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The World Bank

Report No: ICR00004059

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(TF-95991 and TF-96093)

ON A

GLOBAL ENVIRONMENT FACILITY (GEF) GRANT

IN THE AMOUNT OF US$2.6 MILLION

AND AN OZONE PROJECTS TRUST FUND (OTF) GRANT

IN THE AMOUNT OF US$1.0 MILLION

TO THE

REPUBLIC OF THE PHILIPPINES

FOR A

CHILLER ENERGY EFFICIENCY PROJECT

June 30, 2017

Environment and Natural Resources Global Practice
East Asia and Pacific Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective June 16, 2017)

Currency Unit = Philippine Peso
PhP 1.00 = US$0.020
US$1.00 = PhP 49.08

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AC	Air Conditioning
CAS	Country Assistance Strategy
CDM	Clean Development Mechanism under the Kyoto Protocol
CE	Coordinating Entity
CEEP	Chiller Energy Efficiency Project
CER	Certified Emission Reduction
CF	Carbon Finance
CFC	Chlorofluorocarbon
CO2e	Carbon Dioxide Equivalent
DAO	Department Administrative Order
DENR	Department of Environment and Natural Resources
DED	Detailed Engineering Design
DNA	Designated National Authority
DOE	Department of Energy
EE	Energy Efficiency
EMB	Environmental Management Bureau
EMF	Environmental Management Framework
EMP	Environmental Management Plan
ERPA	Emission Reduction Purchase Agreement
ERTA	Emissions Reduction Transfer Agreement
ESCO	Energy Services Company
FASPO	Foreign-Assisted and Special Projects Office
FI	Financial Intermediary
FMIS	Financial Management Information System
GEF	Global Environment Facility
GEO	Global Environmental Objective
GHG	Greenhouse Gas
GOP	Government of the Philippines
GWh	Gigawatt - hour
GWP	Global Warming Potential
HCFC	Hydrochlorofluorocarbon
HFC	Hydrofluorocarbon
ICB	International Competitive Bidding
IFC	International Finance Corporation
IRR	Internal Rate of Return
KfW	Kreditanstalt für Wiederaufbau (German Reconstruction Bank)
KP	Kyoto Protocol

kWh	Kilowatt-hour
kW/TR	Kilowatt-hour per ton of Refrigeration
LGU	Local Government Unit
MIS	Management Information System
MLF	Multilateral Fund for the Implementation of the Montreal Protocol
MMV	Measuring, Monitoring and Verification
MOU	Memorandum of Understanding
MP	Montreal Protocol on Substances that Delete the Ozone Layer
MT	Metric Ton
MTPDP	Mid Term Philippine Development Plan
MW	Megawatt
MWh	Megawatt-hour
NCB	National Competitive Bidding
NPV	Net Present Value
ODS	Ozone Depleting Substance
ODP	Ozone Depleting Potential
OM	Operations Manual
PAD	Project Appraisal Document
PCR	Project Completion Report
PCEEP	Philippine Chillers Energy Efficiency Project
PMC	Project Management Contractor
PMU	Project Management Unit
PoA	(CDM) Program of Activities
POD	Philippine Ozone Desk
RAC	Refrigeration and Air-conditioning
SGA	Sub-grant Agreement
TA	Technical Assistance
tCO2e	Tons of CO2 equivalent
TR	Ton of Refrigeration, a unit of measure equivalent to 12,000 BTU/hr
US EPA	United States Environmental Protection Agency
VER	Verified Emission Reduction

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Philippines
Chiller Energy Efficiency Project

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A. Basic Information			
Country:	Philippines	Project Name:	PH - Chiller Energy Efficiency Project
Project ID:	P114119	L/C/TF Number(s):	TF-95991,TF-96093
ICR Date:	03/22/2017	ICR Type:	Core ICR
Lending Instrument:	SIL	Borrower:	REPUBLIC OF THE PHILIPPINES
Original Total Commitment:	USD 3.60M	Disbursed Amount:	USD 2.71 M
Revised Amount:	USD 3.60M		
Environmental Category: B		**Global Focal Area: C**	
Implementing Agencies: Department of Environment and Natural Resources			
Cofinanciers and Other External Partners:			

B. Key Dates				
Process	**Date**	**Process**	**Original Date**	**Revised / Actual Date(s)**
Concept Review:	10/29/2008	Effectiveness:	01/05/2011	03/25/2011
Appraisal:	06/23/2009	Restructuring(s):		06/24/2013 12/22/2014
Approval:	06/03/2010	Mid-term Review:	07/13/2013	06/24/2013
		Closing:	01/01/2015	01/01/2017

C. Ratings Summary	
C.1 Performance Rating by ICR	
Outcomes:	Satisfactory
Risk to Global Environment Outcome	Low or Negligible
Bank Performance:	Satisfactory
Borrower Performance:	Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance			
Bank	**Ratings**	**Borrower**	**Ratings**
Quality at Entry:	Satisfactory	Government:	Satisfactory
Quality of Supervision:	Highly Satisfactory	Implementing Agency/Agencies:	Moderately Satisfactory
Overall Bank Performance:	Satisfactory	**Overall Borrower Performance:**	Moderately Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Implementation Performance	**Indicators**	**QAG Assessments (if any)**	**Rating**
Potential Problem Project at any time (Yes/No):	No	Quality at Entry (QEA):	None
Problem Project at any time (Yes/No):	Yes	Quality of Supervision (QSA):	None
GEO rating before Closing/Inactive status	Satisfactory		

D. Sector and Theme Codes		
	Original	**Actual**
General energy sector	50%	60%
District heating and energy efficiency services	50%	40%

Theme Code: Climate change	100%	100%

E. Bank Staff		
Positions	**At ICR**	**At Approval**
Vice President:	Victoria Kwakwa	James W. Adams
Country Director:	Mara K. Warwick	Bert Hofman
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	Ashraf Bakry El-Arini	

F. Results Framework Analysis
Global Environment Objectives (GEO)

The objective of the project is to reduce greenhouse gas emissions by replacing inefficient chillers including both old CFC-based chillers and non-CFC-based chillers within the territory of the recipient.

Revised Global Environment Objectives

The PDO/GEO was not revised.

(a) GEO Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Cooling capacity addressed by the project (Number of TRs)			
Value (quantitative or Qualitative)	0.00	30,649.00		45,687.00
Date achieved	06/24/2013	06/24/2013		01/01/2017
Comments (incl. % achievement)	Achieved. The indicator, adopted at the 2013 restructuring (See Sect. 1.3), was **exceeded by 49%** due to a drop in the cost of chiller equipment, which resulted in a commensurate reduction in the dollar value of the subsidies paid out. As a result, a higher number of chiller replacements than projected at restructuring were possible. Measurement of cooling capacity accurately captures reductions in GHG emissions as a result of direct phase-out of ozone-depleting refrigerants (which have GWP), as well as the tCO_2eq associated with the energy savings generated by chillers with more efficient cooling capacity. Data was collected at source from individual chiller data loggers and aggregated through the Philippine Chiller Energy Efficiency Project - Chiller Management Information System.			
Indicator 2 :	ODP Consumption phase-out due to the replacement of chillers (ODP ton)			
Value (quantitative or Qualitative)	0.00	22	5.70	6.9
Date achieved	06/30/2010	01/01/2017	01/01/2017	01/01/2017
Comments (incl. % achievement)	Achieved. The target value, which was reduced downwards during the 2013 restructuring (see Sect. 1.7), was **exceeded by 21%** as a result of the higher number of chillers ultimately replaced. Direct reductions of ODP emissions result from the phase-out of CFC and HCFC refrigerants, given their respective high GWP. The phase out of the refrigerants directly contribute to reduction in GHG emissions due to the high Global Warming Potential of these refrigerants e.g. Chlorofluorocarbons, Hydrochlorofluorocarbons. The project was restructured due to the cancellation of the ERPA.			
Indicator 3 :	Cumulative carbon emission reduction as direct benefits from the project (k tCO_2)			
Value	0.00	560	62.4	151.4

