255	295	325	350	375	375	

Replacement Schedule (Option 1)

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
No. of Chiller Replaced (Option 1)	Nos.	57	57	25	21	21	29	33	25	21	21	-	310
R-123(HCFC) to R-717(NH3)	**80%**	3	3	1	1	1	1	2	1	1	1	-	15
R-22(HCFC) to R-134a(HFC)	80%	49	49	21	18	18	25	28	21	18	18	-	265
R-12(CFC) to R-134a(HFC)	80%	5	5	3	2	2	3	3	3	2	2	-	30
Cumulative Number of Chillers	Nos.	57	114	139	160	181	210	243	268	289	310	310	310
Chillers under Monitoring (Tot.Pop)	Nos.	57	114	139	160	181	153	129	129	129	129	100	
R-123(HCFC) to R-717(NH3)		3	6	7	8	9	7	6	6	6	6	5	
R-22(HCFC) to R-134a(HFC)		49	98	119	137	155	131	110	110	110	110	85	
R-12(CFC) to R-134a(HFC)		5	10	13	15	17	15	13	13	13	13	10	
Sample Size	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Chillers under Monitoring (Samples)	Nos.	57	114	139	160	181	153	129	129	129	129	100	

Replacement Schedule (Option 2)

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
No. of Chiller Replaced (Option 2)	Nos.	13	13	5	4	4	6	7	5	4	4	-	65
R-123(HCFC) to R-717(NH3)		-	-	-	-	-	-	-	-	-	-	-	-
R-22(HCFC) to R-134a(HFC)		12	12	5	4	4	6	7	5	4	4	-	63
R-12(CFC) to R-134a(HFC)		1	1	-	-	-	-	-	-	-	-	-	2
Cumulative Number of Chillers	Nos.	13	26	31	35	39	45	52	57	61	65	65	65
Chillers under Monitoring (Tot.Pop)	Nos.	13	26	31	35	39	32	26	26	26	26	20	
R-123(HCFC) to R-717(NH3)		-	-	-	-	-	-	-	-	-	-	-	
R-22(HCFC) to R-134a(HFC)		12	24	29	33	37	31	26	26	26	26	20	
R-12(CFC) to R-134a(HFC)		1	2	2	2	2	1	-	-	-	-	-	
Sample Size	%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	
Chillers under Monitoring (Samples)	Nos.	13	26	31	35	39	32	26	26	26	26	20	

CDM Revenues (Option 1)

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Emission Reduction (Bey - PEec,y)	tCO2	11,465.16	34,395.48	50,874.85	60,109.94	68,551.72	78,595.18	68,125.43	56,847.31	56,053.99	56,053.99	51,833.11	592,906
R-123(HCFC) to R-717(NH3)		627	1,882	2,719	3,137	3,555	3,974	3,346	2,719	2,719	2,719	2,510	
R-22(HCFC) to R-134a(HFC)		9,903	29,708	43,854	51,736	59,011	67,701	58,607	48,704	48,098	48,098	44,460	
R-12(CFC) to R-134a(HFC)		935	2,806	4,302	5,237	5,985	6,920	6,172	5,424	5,237	5,237	4,863	
Emission from Refrigerants (PEref,y)	tCO2	210.60	631.80	936.00	1,107.60	1,263.60	1,450.80	1,259.70	1,053.00	1,037.40	1,037.40	959.40	10,947
R-123(HCFC) to R-717(NH3)		-	-	-	-	-	-	-	-	-	-	-	
R-22(HCFC) to R-134a(HFC)		191	573	846	998	1,139	1,307	1,131	940	928	928	858	
R-12(CFC) to R-134a(HFC)		20	59	90	109	125	144	129	113	109	109	101	
CDM Emission Reduction	tCO2	11,255	33,764	49,939	59,002	67,288	77,144	66,866	55,794	55,017	55,017	50,874	581,959
CDM Revenues (Option 1)		-	135,055	405,164	599,266	708,028	807,457	925,733	802,389	669,532	660,199	660,199	6,373,022
CDM REVENUE AGAINST TOTAL		0.0%	2.1%	6.4%	9.4%	11.1%	12.7%	14.5%	12.6%	10.5%	10.4%	10.4%	
CUMULATIVE LIFETIME REVENUE		0.0%	2.1%	8.5%	17.9%	29.0%	41.7%	56.2%	68.8%	79.3%	89.6%	100.0%	

CDM Revenues (Option 2)

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Emission Reduction (Bey - PEec,y)	tCO2	2,612.16	7,836.47	11,459.09	13,277.92	14,894.67	16,915.60	14,318.50	11,519.30	11,317.21	11,317.21	10,508.84	125,977
R-123(HCFC) to R-717(NH3)		-	-	-	-	-	-	-	-	-	-	-	
R-22(HCFC) to R-134a(HFC)		2,425	7,275	10,711	12,530	14,147	16,167	13,944	11,519	11,317	11,317	10,509	
R-12(CFC) to R-134a(HFC)		187	561	748	748	748	748	374	-	-	-	-	
Emission from Refrigerants (PEref,y)	tCO2	50.70	152.10	222.30	257.40	288.60	327.60	276.90	222.30	218.40	218.40	202.80	2,438
R-123(HCFC) to R-717(NH3)		-	-	-	-	-	-	-	-	-	-	-	
R-22(HCFC) to R-134a(HFC)		47	140	207	242	273	312	269	222	218	218	203	
R-12(CFC) to R-134a(HFC)		4	12	16	16	16	16	8	-	-	-	-	
CDM Emission Reduction	tCO2	2,561	7,684	11,237	13,021	14,606	16,588	14,042	11,297	11,099	11,099	10,306	123,539
CDM Revenues (Option 2)		-	30,737	92,212	134,841	156,246	175,273	199,056	168,499	135,564	133,186	133,186	1,358,801
CDM REVENUE AGAINST TOTAL		0.0%	2.3%	6.8%	9.9%	11.5%	12.9%	14.6%	12.4%	10.0%	9.8%	9.8%	
CUMULATIVE LIFETIME REVENUE		0.0%	2.3%	9.0%	19.0%	30.5%	43.4%	58.0%	70.4%	80.4%	90.2%	100.0%	