(quantitative or Qualitative)				
Date achieved	06/30/2010	01/01/2017	06/24/2013	01/01/2017
Comments (incl. % achievement)	Achieved. The target value, which was reduced downwards during the 2013 restructuring (see Sect. 1.7), was **exceeded by 136%** as a result of the higher number of chillers ultimately replaced, as well as the increasing energy efficiency of technology within the sector. The value includes GHG emissions as a result of direct phase-out of ozone-depleting refrigerants (which have GWP), as well as the tCO_2eq associated with the energy savings generated by chillers with more efficient cooling capacity.			
Indicator 4 :	GWh savings and MW demand reduction (Gigawatt-hour (GWh)			
Value (quantitative or Qualitative)	0.00	341 GWh/y over 20 years 59 MW	124.7 GWh 29.7 MW	35 GWh/y
Date achieved	06/30/2010	01/01/2017	06/24/2013	01/01/2017
Comments (incl. % achievement)	Substantially Achieved. The target value for GWh/y, was revised to GWh, and was reduced downwards during the 2013 restructuring (see Sect. 1.7) to 124.7 GWh. This had to be indexed to 2016 which gives a value of 37 for comparison. This gives a **95% achievement** of the target. In terms of MW demand reduction, the project achieved a reduction of 18.95 MW, which **exceeded the revised target of 10 MW by 90%**. The 10 MW reduction is an intermediate target indexed to 2016. Please refer to para 29 for a more comprehensive explanation. This indicator was originally tracking two numbers, the GWh/y and the MW demand reduction. The team was advised to retain only one indicator. The indicator on GWhr was retained. This indicator contributed to the evidence on GHG reduction and energy efficiency. Energy efficiency would substantiate the objective of providing efficient chiller replacements. Reduction in GHG is also based on the current Philippine Energy mix where only 10 % comes from renewable sources and the rest from coal, diesel and natural gas.			

(b) Intermediate Outcome Indicator(s)

Indicator	Baseline Value	Original Target Values (from approval documents)	Formally Revised Target Values	Actual Value Achieved at Completion or Target Years
Indicator 1 :	Number of new energy efficient chillers installed			
Value (quantitative or Qualitative)	0.00	375	53	71
Date achieved	06/30/2010	01/01/2017	06/24/2013	01/01/2017
Comments (incl. % achievement)	Achieved. The revised target value, which was reduced downwards during the 2013 restructuring (see Sect. 1.7), was **exceeded by 34%.** The target value was redefined based on the reduction of available financing due to the loss of potential carbon finance reflows, which restricted the project's design to payment of a fixed level subsidy tied to the grant financing available, which determined the number of chiller conversions possible based on the going market price at the time. The revised target was surpassed given that the cost of chiller technology dropped during implementation, thereby allowing for additional			

	chillers to be replaced. The PDO clearly states its objective of replacing inefficient chillers. This indicator gives evidence on the replacement achieved.			
Indicator 2 :	Data MIS for VER Claims (% of units providing data)			
Value (quantitative or Qualitative)	0.00	100	35	41
Date achieved	06/03/2010	01/01/2017	06/24/2013	01/01/2017
Comments (incl. % achievement)	Achieved. The revised target value, which was reduced downwards during the 2013 restructuring (see Sect. 1.7), was **exceeded by 23%,** as 41 of the 71 new chillers installed (58%) were connected to the Chiller Management Information System (CMIS) at the time of project completion, with the remainder set to come online upon completion of installation. This indicator is essential in proving that the chillers are sustainable operating, by providing chiller operating efficiency information through the MIS which the DENR will be monitoring.			
Indicator 3 :	Number of project recipients participating in the recognition program			
Value (quantitative or Qualitative)	0.00	50	15	29
Date achieved	06/03/2010	01/01/2017	06/24/2013	01/01/2017
Comments (incl. % achievement)	Achieved. The revised target value, which was reduced downwards during the 2013 restructuring (see Sect. 1.7), was ultimately **exceeded by 93%.** As a means of ensuring the sustainability of the energy efficiency of chillers, this recognition program was established. This will be done on a yearly basis and gives recognition to the chillers owners achieving the highest energy efficiency based on data received through the MIS.			
Indicator 4 :	Number of training sessions and workshops			
Value (quantitative or Qualitative)	0.00	15	12	26
Date achieved	06/03/2010	01/01/2017	06/24/2013	01/01/2017
Comments (incl. % achievement)	Achieved. The revised target value, which was reduced downwards during the 2013 restructuring (see Sect. 1.7), was **exceeded by 117%.** Training was targeted for technical representatives from beneficiary facilities and involved technical handling and maintenance good practices, as well as introduction to the online functionality of the project's monitoring information system (MIS). Government staff involved in ongoing results monitoring in the sector, were also trained. This training component was important in ensuring that the chiller owners continue operating their chillers efficiently through preventive maintenance and good housekeeping. It also trained them on how to transmit the chiller operating data to the DENR through the Chiller Management Information System (CMIS)			
Indicator 5 :	Number of Sub-grant Agreements signed			
Value (quantitative or Qualitative)	0.00	20		40
Date achieved	06/24/2013	01/01/2017		01/01/2017

Comments (incl. % achievement)	Achieved. This indicator was added at the time of the 2013 restructuring to introduce a legally binding instrument by which to document chillers owners' commitment to the proper and sustainable operation and maintenance of the new chillers subsidized by the project (see Sect. 1.3), was **exceeded by 100%.** This overachievement was made possible by the successful marketing of the project, as well as the fact that the decline in the cost of chiller equipment allowed for a great number of replacements to be approved. The sustainability of the operation of the chiller is part of the terms of the subgrant agreement. The chiller owners commit to send chiller performance data through the CMIS for ten years. The chiller performance data will allow the DENR to monitor efficient chiller performance. The number of sub-grant agreements signed gave the project a basis to monitor the commitment of chiller owners to participate in the PCEEP.

G. Ratings of Project Performance in ISRs

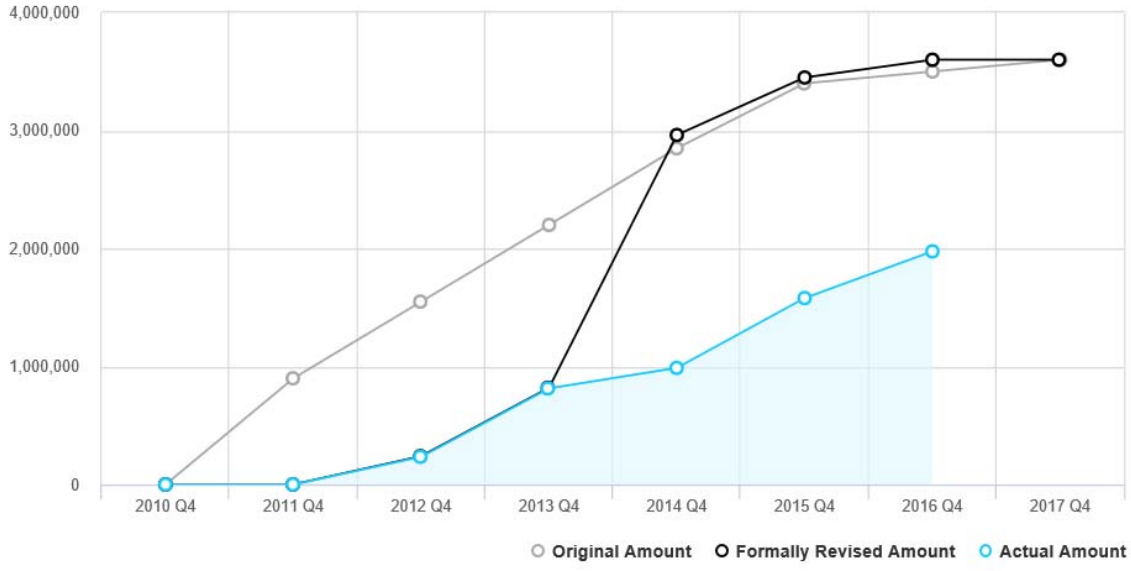
No.	Date ISR Archived	GEO	IP	Actual Disbursements (USD millions)
1	06/21/2011	Satisfactory	Satisfactory	0.00
2	07/12/2011	Moderately Satisfactory	Moderately Satisfactory	0.00
3	12/28/2011	Moderately Satisfactory	Moderately Unsatisfactory	0.20
4	07/01/2012	Moderately Unsatisfactory	Moderately Unsatisfactory	0.23
5	11/13/2012	Moderately Unsatisfactory	Moderately Unsatisfactory	0.74
6	06/02/2013	Moderately Unsatisfactory	Moderately Unsatisfactory	0.81
7	10/24/2013	Moderately Satisfactory	Moderately Satisfactory	0.85
8	05/27/2014	Moderately Satisfactory	Moderately Satisfactory	0.98
9	12/29/2014	Moderately Unsatisfactory	Moderately Unsatisfactory	1.41
10	06/21/2015	Moderately Satisfactory	Moderately Satisfactory	1.58
11	09/30/2015	Moderately Satisfactory	Moderately Satisfactory	1.72
12	04/21/2016	Moderately Satisfactory	Moderately Satisfactory	1.93
13	09/06/2016	Satisfactory	Moderately Satisfactory	2.07
14	12/18/2016	Satisfactory	Satisfactory	2.71

H. Restructuring (if any)

Restructuring Date(s)	Board Approved GEO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		GEO	IP		
06/24/2013		MU	MU	0.81	Realignment of one of the original PDO Outcome Indicators due to depression of

Restructuring Date(s)	Board Approved GEO Change	ISR Ratings at Restructuring		Amount Disbursed at Restructuring in USD millions	Reason for Restructuring & Key Changes Made
		GEO	IP		
					global carbon market, delays experienced in the validation process, as well as the mutually agreed termination of the Emissions Reduction Purchase Agreement (ERPA) between the Government and the Kreditanstalt fur Wiederaufbau (KfW), as well as related downward reduction of target values for remaining Outcome and Intermediate Results indicators (see ICR Sections 1.6 and 1.7)
12/22/2014		MS	MS	1.41	Closing date extension from 01/01/2015 to 1/01/2017.

I. Disbursement Profile



1. Project Context, Global Environment Objectives and Design

1.1 Context at Appraisal

Country and Sector Background

1. The Philippine Chiller Energy Efficiency Project (PCEEP) was designed within the context of the 2004-2010 Medium-Term Philippine Development Plan (MTPDP), key elements of which included greater energy self-sufficiency, supported by improved energy efficiency (EE), and uptake of ozone friendly technologies, products and equipment as means to protect the environment and improve Filipinos' quality of life. At the time of the project's design, government policies[1] promoted an aggressive EE program to keep pace with the Philippines' growth and economic development trajectory in support of the MTPDP. Enhanced energy independence measures identified in support of conservation, renewable, and efficient use of energy included, inter alia, energy management programs to assist industrial and commercial installations, and support for public sector energy conservation.

2. Energy use in buildings forms a large part of global energy demand. In particular, the demand for cooling has increased significantly, accounting for over 10 percent of global electricity consumption, due in large part to the growth of air conditioning. This increase in electricity consumption, and its associated increase in peak electricity demand, has created challenges for power systems capacities, and national and local governments, to meet their Green House Gas reduction and green growth goals.

3. The Project sought to address financial, technology, and information barriers to increasing cooling efficiency, the largest use of electricity in most commercial and institutional buildings. The EE potential associated with chiller-based cooling, the predominant method used in large commercial and industrial buildings and facilities, offered an efficient vehicle through which to realize ambitions outlined in the Government's energy reform agenda, particularly given that air-conditioning is a sector recognized as fundamental to the functioning of productive, growing economies. The Project offered the opportunity to capture significant potential for EE gains by encouraging more energy conscious decision-making by chiller owners, accelerating the replacement of the stock of building chillers that used refrigerants with both significant ozone-depleting and global warming potential,[2] and laying the groundwork for sustainable market transformation in the building cooling sector.

4. As highlighted in the Project Appraisal Document, buildings using water-cooled centrifugal chillers, those units that offer the most cooling capacity, on average dedicate 15-20% of their total energy use to chiller operation. At Project design, improvements in chiller technology EE across the industry meant that reduced power consumption, associated energy savings, and avoided emissions were accessible to Philippine building owners. Yet, despite the benefits of opting for more modern and efficient chiller technology, early replacement was not occurring because of financial, technology and information barriers. Chiller replacement calls for high upfront capital expenditure. Concerns, including competing investment opportunities and

[1] Laws and policies addressed by the Project include: the Philippine Energy Plan (2007-2014); the Presidential Administrative Order No. 110 of 2004; the 'Institutionalization of a Government Energy Management Program; the Republic Act No. 7638 of 1992; and the 'Department of Energy Act of 1992'.
[2] CFC-11 and CFC-12 have GWPs of 5,000 and 8,500 respectively.

resource constraints, challenges in accessing capital, perceived technology risks and lack of awareness regarding potential savings offered by new technologies and rates of return, meant that consideration of chiller replacement was relegated as a relatively low priority for building owners, who therefore often keep old chillers running as long as possible.

5. Cooling needs represented roughly, 66 percent of the Philippines' consumption of Chlorofluorocarbons (CFCs). The country had completely phased out CFC consumption[3] by January 1, 2010, in accordance with its obligations under the Montreal Protocol (MP) on Substances that Deplete the Ozone Layer. However, the use of stockpiled or recycled CFCs in the cooling servicing sector was not controlled and therefore persisted, encouraging the ongoing use of older, inefficient building chiller technology. In contrast, modern high-efficiency chiller technology manufactured at the time of Project design used on average 35 percent less electricity than technology manufactured in the decades prior. In addition, poor overall chiller maintenance practices contributed to inefficiency of energy consumption, even among newer, non-CFC-based chillers installed in the late 1990s/early 2000s that used hydrochlorofluorocarbons (HCFCs), refrigerants which, like CFCs, have both ozone depletion and global warming potential. The conversion of inefficient chillers to modern high-efficiency technology offered a number of environmental and economic incentives. These include direct reduction of greenhouse gas (GHG) emissions that is consistent with the Philippines' Kyoto Protocol climate objectives. Other incentives include a reduction of the burden on ongoing CFC usage in the service sector and the replacement of less efficient HCFC technology that are complementary to other initiatives of the country's Kyoto Protocol obligations; and the opportunity to demonstrate to building owners that investment choices based on selection of environmentally-friendly EE technologies make good business sense. It also gives the potential to generate favorable rates of return based on energy cost savings, improved reliability, and lower maintenance costs.