Implementation Schedule for TA

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Workshop & Training	Nos.												
Project Awareness	Nos.	1	2	1	-	-	-	-	-	-	-	-	4
Technical Workshop	Nos.	1	2	1	1	1	1	1	1	1	1		11
Public Awareness				1	1	1							3
Recognition Program	Nos.	1	1	1	1	1	1	1	1	1	1	1	11

INFLOW

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
MLF	US$	553,987	446,013										1,000,000
GEF	US$	1,128,600	1,471,400										2,600,000
KfW – for PDD Devel.	US$	9,500											9,500
KfW – for Validation, Verif., Monit.	US$	145,000											145,000
CDM Revenue (Option 1)	US$	-	135,055	405,164	599,266	708,028	807,457	925,733	802,389	669,532	660,199	660,199	6,373,022
CDM Revenue (Option 2)	US$	-	30,737	92,212	134,841	156,246	175,273	199,056	168,499	135,564	133,186	133,186	1,358,801
GoP	US$	32,500	32,500	32,500	32,500	32,500	32,500	32,500	32,500	32,500	32,500		325,000
US EPA	US$	50,000											50,000
Total	**US$**	**1,919,587**	**2,115,705**	**529,877**	**766,608**	**896,774**	**1,015,230**	**1,157,289**	**1,003,388**	**837,596**	**825,885**	**793,385**	**11,861,323**

OUTFLOW

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Component 0: Registration and Issuance Fees													
Registration Fee Expense	US$	11,386											11,386
Registration Fee Balance (memo)	US$	11,386	4,597	0	0	0	0	0	0	0	0	0	15,983
Gross Issuance Fee (memo)	US$	1,382	6,790	10,735	12,905	14,879	17,246	14,681	11,918	11,723	11,723	10,736	124,718
Recovery of Registration Fee (memo)	US$	0	6,790	4,597	0	0	0	0	0	0	0	0	11,386
Net Issuance Fee Expense	US$	1,382	0	6,138	12,905	14,879	17,246	14,681	11,918	11,723	11,723	10,736	113,332
Total Reg. & Issuance Fees	US$	**12,768**	**0**	**6,138**	**12,905**	**14,879**	**17,246**	**14,681**	**11,918**	**11,723**	**11,723**	**10,736**	**124,718**
Component 1: Investment in Chiller Replacement													
Incentive to Chiller Owners (Option 1)	US$	1,128,600	1,128,600	495,000	415,800	415,800	574,200	653,400	495,000	415,800	415,800	-	6,138,000
R-123(HCFC) to R-717(NH3)		59,400	59,400	19,800	19,800	19,800	19,800	39,600	19,800	19,800	19,800	-	297,000
R-22(HCFC) to R-134a(HFC)		970,200	970,200	415,800	356,400	356,400	495,000	554,400	415,800	356,400	356,400	-	5,247,000
R-12(CFC) to R-134a(HFC)		99,000	99,000	59,400	39,600	39,600	59,400	59,400	59,400	39,600	39,600	-	594,000
Incentive to Chiller Owners (Option 2)	US$	-	24,590	73,770	107,873	124,997	140,218	159,245	134,799	108,451	106,549	106,549	1,087,041
Component 2: Measurement, Monitoring & Verification													
Baseline Measurement	US$	42,000	42,000	18,000	15,000	15,000	21,000	24,000	18,000	15,000	15,000	-	225,000
Data Logger and Transmitter	US$	87,500	87,500	37,500	31,250	31,250	43,750	50,000	37,500	31,250	31,250	-	468,750
Monitoring Cost	US$	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	220,000
Validation & Verification Costs	US$	70,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	40,000	470,000
PDD Costs	US$	9,500											9,500
Repayment of Advances from KfW	US$		159,500										159,500
Total Reg. & Issuance Fees	US$	12,768	0	6,138	12,905	14,879	17,246	14,681	11,918	11,723	11,723	10,736	124,718
CDM Secretariat Application Fees	US$	-	8,167	8,167	3,500	2,917	2,917	4,083	4,667	3,500	2,917	2,917	43,750
DMFIS	US$	100,000											100,000
Component 3: Technical Assistance													
Trainings & Workshops													
Project Awareness	US$	1,000	2,000	1,000	-	-	-	-	-	-	-	-	4,000
Technical Workshop	US$	1,000	2,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	-	11,000
Public Awareness	US$	-	-	1,000	1,000	1,000	-	-	-	-	-	-	3,000
Recognition Program	US$	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	11,000
Training Support & Logistics	US$	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500	12,500		125,000
USEPA Tools & Technical Support	US$	50,000											50,000
Component 4: Project Management													
PMC Start-up Costs (Year 1)	US$	50,000											50,000
PMC Fees (Staff & Operating Costs)	US$	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	100,000	1,100,000
Program Setup & Supervision	US$	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000	20,000		200,000
Incremental Operating Costs	US$	62,719	64,435	32,102	29,053	29,149	36,923	41,214	34,026	30,156	30,455	10,301	400,534
Performance Audit	US$	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	6,000	66,000
Contingency US$	2%	33,842	33,716	16,814	15,688	16,060	20,085	22,292	18,078	15,678	15,634	5,950	213,836
Total	**US$**	**1,808,429**	**1,752,007**	**889,991**	**832,569**	**851,552**	**1,056,840**	**1,169,416**	**954,489**	**832,058**	**829,827**	**303,453**	**11,280,629**

CASH FLOW

Item	Unit	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	Total
Opening Balance	US$	-	111,158	474,857	114,742	48,781	94,004	52,394	40,267	89,166	94,704	90,761	
Inflow	US$	1,919,587	2,115,705	529,877	766,608	896,774	1,015,230	1,157,289	1,003,388	837,596	825,885	793,385	11,861,323
Outflow (Expenditure)	US$	1,808,429	1,752,007	889,991	832,569	851,552	1,056,840	1,169,416	954,489	832,058	829,827	303,453	11,280,629
Ending Balance	US$	111,158	474,857	114,742	48,781	94,004	52,394	40,267	89,166	94,704	90,761	580,694	**580,694**

Global Benefits and Incremental Costs

10. ***Global Environmental Objectives and Benefits:*** Following the India chiller study and an international study commissioned by the World Bank in 2005 involving 12,500 CFC chillers, an analysis of the Project's incremental cost effectiveness demonstrates the benefits of replacing 375 inefficient chillers 5 years earlier than its life expectancy and using more environment-friendly refrigerants. The key parameters for determining the carbon abatement benefits of the Project are summarized in Table A9.3.

Table A9.3 Key Parameters of Target Chillers

Parameters	***Value***	***Unit***
Replacement of Chillers	375	Set
R-123(HCFC) to R-717(NH3) 570TR	15	
R-22(HCFC) to R-134a(HFC) 240TR	228	
R-12(CFC) to R-134a(HFC) 400TR	32	
Project Average Cooling Capacity*	330	TR
Average Energy Consumption 10+ years old chillers	1.00	kW/TR
Average Energy Consumption Replacements	0.55	kW/TR
Estimated Operating Time	5,760	hrs/year
Remaining Lifetime of Chillers for Replacement	5	years
Phil. Electricity Generation Emission Factor	0.472	CO2/kWh
Cost of Energy	0.10	US$/kWh
Investment / Watt Capacity	1.86	US$/watt

11. The early commissioning of at least 375 energy efficient chillers to replace five years of inefficient operation of older chillers translates to GHG savings of 705,498 tCO2 of which 284,848 tCO2 could be attributed to GEF and MLF resources.

12. Equally significant are the GHG reduction benefits that would occur from transitioning to better designed chillers, as shown in Table A9.4, that replace refrigerants using HCFC-123, HCFC-22 and CFC-12 with alternative refrigerants using NH3-717 and HFC-134a that have lower GWP, as shown in Table A9.5.

Table A9.4 Climate change benefit from refrigerant substitution

Parameters	Value
Project Average GWP Baseline of Old Chillers	2,396
Leakage Rate (% per year)	10%
Leakage Potential per Year (tCO2)	53,916
Project Average GWP of Replacement Chillers	1,248
Leakage Rate (% per year)	1%
Leakage Potential per Year (tCO2)	2,808
GHG Savings - Project 375 Units (tCO2) per Year	51,108
GHG Savings - Project 375 Units (tCO2) 5 Years	**255,540**

*Average GWPs for the baseline and replacement chillers are based on the market share of 5%: 86%; 9% of HCFC-123; HCFC-22; CFC-12 chillers of the total target replacement size of 375 units.

Table A9.5 Refrigerant GWP

Refrigerant	GWP	Charge Size (kg)
R-123 (HCFC)	120	600
R-22 (HCFC)	1,700	600
R-12 (CFC)	10,600	600
R-717 (NH3)	0	650
R-134a (HFC)	1,300	600

14. ***GEF and MLF Alternative:*** The Project would directly result in early replacement of approximately 375 chillers. The Project would also assist the Philippines to establish a sustainable mechanism for removing barriers preventing the adoption of energy efficient chillers. It is expected that the Project would imprint the product life-cycle analysis as a basis for future private investment decisions, and that the mechanisms established by the Project could be used for financing other types of energy efficient chillers and related products.

15. ***Without the Project:*** In the absence of the external support to remove the aforementioned barriers, it is highly probable that existing CFC chillers would remain in service for the rest of their product lifetime. Based on a 20-year life expectancy, the complete phase-out or replacement of these chillers would not occur before 2019. Continuing demand of CFCs for

servicing these chillers would remain beyond 2010 when all countries are obligated by the Protocol to no longer produce nor import virgin CFCs. This could lead to illegal production or trade of CFCs after 2010.