6. The PCEEP was among a handful of Bank projects at the time that sought to bring together grant funding at the nexus of ozone and climate goals, with a view to leveraging carbon finance revenues and mobilizing commercial finance. The synergy of this design complemented and expanded upon, the results of the Philippines' National CFC Phase-out Plan and informed the concept under discussion for a follow-on HCFC phase-down operation. Its incentive-based chiller replacement program promoted Global Environment Facility (GEF) focal area and strategic program objectives for barrier removal in a sector known to consume, on average, 50-70% of building electricity use, while laying the groundwork for market transformation in support of a low-carbon growth path.

Rationale for Bank Assistance

7. The PCEEP was consistent with the goals of the Philippines Country Assistance Strategy (CAS) 2010-2012 developed in partnership between the Bank and the government that sought to support the country's goal of achieving growth that is more inclusive to reduce vulnerabilities. In particular, the PCEEP sought to underpin the strategy's organizing principles with regard to fostering stronger partnerships and mitigating climate-related risks and reducing GHG emissions across sectors and local government units (LGUs). The Bank and the Government of the Philippines designed the Project to engender closer collaboration and synchronized efforts on climate change. In addition, strategic use of financing instruments that included the GEF, the Multilateral Fund for the Implementation of the Montreal Protocol

[3] Article 1 of the MP defines Consumption as 'Production + imports – minus exports'. The Philippines was not a producer, nor exporter of CFCs.

(MLF), and carbon finance funds, have been used to demonstrate how an improved use of EE chillers can contribute to reducing carbon emissions.

8. At the time of Project design, the Bank had amassed a solid body of experience in managing strategic and potentially complex financing mechanisms for both Ozone Depleting Substances-reduction projects and large-scale energy-saving projects. Innovative replacement of CFC-based chillers had already been demonstrated in Mexico, Thailand, and Turkey, and the Bank had developed a methodology for the early replacement of chillers in India (see Section 2.1, Assessment of Project Design), from which lessons could be applied to the case of the Philippines. The Bank had extensive experience in the development of CDM methodologies, project design, and implementation of CDM interventions. It has been, and continues to be, an institution recognized as a significant player in the global carbon market.

1.2 Original Global Environment Objectives (GEO) and Key Indicators

9. As stated in the GEF Grant Agreement, "*The objective of the Project is to reduce greenhouse gas emissions by replacing inefficient chillers, including both old CFC-based chillers and non-CFC-based chillers within the territory of the Recipient*."

10. ***Key Indicators***: As expressed in the results framework in the Project Appraisal Document, the original outcome indicators, whose target values were calculated forward across a ten-year period, included (a) 195 inefficient chiller replacements (average of 330 TR each) undertaken by 2012; (b) ODP consumption phase-out due to replacement of chillers; (c) cumulative carbon emission reduction as direct benefits from the project; and, (d) MWh savings & MW demand reduction.

11. The project's intermediate outcome indicators, included: (a) number of new energy efficient chillers installed; (b) data MIS for CER claims; (c) number of project recipients participating in the recognition program; and (d) number of trainings and workshops.

1.3 Revised GEO and Key Indicators, and reasons/justification

12. The PDO was not revised, however several PDO and intermediate indicators were revised during a level 2 restructuring in June 2013.

13. ***Key Indicators***: The first outcome indicator of replacing 195 inefficient chillers by 2012 was revised in June 2013 during a project restructuring. Both the original target and target date were incorrect, because 195 actually corresponded to 2014 (Year 4 of implementation) and the stated end target was 395, which corresponded to 2020 (Year 10). The 2020 targets were linked to the CER delivery schedule of the ERPA, even though the closing date of the investment project was January 1, 2017. An appropriate target for end-of-project would have been 255, which was the intermediate target for 2016. The indicator itself was redundant, since the targets for this *outcome* indicator for chillers "replaced" were identical to the *intermediate* indicator targets for chillers "installed," except that the outcome indicator definition included the average cooling capacity of the chillers. This suggests that the intent of the indicator was actually to measure cooling capacity, as in the new indicator, not chiller replacement. The 2016 cooling capacity target for 255 chillers of 330 TR each would have been 84,150 TR. The reduced target as a result of the restructuring was necessary to respond to the reduced available financing for chiller replacement scale-up when the ERPA was terminated, thereby excluding the project's planned carbon finance reflows option from the project scope. The 2013 restructuring introduced a simplified and appropriate technical parameter (a cooling capacity indicator) to

provide incentives for project beneficiaries that are willing to replace old chillers. The said indicator focuses not only on GHG emissions reductions but also more broadly on energy efficiency and cooling needs. In tandem, the revised outcome indicator introduced a simplified and less rigorous eligibility criteria versus that previously imposed by the CDM option, since the emissions reductions no longer had to meet the strictly defined methodological and documentation standards of the carbon market. This allowed the Project to maximize the number of chiller conversions using the financial incentives under the GEF grant, which paid participating chiller owners either 15 percent of the ex-works price or 15 percent of the normative cost of chiller replacement. In short, the outcome-level indicator for chiller replacements was replaced by an indicator tracking cooling capacity addressed, which the number of chillers installed continued to be monitored by the existing intermediate indicator. In both cases, the targets were reduced to reflect the termination of the ERPA.

14. The adaptive restructuring strategy introduced a solution for important structural realignment focused on EE without compromising the possibility of achieving the GHG reductions called for under the PDO. This allowed the Project to continue implementation of replacement of the firm pipeline of more than 50 inefficient chillers that had been confirmed prior to restructuring.

15. In tandem, a fifth Intermediate Outcome Indicator was added to monitor the number of sub-grant agreements (SGAs) signed with beneficiaries as a legally binding means by which to document chillers owners' commitment to the proper and sustainable operation and maintenance of the new chillers subsidized by the Project.

16. Lastly, all the original indicators target values were revised downward to reflect the termination of the ERPA, which removed carbon market financial incentives. This substantially reduced the project's expected scale, since incentives would only be based on direct payments for chiller conversion and provision of technical assistance and training (see Sect. 1.6 and Sect. 1.7, Table 1).

1.4 Main Beneficiaries

17. The primary group of beneficiaries targeted by the PCEEP are the owners of chillers in commercial and institutional establishments. This group received financial assistance worth 15% of the ex-works cost of new chillers to support investment choices geared to selecting energy efficient, environment-friendly technologies to replace their stock of aging, inefficient and ODS-reliant chillers. The Project complemented this with provision of technical training in the handling and management of alternative refrigerants, technologies and servicing equipment, as well as on the use of the chiller Management Information System (MIS) designed for the Project to ensure the ongoing monitoring and sustainability of the Project's investments. The capacity of these beneficiaries also accrued with respect to exposure to applicable government environmental, health and safety regulations.