16. ***Incremental Cost Effectiveness Analysis***: The focus of the Project is on the establishment of a barrier removal mechanism that will result in a total replacement of about 375 chillers. This amount of chillers is limited by the assumption that the market of carbon emission trade would end in 2019. If the carbon market continues to operate beyond 2019, around 25 chillers per year could then be replaced by this mechanism.

17. Given the overall target of the Project to accelerate replacement of 375 chillers five years before the end of their expected life is approximately US$ 60 million, of which US$ 3.6 million would be funded from GEF (US$ 2.6 million) and MLF (US$ 1 million). Based on findings in the India Chiller Sector Strategy study, the cost of foregoing other mission critical projects or the opportunity costs incurred for replacing a chiller 10-25 years in age can go as high as 30% of the initial cost of the new chiller – for purposes of the calculations here, this amounts to US$ 17,879,400. Including the opportunity cost to chiller owners, the economic costs total around US$ 82 million as shown in Table A9.6.

18. The potential benefit in early chiller replacement is estimated at US$ 160 million, mainly from electricity cost savings. The same electricity savings translate to an avoidable electricity generation investment of US$ 104 million (see Table A9.6).

Table A9.6 Incremental Cost (Benefit) Matrix

	Baseline	Alternative	Increment
Domestic Benefit			
Number of Chillers	375	375	
Energy Investment Requirement (US$)	103,626,790		(103,626,790)
Global Environment Benefit (tCO2)	**1,951,788**	**939,254**	**1,012,534**
Energy	1,682,208	925,214	756,994
Refrigerant Substitution @ 1% Leakage	269,580	14,040	255,540
Cost (Benefit) in US$	**355,705,289**	**277,170,897**	**(78,534,392)**
Capital Cost		59,598,000	59,598,000
Cost between Mission-Critical and Mission-Marginal*		17,879,400	17,879,400
Cost of MM&V		1,821,218	1,821,218
Cost of Technical Assistance		204,000	204,000
Cost of PM		1,816,534	1,816,534
Contingency		213,836	213,836
Electricity Cost	**355,705,289**	**195,637,909**	**(160,067,380)**

19. The chiller replacements have the potential to abate a discharge of 705,498 tCO2 of which 284,848 tCO2 could be attributed to GEF and MLF resources.

20. Overall, the total GEF and MLF funding that would yield global environmental benefits in the form of GHG reductions is equivalent to US$ 3.56/tCO2 abated. On the other hand, the Effective Net Economic Benefit of the project, defined as electricity cost savings and avoided power generation investment less all project and installation costs, could reach US$ 180/tCO2 abated.

Annex 10: Environmental Safeguards Policy

PHILIPPINES: PH - Chiller Energy Efficiency Project

Environmental Management Framework

A. Introduction

The Government of the Philippines has requested World Bank assistance for the Chillers Energy Efficiency Project. This project corresponds with the central features of the Government's strategy for energy efficiency and the phase-out of ozone depleting substances.

The objectives of this EMF are:

- To establish clear procedures and methodologies for the environmental and social planning, review, approval and implementation of subprojects to be financed under the Project;
- To specify appropriate roles and responsibilities, and outline the necessary reporting procedures, for managing and monitoring environmental and social concerns related to subprojects;
- To determine the training, capacity building and technical assistance needed to successfully implement the provisions of the EMF;
- To establish the project funding required to implement the EMF requirements.
- To provide practical resources for implementing the EMF.

B. Legal Framework

The Philippines is a signatory to the 1987 Montreal Protocol on Substances that Deplete the Ozone Layer, and to succeeding amendments such as the 1992 Copenhagen Amendment and the 1999 Beijing Amendment. The Montreal Protocol binds member Parties to agreed strategies to protect the ozone layer. The 1999 Beijing Amendment to the Montreal Protocol tightens controls on hydrochlorofluorocarbons (HCFCs) - a significant ozone-depleting substance, introduces controls on bromochloromethane (BCM) - a lesser used ozone-depleting substance, and enhances reporting requirements. The Montreal Protocol was ratified through a Senate Resolution No. 86 on March 19, 2001, as required under the Philippine Constitution.

There is a proposed Department Administrative Order DAO Drafted in October 2007 with the Title: "Guidelines on the Enforcement of the Provisions Related to Ozone Depleting Substances Under Republic Act No. 6969, DAO No. 29, Series of 1992 and DAO No. 2004-08". This Administrative Order will provide comprehensive guidelines on the investigation, enforcement of preliminary/permanent preventive measures, prosecution, and imposition of fines on the illegal sale, storage, possession, use, manufacture, transport, import or export of Ozone Depleting Substances, and other prohibited acts.

C. Project Description

A chiller is the primary component in a refrigeration or air conditioning system. It produces chilled water through heat transfer by circulating a primary refrigerant medium (CFC, HCFC, HFC, NH3) in pipe circuits or heat exchangers to a secondary refrigerant, usually water or water plus glycol (called

chilled water), using pumps and distributing this chilled water in a building pipe circuit as in the case of air conditioned buildings or in refrigeration or freezing plants. The ventilating fans in air handling units then transfer the chilled water cold energy to the air resulting in “air conditioning”.

Non-CFC based (i.e. natural and HFC) chillers manufactured today can achieve at least 30% improvement in energy consumption (about 0.50 kW/TR) as compared to average energy consumption of older CFC-based chillers (0.8 kW/RT or higher, depending on maintenance and operational standards).

However, this energy consumption disparity is difficult for chiller owners to understand and replacing the inefficient chillers has not happened due to other various factors being mentioned, like lost income due to business activity disruption, increased replacement and maintenance expenses, additional electrical & mechanical equipment and component replacements as well as perceived lost market share to competitors.

With this scenario in mind, the project proposes to promote the early replacement of CFC based chillers by:

(a) Offering upfront financial incentives coupled with technical and technological monitoring assistance if the chiller owners opt to replace their chillers within the given project replacement period so as to lower their capital expenditure in this major equipment.
(b) As an added impetus to the financial grant mentioned above, the DENR shall seek to provide other incentives for the replacement of the inefficient chillers.
(c) The Bank shall also work out a direct tie-up with chiller suppliers viz-a-viz the chiller owners thus removing any administrative costs and other overhead expenses inherent in such a business undertaking. This will also make it easy for the Bank to monitor the project from the beginning of the project and up to the monitoring stage.
(d) Establishing a mechanism, which can become permanent later on, where the Bank becomes the repository for initial and future chiller replacements in availing carbon finance revenues in the international market thus, strengthening the linkages between organizations and the government of the Republic of the Philippines.
(e) Increasing the awareness of the public on the recent ban of CFC and its effects in contributing to ozone depletion and global warming, as well as the ban in production of virgin CFC whether domestic and international, this eventually will put on pressure for chiller owners to replace their ageing chillers.
(f) Assuage the chiller owners’ perceived technology risks by showing them that an ounce of prevention is worth a pound of cure, and that replacing their chillers now will show savings in energy consumption and potential low or no cost measures in replacement and maintenance especially in commercial buildings.

The financial grant shall come from the GEF and MLF to support part of the chiller replacement costs. The financial incentive will be given to the chiller owners willing to replace their chillers with natural or HFC chillers, which will lead to revenues from carbon finance as they will surrender their old chillers, and the ensuing carbon credits, to the project. Since the project will only provide financial incentives to entice them to replace their old chillers, a significant potential in co-financing from other commercial and institutional sources must be mustered to complete the financial framework.

The project is expected to replace a total of 375 chillers within a 10-year CDM crediting period with

a financial up-front incentive of 15%. The incentive package to chiller owners also include technology assistance, trainings and capacity building to be given during the monitoring phase. Additional units can eventually be replaced when co-financing sources shall come in after the project has been started and proven to be a success.

D. Environmental Impacts

Chillers for air conditioning and refrigeration applications impact the global environment in three major ways:

1) By releasing ozone depleting substances (ODS) such as CFCs used as refrigerant in chillers of any type and operation principle, due to leakages, servicing, decommissioning and maintenance.

2) New chillers still using HCFC and even HFC refrigerants have high Global Warming Potential (GWP) and Greenhouse Gas (GHG) emission rates, which means their prolonged use translates to cumulative trapping and reflection of heat, thereby contributing to climate change.

3) Consumption of considerable amounts of electricity from energy generation grids of the power industries normally run by fossil fuel combustion (coal, diesel, oil and bunker fuel) still produces greenhouse gases and carbon emissions which have a direct impact on global warming.

Not only that chillers are net energy consumers but they also impact the local environment since a poorly maintained chiller can emit harmful chemicals and pollutants such as particulate matter, sulphur dioxides, nitrogen oxides, lead, carbon monoxide, other airborne toxic chemicals and ground level ozone. Health risks from these pollutants include lung cancer, chronic pulmonary disease, pulmonary heart disease, and bronchitis, which are leading causes of death and sickness in developing countries. These pollutants also cause economic damage to buildings and environmental and economic damage to vegetation, animals, and natural resources.

<u>Negative Environmental Impacts</u>

The Disposal of Baseline Equipment which entails physical destruction of the chiller including compressor, will generate several potential wastestreams and occupational hazards, which are of concern:

1. Insulation Material: The insulation such as cladding and padding material should be checked for asbestos. The chiller may also be enclosed in a concrete structure which may need to be demolished in the removal of the chiller. Old concrete structures may also contain asbestos.
2. Lubricating oils and greases. Large chillers may have lubricating oils and gear oils which may contain hazardous compounds. Spillage of these oils and solvents may cause contamination of the site.
3. Generation of contaminated scrap material. Scrap metal may contain hazardous substances such as solvents, and heavy metals.
4. Movement of large equipment and operation thereof may generate localized negative impacts such as dust and noise pollution. Particularly, high noise levels from cutting equipment can cause elevated sound pressure levels which may lead to temporary or diminished hearing loss.
5. The Destruction of the ODS substances collected from the Chiller Equipment may also produce deleterious substances such as dioxins and furans if not treated properly.

6. Leakage of CFC's during decommissioning and destruction. Negative impacts of CFC's are two-fold, increase in ozone depleting substances in the atmosphere and increase in greenhouse gases. GWP of CFC-11 is higher that Carbon Dioxide by more than 4000 times.

Positive Environmental Impacts

Removal and destruction of CFC in existing chillers will significantly reduce the ODS inventory of the Philippines. This will reduce the environmental footprint of the Philippines in terms of Ozone Depleting Substances, and Greenhouse Gas Emissions. Conversion to non-CFC refrigerants in Chillers will also increase the energy efficiency of the Chillers.