18. Also counted amongst the Project's primary beneficiary group are energy service companies (ESCOs), whose business is related to upgrading existing equipment through a performance-based incentive with chiller owners and chiller suppliers. This allows the chiller owners to replace their chillers without incurring as much up-front cost. At restructuring, the Project introduced an alternative approach that built on efforts introduced by the International Finance Corporation (IFC) to engage ESCOs as key players in the Project's replication and scale-up strategy. By facilitating investments in the replacement of inefficient chillers (in addition to the subsidy offered by the project) and/or providing operating and maintenance services for chiller owners, ESCO involvement further bought down the risk for chiller owners associated with the

investment required by chiller replacement. ESCOs in turn, were guaranteed a favorable return on investment (4 years or less) through the generation of energy savings achieved as a result of the conversions to more energy efficient technologies. The PCEEP partnership with ESCOs allowed the Project to develop a viable marketing strategy, provided ESCOs with the opportunity for market expansion nationwide, and increased employment opportunities in the refrigeration and Air Conditioning sector. By demonstrating and promoting the potential for effective market penetration for chiller replacement, the ESCO market in the Philippines was able to double over the course of the Project's restructured phase, increasing from 2 to 4 companies.

19. Public sector interests also benefited. The Project counts among climate change mitigation programs that contribute to reducing the Philippines' GHG emissions from the power sector by reducing power demand and consumption. This reduction in demand effectively enabled the government to defer investment in new power generation into the future. Furthermore, the Project deepened awareness on energy efficient technologies in the Department of the Environment and Natural Resources (DENR), and built the capacity of DENR policy and technical staff to engage in positive interministerial coordination and private-sector outreach to support the Government of the Philippines (GoP's) interest in promoting low-carbon growth. Project results were showcased during the Department of Energy's prestigious Don Emilio Abello Energy Efficiency Awards, celebrated annually during National Energy Consciousness Month to recognize private-sector efforts to promote and implement energy conservation programs, which raised the profile of national GoP environmental policy initiatives and leveraged enhanced sector interest in EE for building envelopes. It contributed to ongoing efforts to meet the Philippines' obligations under the MP to reduce reliance on CFCs and old CFC-using equipment, and expanded the dialogue on options to meet growing cooling needs, introducing DENR to the concept of district cooling systems (see Sect. 3.5 (c)).

1.5 Original Components

20. As originally approved and expressed in the Project Appraisal Document and Grant Agreement, the Project was designed to address three streams of work, as well as provide for project management support.

21. *Component 1- Investments in Chiller Replacement ($43.84 million, of which GEF $2.6 million,$2.35 million carbon finance markets, $36.62 million chiller owners and other private industry partners):* Provide financial incentives to chiller owners to lower their opportunity and up-front capital costs in an effort to accelerate the replacement of inefficient chillers, prior to their residual technical end-of-life, with energy efficient chillers to promote market, economic and technological barrier removal. Chiller owners could either accept an up-front grant subsidy of 15% of the cost of new, non-CFC-based energy efficient chillers[4] or, receipt of future CDM-based carbon finance revenues generated by the energy savings gained as a result of the chiller conversion.

22. Baseline chillers to be given priority were those eligible under the Kyoto Protocol's Clean Development Mechanism (CDM), with the aim of generating sufficient carbon finance revenue for a significant scaling up of the on-going replacement initiated with GEF funding. The methodology to be used in determining emission reduction levels was based on that developed

[4] If this option was selected, chiller owners had to agree to relinquish and future carbon finance revenues generated by their sub-project(s) under the CDM Program of Activities (PoA).

by the Bank for a similar project undertaken in India, which had already received approval from the CDM Executive Board. In line with this methodology, the primary chillers targeted for replacement were those with an average cooling capacity of 330 TR (tons refrigeration). In order to be eligible for replacement, they had to be in use, have a residual technical life of more than 5 years and be installed post-1995. CFCs recovered from retired chillers were to be inventoried, stored and properly managed, meaning they could only be used to service other refrigeration and air-conditioning equipment on-site, or be destroyed, as per detailed guidelines.

23. *Component 2 - Measurement, Monitoring and Verification (MMV) ($ 1.82 million, of which MLF grant of $ 581,487and CDM grant of $1.24 million):* Measure and monitor data related to the power-output function of the inefficient baseline equipment and the electrical consumption and cooling output of the new chillers, installed in accordance with the CDM-approved methodology, and develop an online management information system (MIS) to track chiller replacement data and generate reports to support the verification of carbon emissions reduction claims.

24. *Component 3 - Performance Standards and Technical Assistance ($ 204,000, of which MLF grant of $29,000; United States Environmental Protection Agency (USEPA) grant of $50,000 and $ 125,000 government counterparts):* Build the capacity of relevant Project stakeholders regarding energy efficiency measures and refrigerant management:

- provide training, organize workshops and facilitate acquisition and distribution of educational materials to build awareness of the requirements and potential benefits of the Project;
- explore opportunities to expand its coverage to other energy conservation options in large buildings and industries, and inform participants about measurement, monitoring, and verification of power consumption, energy savings and accounting for emission reductions;
- provide recognition awards to chiller owners able to sustain high performance of their chillers through proper operation and maintenance, with a view to encouraging chiller owners to closely monitor their chillers' performance and rate of return; and,
- develop and adopt performance standards to promote good practice in the operation of non-CFC energy efficient chillers.

25. *Component 4 - Project management ($ 1,816,534 million of which MLF grant of $389,153; CDM grant of $545,160; and $ 200,000 government counterparts)*: Coordinate and supervise Project implementation and establish a grievance handling mechanism to allow feedback from the chiller owners and potential stakeholders.

1.6 Revised Components

26. Component 1, *Investments in Chiller Replacement*, was modified, as part of a Level 2 Restructuring in June 2013, to de-link the CDM component and its projected funding from the Project, and shift focus onto promotion of EE funded solely by the GEF grant. The revision was necessary as delays experienced due to complexities associated with the CDM registration and validation processes, compounded by the Project Management Contractor's (PMC) ultimate inability to commit to targets stipulated in the Emissions Reduction Purchase Agreement (ERPA), led to a decision by Kreditanstalt für Wiederaufbau (KfW), the purchaser of the projected carbon emissions credits, to terminate the ERPA. In tandem, a downturn in the global carbon market resulted in dramatically lower prices for CERs.

27. These factors pointed to the need for a revision and simplification of the eligibility criteria and financial incentive for chiller replacements, though no material change resulted. The

elimination of CDM-specific technical conditions[5] outlined in the ERPA (see Annex 9) expanded eligibility to a greater number of older CFC-based chillers, which raised the profile of the Project's EE potential while still offering significant climate benefits, by encouraging prioritization, upstream, of less efficient chillers with large cooling capacity. In tandem, the scope of the Project's financial incentive was restricted to a maximum subsidy of 15% of the price of a new chiller, which simplified the Project's financial management (FM) design by eliminating the need to account for the reflows from the sale of carbon credits.

1.7 Other significant changes

28. In lieu of a midterm review, a Level-2 restructuring was initiated at the request of DENR. The Bank approved the Level 2 restructuring in June 2013 and an amendment to the grant agreement was countersigned on September 10, 2013. Throughout, reference to certified emissions reduction (CER) was replaced with the term emission reduction (ER), given the elimination of the CDM component.