E. Environmental Management Framework

This framework publicly posted by DENR on June 17, 2009, (please refer to the complete set of the Environmental Management Framework in the project files) provides guidance on the 1) environmental management plan (EMP), 2) the environmental monitoring plan and 3) the capacity building and training requirements, 4) EMF implementation budget. The EMF contains a series of mitigating and enhancement measures designed to ensure that the project minimizes any negative impacts and brings about positive ones. The activities included in this EMF are mainstreamed in the project's design.

1. Recovery of CFC's from Decommissioned Units. Proper capture of all ODS is essential to avoid atmospheric release. The CFC's in chillers are highly volatile and can easily be unintentionally release through fissures in the chiller structure. The procedure should be carried out by a certified technician and the process of recovery of refrigerant gas from retiring chillers needs to be witnessed and certified.
2. Inventory of Recovered CFC's. All refrigerants recovered from the phase-out of CFC-run Chillers must be recorded to ensure that these can be monitored and tracked. The purpose of the proposed inventory is to track future movements of these gases. This inventory should be updated and made available for inspection by independent third party auditors.
3. Procedures under the CDM methodology should be followed, such as providing independent third party witnesses (licensed engineers) during the destruction procedure and providing photographic documentation of the process.
4. Destruction of CFC's. Any proposed process of destruction should guarantee the total conversion of CFC's into non-hazardous compounds. Of particular concern is the use of low temperature incineration processes which may emit dioxin and furan compounds. Any elected process must be done in accordance with provisions of the Philippine Clean Air Act and other relevant regulations particularly RA 6969 (Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990).
5. A site assessment for asbestos should be carried out in the immediate area of the chiller. If asbestos presence is determined, a management plan for removal, transport and disposal is followed. It is important to isolate the area during the removal process of asbestos. Particle masks and containment rooms are standard precautionary measures.
6. Collection and clean-up of oils and solvents will have to be carried out. Use of drip pans and collection sumps for large amounts of oils, greases and solvents and other spill control measures should be followed.

7. Occupation and Safety measures such as use of personal protective equipment and noise protection equipment, during decommissioning and demolition processes should be followed. The project's Operations Manual states that the new chillers should comply with ASHRAE 15-2007 (Safety Standard for Refrigeration Systems) with ANSI/ASHRAE 34-2007 (Designation and Safety Classification of Refrigerants specifies safe design, construction, installation, and operation of refrigeration systems.
8. Environment and Safety Operations Manual. The Project may develop a manual containing guidelines for all contractors, setting forth the environmental rules and procedures to be followed during the removal/destruction of Chiller equipment. The manual will include actions related to the environmental management and supervision of works, the environmental requirements for contractors, environmental planning rules for construction and oversight of works, including activities to minimize and mitigate removal or equipment movement-related impacts.

Environmental Monitoring Plan

The environmental monitoring plan is designed to ensure that mitigation measures are implemented and have the intended result. Remedial measures may also be carried out if the mitigation measures identified above are inadequate or the impacts have been underestimated.

Supporting Documents

The following documents are supporting documents to this EMF:

1) Operations Monitoring Plan - The Operations Monitoring Plan (OMP) defines a standard against which the project performance in terms of its greenhouse gas (GHG) emission reductions (ERs) and conformance with all relevant CDM and KfW criteria will be monitored and verified. It is a tool to help project developers coordinate all the monitoring requirements for generating verified emission reductions (VERs) or certified emission reductions (CERs) from their project and for ensuring compliance with applicable KfW's standards.
2) Manual of Protocols – These are nine (9) detailed protocols to be followed in the conversion of chillers. These protocols would guide the Chiller Owners for example in establishing baseline power-to-output function, destruction certification, tracking of refrigerant leakage among others.
3) Operations Manual – A general procedural guide in the chiller conversion process.
4) World Bank Guidance Note on Asbestos. June 2007

F. Institutional Arrangements

The chiller owner will be responsible for reporting the delivery of the recovered CFCs and the dismantled main chiller parts (eg., compressor) from the old replaced chiller to a project designated facility. The chiller owner will conduct the dismantling, destruction and disposal according to an Equipment Destruction and Disposal Plan and the Environmental Management Framework. Chiller Owner will then report their compliance to this plan to the PMC, DENR and the World Bank. Training will be conducted to ensure that the chiller owners are capable of conducting this activity and the PMC will coordinate the surrender of the dismantled parts and CFCs with DENR. The PMC will record the necessary information in the project database. The PMC, DENR and the World Bank shall be given access to the old and new chiller replacements.

There will be a series of capacity building activities which will be initiated by the PMC for the chiller owners, the manufacturers/suppliers, DENR and DOE. These activities will ensure familiarization with the general and specific guidelines in the Operations Manual. Compliance to the Chemical Control Order (CCO) 2004-08 Revised Chemical Control Order for ODS is required of all chiller owners. CO 2004-08 is being updated to include the specific requirements in the replacement of the old, inefficient CFC chillers to new energy efficient non-CFC chillers. This is expected to be finalized during project implementation.

Legal agreements will be signed between the Project Management Consultant (PMC), the chiller manufacturer/supplier and the chiller owner. This legal agreement will include the responsibilities for the development and the implementation of this Environmental Management Framework (EMF). The PMC is thus mandated to report the progress of the project to DENR and the World Bank and to the local regulating agency of the government of the Republic of the Philippines.