29. During this restructuring, the indicator on GWh savings and MW demand reduction (Gigawatt-hour (GWh) were revised. The indicator on GWhr/yr was revised to measure the cumulative GWhr reduced. Only one target per indicator was retained and the MW demand was dropped. This was continuously tracked though by recording it in the comment section. The GWh reduction in energy savings is more related to the PDO through a direct correlation to greenhouse gas reduction. The reduction and revision in GWh target from 341GWhr/y to 124.7 GWh savings, followed after the cancellation of the CDM component of the project. The target of 341 GWh/year was actually the target to be achieved by 2020 (in line with the delivery schedule in the ERPA), The appropriate intermediate target for comparative purposes would be 37 GWh by the end of 2016 (Year 6). The target for MW demand reduction was 59 MW by 2020, while the proportional target (to the intermediate GWh targets) for 2016 would have been 10 MW. The new target set in the detailed results framework in the RP was 29.7 MW.

30. The terms of Project execution, as originally outlined under Schedule 2, were amended to clarify changes introduced with respect to implementation arrangements, to update the terms and conditions governing the Project's financial incentives, monitoring, reporting and evaluation and financial management.

31. The process:

    a) Delinked the Project from the CDM and carbon finance, revised eligibility criteria, and refocused implementation on promotion of EE gains;

    b) Revised the full complement of Results Indicators in light of the lower number of chillers to be replaced;

    c) Reallocated MLF Project funds under Components 2, 3, and 4—as a result of savings from monitoring & verification and project management activities that would have been required under the CDM component—to strengthen performance standards and technical assistance training;

[5] Required to allow beneficiaries to receive credits from their reduced carbon emissions.

d) Changed the Project Management Contractor (PMC) entity from a firm to qualified individual consultants given the change in Project nature and the removal of CDM revenue; and,

e) Introduced the requirement for internal audit review within the context of the Project's financial management (FM) arrangement.

32. ***Redefinition of Project Scope and Timeline.*** Stemming from revision of Component 1, and the withdrawal of the associated CDM-generated financing originally envisioned to scale-up investment in replacement of chillers, the Project's GEO and Intermediate Outcome Indicators were revised. The new GEO Indicator 1 targets the cooling capacity and an appropriate indicator under the Project to complement the revised terms of financing and measurement of complementary energy savings and ozone impact. The loss of expected carbon credits revenue generation forced a Project downgrade to match the terms of the GEF grant, which overall, served as a basis to define the restructured Project target values. In order to ensure commitment to the proper and sustainable operation and maintenance of new chillers subsidized by the Project, an indicator on the number of legally binding SGAs signed was also introduced as an Intermediate Outcome Indicator.

Table 1: Revised Outcome and Intermediate Results Indicators, at 2013 Restructuring
(*source: World Bank Restructuring paper, June 24, 2013*)

Indicators	Unit measurement	Original Target	Restructured Target
GEO Indicators			
195 inefficient chiller replacements (avg of 330 TR each) undertaken by 2012	number chillers	195 by 2012/ 375 by year 10	***Indicator dropped***
Cooling capacity addressed by the Project	TR	***New indicator***	30,649
ODP Consumption Phase-out due to replacement of Chillers	Ton	22	5.7
Cumulative carbon emission reduction as direct benefits from the Project	$ktCO_2$	560	62.4
MWh savings and MW demand reduction *	GWh/ MW	341 GWh/y over 20 years; 59 MW	124.7 GWh/y
Intermediate Outcome Indicators			
Component 1 – Number of Sub-grant Agreements (SGAs) signed	number SGAs	***New indicator***	20
Component 1 – Number of new energy efficient chillers installed	number chillers	375	53
Component 2 – Data MIS for CER claims (changed to VER @ restructuring)	Percentage	100	35
Component 3 – Number of chiller owners participating in the recognition program *	number chillers	50	38
Component 3 – Number of trainings/workshops	number events	15	12

***** *Discrepancies were noted between the target indicators and values presented in the body of the 2013 Restructuring Paper (RP) and its revised Results Framework (Annex I). For PDO Indicator 4 (*), MWh savings were indicated in the Paper, while the Annex specified GWh savings. For IO Indicator 3 (**), 'chiller owners' were substituted by 'recipients' in the Annex table, and the target value dropped significantly from 38 in the RP to 15 in the Annex. It is the latter that was used as the indicator moving forward.*

33. ***Reallocation of Funds.*** Funds were reallocated for Project Components 2, 3, 4 consistent to carry out activities to achieve the revised Component 1 targets on the number of new energy efficient chillers installed. In addition, the reallocation focused on shifting additional funds to

Component 3 to support performance standards and technical assistance needs associated with chiller replacements.

34. ***Closing Date Extension and Second Grant Agreement Amendment.*** The Grant Agreement for the GEF Trust Fund TF095991 was further amended in December 2014 to authorize a Closing Date Extension of two years, from January 1, 2015 to January 1, 2017. The discussions on extending the Grant Agreement was postponed during the Project restructuring in 2013 until sufficient and sustained progress in terms of chiller replacements and associated disbursements were demonstrated. By December 2014, the chiller replacement pipeline was assessed to be robust, which resulted in an upgrade of the Project's implementation rating and justified the extension of the Closing Date. This allowed DENR to advance the pipeline of pending chiller conversions, aligned the TF Grant Agreement's closing date with that of the MLF grant and supported achievement of the GEO outcome.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

35. The design of the GEO is considered sound, offering both a very focused objective and the potential for far broader results for the sector in terms of co-benefits. Diverse sources of financing were co-mingled to achieve positive climate impact focused on reduction of GHG emissions, while implicitly encouraging co-benefits in the form of energy savings and the elimination of high ozone-depleting, high-GWP refrigerants that remained in use for the servicing of old chillers. A testament to the strength of its design lies in the fact that its embedded co-benefits imbued it with a flexibility that allowed, when strategic restructuring was deemed necessary, to bring more targeted emphasis on EE to the fore without the need to change the GEO.

36. ***Assessment of Project Design.*** The Project was designed to encourage the adoption of commercially-available EE non-CFC chiller technology by offering a financial incentive calculated to be significant enough to overcome the various barriers identified, in particular, the high upfront cost of chiller replacement. Its operational approach was straightforward: address the financial, technological and information barriers to adoption of commercially-available energy efficient alternatives in a recognized energy consumption growth sector by building the EE-informed decision-making capacity of chiller owners, laying the foundations to catalyze sustainable market change across the sector as a whole.

37. The design responded to the 2004-2010 MTPDP's goal of achieving higher energy self-sufficiency, and supported the Philippine Energy Plan (2007-2014) prepared by the Department of Energy (DOE), which informed the MTPDP. It was closely aligned with the Philippines' existing ODS phase out program in support of the MP and addressed the GoP's Kyoto objective of encouraging energy savings to support reduction in emissions of GHGs. This established the Project within a supportive policy environment that benefited from sound institutional arrangements and execution capacity.

38. The Project was grounded within an environment familiar with performance-based environmental programming, based on the Philippines' mature and successful national CFC phase-out program, and it supported the GEF objective of catalyzing transformation of the marketplace and introducing the concept of life cycle-based decision making in the chiller sector. It used as reference the experiences and lessons learned from chiller conversion demonstration projects undertaken with the support of the Bank in various countries including Mexico, Thailand and Turkey, as well as the findings of a chiller sector study prepared for a

similar chiller replacement project that was under preparation in India at the time. The implementing agency assured that stakeholders are engaged upstream with the organization of a series of meetings with chiller owners and public sector stakeholders at the national level, as well as with global sector experts. The Bank team benefitted from these discussions to feed forward implementation lessons and recommendations to the Project's approach and design. These include: 1. An assessment to understand the upstream market, so that resources required are quantified 2. The inclusion of private sources as a diversification strategy to finance CDM to encourage scale-up 3. The creation of an enabling environment so that chiller maintenance practices and performance monitoring can contribute to maximize energy savings, and the 4. Consideration of other project-related factors and risks to implement the project aside from economic benefits and financial returns.

39. The Project offered GEF grant funds as incentive for investment in replacement of inefficient chillers, with associated MLF grants funds used to support effective measurement, monitoring and verification, maintenance of strong performance standards and technical assistance. Additional investment in chiller replacement would be driven by the potential for revenue generation through the sale of carbon credits under the CDM. Chiller owners were provided the opportunity to buy down the risk of early chiller replacement by either accepting (i) an initial upfront subsidy of 15% of the normative cost of new energy efficient chillers using GEF grant funds or (ii) deferred revenues in the form of annual payments for 80% of CER revenues generated from the actual energy savings achieved through the operation of the new chillers.[6] No grant funding was available to provide financial subsidy if the CDM option was selected. The level of incentive was determined by aggregating opportunity costs using the model developed in the India Chiller Sector Strategy. Use of the three financing mechanisms ensured that technical capacity building, information exchange and robust monitoring supported access to technical investment through subsidies, while the potential for reflows offered strategic sequencing of mature funding instruments.

40. ***Assessment of Risks.*** At concept, the Bank team identified the risk factors facing the operation which ranged from the inability to generate stakeholder interest, the possibility of sub-optimal performance of new chillers, project management concerns, as well as how the complexities of the CDM process and uncertainties associated with the carbon market may affect the Project's implementation.

41. A key risk factor involved the possibility that despite the incentives on offer, chiller owners would not be compelled to participate in the Project, which in turn would not allow the Project to meet its target regarding chiller replacements. A series of thorough consultations, or marketing workshops, were held with chiller owners and GoP representatives to inform them of the energy savings potential available with new chiller technology, as well as to demonstrate, using a tailored financial analysis tool, the financial benefits of chiller replacement.

42. To mitigate technical performance risks, the Project instituted technical assistance (TA) that emphasized the correlation between improved technology and quality maintenance practices. The Project's MMV component ensured that real-time performance monitoring of new chillers would be required, while its Performance Standards and TA component ensured that chiller

[6] Grant Agreement (GEF Grant Number TF 095991), Schedule 2: Terms and Conditions Governing Financial incentives under the Project, paras. 1 (b) (i) (ii); p. 8; June 28, 2010.

maintenance staff received sound technical training at the time of installation from either equipment suppliers or the ESCOs with whom they were working.

43. From a project management perspective, the principal risks identified at the design stage were that slow disbursements attributable to weak FM, procurement and project management capacity, as well as the large number stakeholders that would need to participate in the Project that may impede the FM and procurement processes. The PCEEP Project Management Unit included the Project's FM policies, procedures and responsibilities in the Operations Manual (OM) to mitigate the risk of errors and un-reconciled account balances and to avoid mixing of funds. Risk factors associated with procurement centered on transparency of process and the possibility of delays affecting project implementation and sustainability. To circumvent these issues, the Project required that calls for bids and selection of awards of contracts be advertised in the national print press, as well as on the dedicated website to be created under the Project.

44. Potential risks associated with the complex nature of the CDM process were to be mitigated by the engagement of a qualified and experienced private entity as Project Management Contractor (PMC), to be initiated as a condition of negotiation, whose role it would be to manage the full scope of the Project's day-to-day operations. The project's association with KfW as the carbon buyer also sought to address complexities involved in CDM transactions, as well as uncertainties associated with the carbon market. KfW provided both financing and assistance in the preparation of documentation required for submission to the CDM Executive Board, and its signature of the ERPA with the GoP. The ERPA, in turn, outlined its intent to purchase a minimum of 560,000 tons of certified emission reductions (CERs) from the Project, served as an initial guarantee of interest in leveraging the potential for energy savings.

2.2 Implementation

45. A key aspect of the methodology adopted by the PCEEP lay in incentivizing the replacement of inefficient chillers on a scale significant enough to demonstrate the viability of energy savings for building cooling, and to reduce market and techno-economic barriers for early adoption of more energy efficient chillers; and create interest and demand to invest within the sector. Grant funding made available would be key to promote interest and uptake of early chiller replacement. However, the achievement of the broader, longer-term targets was understood to not be possible without CDM revenues. As aforementioned, this methodology was on that developed for a related India project, though the approach was first launched in the Philippines.

46. The two financial incentive options established, grant funding versus CDM, were proposed to offer flexibility in financing, and to account the differences of private and public chiller operating environments. The 15% grant subsidy of the cost of a new chiller, was projected to appeal more strongly to private sector chiller owners to access private capital financing. This was based on a normative price of US $400/TR allowed for payment to be made immediately following installation and commissioning of a new chiller, and upon proof that existing baseline chillers had been rendered unusable as per terms stipulated by the Project. Public sector owners, in contrast, were expected to be more likely to select an annual subsidy of 80% of CDM revenues generated from actual energy savings achieved by the new chillers, with payment beginning one year following installation and commissioning of new chillers, and continuing through 2019.

47. The Bank team recognized these complexities associated with the management of the CDM component. Apart from establishing of a Project Management Unit (PMU) to oversee Project

implementation within the DENR's Environmental Management Bureau (EMB), a private entity Project Management Contractor (PMC) was engaged to manage the Project's day-to-day activities. These activities include, working with chiller suppliers/ESCOs to market the Project to target chiller owners, screening of potential chiller replacement candidates, negotiation of sub-grant agreements (SGAs) with chiller owners, review and endorsement of subsidy payments, provision of financial and procurement services and reports. In addition, the PMC supported the DENR as the Project's Designated National Authority and Coordinating Entity, the primary interlocutor with the CDM Executive Board.

48. A number of issues surfaced following effectiveness that, despite risks assessed during preparation, led to delays. Initiation of Project activities suffered several start-up problems associated with project management due to frequent changes of personnel within the PMC. Given the crucial role of the PMC in launching implementation through the accounting and inventorying of eligible chillers, these generated a legacy of performance problems that could not be overcome, despite the eventual appointment of a new PMC project manager and team, including qualified CDM and chiller specialists. The chronic performance problems experienced with the PMC affected the Project's ability to maintain its commitment to achieve the targets laid out in the ERPA.

49. Identification of candidate chillers for replacement lagged in tandem, due to the stringent technical and processing requirements associated with the CDM's validation and registration criteria. The process required the verified measurement of baseline power performance data for every chiller to be replaced, which involved upfront costs that might have been worth the expenditure had a fully functioning PMC with strong technical expertise be available to support the data capture requirements needed and provide the guarantee for future reflows. These factors raised the Project risks; which were further compounded by a significant downturn in the carbon market. This ultimately led to a mutual agreement with DENR and the KfW to terminate the ERPA.