G. Implementation Schedule

The project will commence in March 2010.

H. Cost Estimates and Sources of Funds

The project will facilitate the replacement of all inefficient chillers over a period of seven years. Financial incentives will be offered through resources from the GEF, MLF and, eventually the CDM (once credits are generated by the project). A total of about $12M ($1M from MLF, $2.6M from GEF, $50,000 from US EPA and $8M from CDM) will leverage private investments of around $51M from the chiller owners.

Annex 11: Project Preparation and Supervision
PHILIPPINES: PH - Chiller Energy Efficiency Project

	Planned	Actual
PCN Review	01/15/2008	10/29/2008
Initial PID to PIC	03/17/2009	01/23/2009
Initial ISDS to PIC	03/17/2009	04/15/2009
Appraisal	06/24/2009	06/24/2009
Negotiations	02/22/2010	
Board/RVP approval	03/31/2010	
Planned date of effectiveness	04/15/2010	
Planned date of mid-term review	07/13/2013	
Planned closing date:		
Ozone Trust Fund Grant Agreement	01/01/2017	
GEF Grant Agreement	01/01/2015	

Key institutions responsible for preparation of the Project: DENR

Bank staff and consultants who worked on the project included:

Name	Title	Unit
Maya Gabriela Q. Villaluz	Sr. Operations Officer /TTL	EASPS
Qing Wang	Environmental Specialist/Co-TTL	EASRE
Minneh Kane	Lead Counsel	LEGES
Preselyn Abella	Financial Management Specialist	EAPCO
Noel Sta. Ines	Procurement Specialist	EAPCO
Maria Consuelo Sy	Team Assistant	EACPF
Viraj Vithoontien	Senior Regional Coordinator	ENVMP
Mary-Ellen Foley	Environmental Specialist	ENVMP
Gerardo Parco	Environmental Specialist	EASPS
Simon Gregorio	Consultant	

Bank funds expended to date on project preparation:

1. Bank resources: US$ 42,546.05 (FY09)
2. Trust funds: US$ (FY09)
3. Total US$

Estimated Approval and Supervision Costs:

1. Remaining cost to approval: US$
2. Estimated annual supervision cost US$75,000

Annex 12: Documents in the Project File
PHILIPPINES: PH - Chiller Energy Efficiency Project

Project Background Documents:

- Minutes of the First Global Chiller Workshop, Washington, DC, September 10, 2005;
- Minutes of the Second Global Chiller Workshop, Washington, DC, January 10, 2006;
- Multilateral Fund Project Document: Global Chiller Replacement Project, November 2005;
- Project Appraisal Document for a Thailand Building Chiller Replacement Project, Environment and Social Development Unit, East Asia and Pacific Region, World Bank, May 2001;
- Philippine Chiller Energy Efficiency Project Identification Note for Carbon Finance;
- Philippine Chiller Energy Efficiency CDM Program of Activities for Carbon Finance;
- Philippine Chiller Energy Efficiency Project Identification Form for GEF Work Program Entry, January 22, 2008;
- East Asia Energy Sector Assessment (Philippines, Vietnam, Indonesia), March 2009
- Aide Memoire: Philippines Chiller Energy Efficiency Preparation Mission

CDM Documents

- Philippines Chiller Energy Efficiency Project CDM Program of Activities Design Document (PoA-DD)
- Manual of Protocols
- Operational Monitoring Plan

Sector Background:

- India Chiller Sector Study, July 2002;
- International Chiller Study, prepared for ENVMP of the World Bank, ICF Consultants, 2005
- Philippine Chillers Inventory, September 2008.

UNFCCC

- AM0060 – Baseline and monitoring methodology for power savings through replacement by energy efficient chillers

Annex 13: Governance and Anti-Corruption Action Plan (GACAP)

PHILIPPINES: PH - Chiller Energy Efficiency Project

No	GAC Risks	Issues/risks	Mitigation measures	Intended outcomes/results	Responsibility centre(s)
1	**Operation Specific Governance Risk**	(i) Perceived lack of objectivity in project operation decisions specifically in the selection of beneficiaries. The DENR will act as the Coordinating entity (CE) with the Project Management Contractor (PMC) assisting DENR in performing its day-to-day operations (ii) Possible abuse of privileges to be issued to chiller owners who will participate in the project (iii) Lack of institutional and operational clarity between the different units within the DENR involved in the project. (iv) Errors in the selection of beneficiaries. Inclusion errors – unqualified beneficiaries selected. Exclusion errors – qualified beneficiaries left out. (v) Compliance with Conditions - PMC and DENR will be overburdened by monitoring requirements.	1. The governance risk this poses is mitigated by: (i) setting up a steering committee including representation from the private sector and civil society and (ii) careful review by the Bank of the contract between DENR and the selected PMC. 2. Civil Society Participation*:* To increase transparency, the DENR's Bids and Awards Committee will comply with the procurement law and invite civil society observers in procurement biddings. 3. Strengthen Internal Control: DENR will institutionalize its internal audit unit to take the lead in determining the adequacy of internal control, monitor and enforce policies, rules and regulations on procurement and financial management. The internal audit services shall cover the project in its annual scope of work with report due to the Bank within four months after the end of each fiscal year. 4. Clear Criteria established in the selection of beneficiaries. 5. Grievance Redress system established to address and resolve inclusion/ exclusion complaints. Within 6 months after grant signing 6. Adequate staffing of PMC to be sufficiently capable to handle expected workload related to compliance monitoring and other required functions.	• Steering Committee set-up to oversee the Project. • Clear Criteria for Beneficiary selection established • Grievance Redress System in place • Adequately staffed PMC. • Robust participation by Civil Society	DENR PMC

No	GAC Risks	Issues/risks	Mitigation measures	Intended outcomes/results	Responsibility centre(s)
2	**Financial Management**	(i) Weak internal control environment at DENR as evidenced by the various issues reported by COA in its audit of the agency's accounts. In addition, there is also the issue of absorptive capacity of the agency especially FASPO and FMS to handle additional project. (ii) COA reported several weak implementations of the internal controls and procedures prescribed in NGAS, for inventories, cash advances, bank reconciliation and property plant and equipment. (iii) Internal audit unit not fully functioning in accordance with international standards. (iv) Existence of three fund source opens risk of wrong fund source used for certain activity. (v) Control over the proceeds of the sale of the carbon credits generated from the chillers funded by the subsidy under this grant. (vi) Risk that criteria on prioritization of grant beneficiaries are properly complied with.	1. Hiring of PMC will address this issue of absorptive capacity and weak internal control environment. 2. FASPO and FMS to each appoint a focal person to coordinate with PMC and facilitate the processing of project documents. This should be a condition for negotiation. 3. The operations manual should clearly describe the criteria in the usage of each fund source, criteria of awarding the incentives to chiller owners and the monitoring and accounting of the proceeds from the sale of the carbon credits. The performance review could also be a form of check into this aspect of the project. 4. The quarterly IFR shall show the receipts and disbursements under each fund source. 5. The strengthening of the internal audit function and the action plan on the resolution of internal controls and accounting issues reported by COA are addressed and monitored under an existing Bank-assisted investment project. 6. The internal audit services shall cover the project in its annual scope of work with report due to the Bank within four months after the end of each fiscal year. 7. Adoption of a grievance monitoring system within 6 months from the signing of the grant agreement.	Strong, timely and transparent financial management to ensure timely disbursement and that the grant proceeds are used for the purposes intended.	• DENR IAS • External Audit (COA) • DENR FASPO and FMS • Bank Supervision

No	GAC Risks	Issues/risks	Mitigation measures	Intended outcomes/results	Responsibility centre(s)
3	**Procurement Issues**	(i) Likely delays in DENR's hiring and mobilizing of the Project Management Consultant (PMC)	TTL obtained the commitment of key DENR officials (Usec Sering and Usec Ignacio) that hiring and mobilization will be concluded in four months. Approval of the contract of the PMC will be a condition for the effectiveness of the Grant	PMC hired.	DENR
		(ii) PMC's lack of experience in handling project financed by the Bank	1. One of the selection criteria of the PMC would be experience in handling projects financed by international financing institutions, World Bank, ADB, JICA, EU, etc., in addition to successful experience in energy efficiency (e.g. energy service company) and chillers. 2. RFP / TOR to specify that PMC's key staff shall include a Procurement Specialist with at least five years of successful experience in handling NCB and ICB procurement of Goods following Banks' procedures.	Competent PMC hired, staffed with persons with the right skills set.	DENR
		(vi) Transparency issues in processing procurement. i.e transparency in the Procurement by the private sector, which is the main procurement method under the project. Around 250 - 324 aging chillers (with about 30% installed in government owned facilities) will be replaced through provision of financial incentives on a grant basis to support 15% of the chiller replacement costs	3. The Grant Agreement and the RFP / TOR to specify that procurement will be carried in accordance with the Bank's procedures, including the Bidding Documents. The first contract of each type of procurement in addition to those above the Bank's threshold will be subject to prior review. A detailed review of the first 18 month procurement plan would be conducted by a technical specialist to ensure that contracts are packaged in an appropriate and optimum manner. Monitoring will be on the basis of the annual procurement plan. In addition to the prior review, post review at a ratio of 1:5 will be carried out. The ratio will be reviewed and adjusted as required based on performance by PMC. 4. Scope is expected to be within 324 aging	PMC website established. ICB Bid opportunities widely publicized	DENR PMC

No	GAC Risks	Issues/risks	Mitigation measures	Intended outcomes/results	Responsibility centre(s)
			chillers (with about 30% installed in government owned facilities). 5. due to highly technical nature of the project a qualified specialist(s) / TA will be hired in drafting tender documents (including neutral technical specifications), evaluating offers and managing the contracts. Accordingly the Task Team would mobilize technical specialists to review / confirm the submission by the PMC /DENR. 6. DENR and / or PMC to witness (as observers) the procurement process of the participating government entities and private sector beneficiaries; 7. The TOR / contract to specify that the PMC shall implement the "Fraud and Corruption" provisions in the Bank's Guidelines. 8. PMC shall be required to provide a website (with link to DENR website) where all project related information will be posted including the Procurement Plan. 9. ICB bid opportunities shall be advertized in the UNDB and dgMarket and that all other bid opportunities shall be advertized in PMC website and a newspaper of wide national circulation, including information on contract award.		