50. With the option of generating carbon finance revenues from energy savings to leverage the on-going replacement of inefficient chillers with new non-CFC based energy efficient chillers off the table, the Project's viability rested on the provision of an up-front grant subsidy of 15% of the normative cost of a new energy efficient chiller. Basing itself on the Project's original design, the Bank team was able to apply flexibility through an adaptive management approach using the remaining available funding that allowed for course correction without compromising the Project's objective or its overall structure.

51. To maximize the benefits of chiller replacement to the extent possible using GEF grant funds, priority was given to less efficient chillers with large cooling capacity or specific energy consumption of more than 1 kW/TR; and equipment that had not been eligible under the terms of the CDM component. In addition, the Bank team recognized that a stringent verification of baseline power performance was unnecessary after the restructuring; and simplified the primary Project performance indicator with the use of chiller data to measure the cooling capacity (TR). TR, as means of measurement, determines chiller cost in the market and therefore serves as an excellent means by which to calculate an equitable subsidy level for each chiller replaced, as well as being a sound measurement of complementary energy savings and ozone impact. The revised eligibility criteria being less restrictive than the CDM criteria meant expansion of the population of eligible chillers made the Project more accessible to a larger proportion of the country's chiller owners.

52. The elimination of the CDM's requirements regarding baseline chiller cooling capacity and the difference in old and new chillers efficiency allowed the restructured Project to underscore the viability of chiller replacement investment based on a market recognized 4-year payback scenario. The Project's financial management services scaled-up its support to chiller owners to determine the returns on investment (ROI) of the project. The support paved the way to encourage and expand the market beyond the scope of the Project; encourage the involvement of chiller manufacturers/suppliers as a replication strategy; and to align with the IFC ESCO initiative to encourage participation of ESCOs during implementation.

53. The development of a web page was instrumental to market and advocate the Project. The web page allowed prospective chiller owners to interact with the PMU; and to submit all the necessary documentation for funding. The Project monitoring and information system, accessible through the PCEEP webpage, similarly facilitated the Project's on-going submission and monitoring processes (see Sect. 2.3).

54. As the restructuring removed the CDM revenues and reflows from the Project, financial management was limited to the grant components. The PMC, whose services were to be covered by MLF funds and CDM revenue, was disbanded and the Project Management Unit (PMU) was expanded to include qualified chiller and M&E specialists, under the leadership of the PMC's new Project Manager, who was brought on board to assume responsibility for the day-to-day management of implementation.

55. As explained in Section 1.7, and outlined in Table 1, the Project's GEO and Intermediate Outcome Indicators were revised consistent to the simplified eligibility criteria in place. GEO Indicator 1 was replaced by targeting the cooling capacity addressed by the Project, which would anyhow not impede the on-going capture of GHG emissions reduced because of old chillers replaced. As a result of the loss of the CDM management framework, the restructuring also added an intermediate outcome indicator covering the number of legally binding SGAs signed as a means to ensure commitment for the proper and sustainable operation and maintenance of new chillers subsidized by the Project.

2.3 Monitoring and Evaluation (M&E) Design, Implementation and Utilization

56. The Project's Outcome Indicators and Intermediate Outcome indicators expressed in the Results Framework are considered to have been well thought out as metrics by which to gauge success in the delivery of Project results. They are considered relevant and realistic in their ability to measure achievement towards the PDO. The Outcome indicators allowed for effective measure of Project design based on their quantifiable nature including, certification of quantified emissions reductions, calculation of decreasing demand in the use of CFCs in the servicing sector and the related compliance with national Montreal Protocol targets, and the reduced demand on power and installed capacity. The Intermediate Outcome Indictors in turn, provided an effective means by which to monitor effectiveness of the Project's financing scheme, the effectiveness of technical assistance provided and penetration of the replacement market in comparison with the overall chiller market. Together, these indicators are used to track progress and identify need to course correction.

57. *Design*. The design of the Project's M&E system was initially predicated on the CDM's Monitoring, Reporting and Verification (MRV) requirements. A Management Information System (MIS), the project's principal M&E tool, was required to measure, monitor and analyze data in accordance with the Measurement, Monitoring and Verification (MM&V) protocol

outlined in the ERPA agreed with KfW and to support the generation of all technical verification reports required for submission to the satisfy the terms of the ERPA. The system also called for a dedicated Measurement and Monitoring (MM) expert to be contracted to manage the technical inspections, including power measurements of baseline and new chiller units, in order to verify actual energy savings and certify MIS reports.

58. At the sub-project level, data loggers and transmitters installed with each new chiller would measure energy consumption of baseline and new chillers, monitor their performance parameters (i.e. flow rates, temperature and electricity input) and their on-line energy savings. The continuous data generated are collected in the MIS, where aggregate energy savings and emission reductions would be determined. The technical reports generated by the MIS summarized performance at the individual chiller level and the overall Project level, and provided the information required to verify and certify emission reduction under the CDM.

59. *Implementation*. The PCEEP's chiller data acquisition and monitoring and reporting system became operational in 2013, following the first chiller replacement completed at the Manila Peninsula Hotel. The MIS introduced a necessary monitoring and management tool to track and report on individual chiller and aggregate energy savings and emission reductions. It serves as the main repository of performance, energy consumption and savings data generated by data loggers installed with each chiller replaced by the Project.

60. The Project engaged both an MIS consultant to manage the software and hardware requirements of the MIS, along with a Monitoring and Verification Specialist to manage the system's operations. Various training sessions were held for technical representatives from beneficiary facilities and regional DENR staff in Manila and Mindanao. The training provided participants with a hands-on introduction to the MIS and its online monitoring functionality including proper data uploading and submission procedures by Project beneficiaries and data monitoring and analysis by DENR's regional offices. To facilitate access, the MIS is housed on the main PCEEP webpage, through a secure log-in point of entry. Chiller owners were able to apply and submit chiller replacement documents online, as well as monitor the status of their application. An interface in the system allowed the owner to automatically upload data through the website once a new chiller is included in the system. On the back end, the Project Management Unit (PMU) was able to verify this data.

61. At Project completion, DENR's Statistics and Information System Management Section (SISMS), under the Policy, Planning and Program Development Division (PPPDD), assumed the on-going management of the MIS. SISMS is now tasked with the overall responsibility of ensuring that all Project beneficiaries come online following installation and commissioning of their new chiller, and that they continue to report energy savings and emission reduction data as part of their good maintenance practices. DENR gave a formal notice to senior-management Project beneficiaries about the transfer of the system's management to SISMS.

62. *Utilization*. The MIS lies at the core of the Project's performance-based structure by providing a continuous 'live' tool to track the energy savings and emission reductions generated by the use of the new EE chillers. The system ensures an on-going and transparent M&E process through the automatic generation of monthly monitoring reports for chiller owners. The system is able to cater to both technical and policy objectives in a number of ways. It supports an efficient use and good maintenance of the chillers installed by the Project brought about by the on-going energy savings gains for chiller owners. The system also allows key data to be generated so that information on government's commitment to optimize climate mitigation opportunities and reduce business risks in support of climate smart development, such as by

informing the elaboration of a new effort to improve energy efficiency in public buildings is made available (see Sect. 2.5). M&E data from the project was used to inform the decisions for the Level two restructurings of the project for example addition of a new GEO Indicator that targets the cooling capacity and an appropriate indicator under the Project to complement the revised terms of financing and measurement of complementary energy savings and ozone impact.

2.4 Safeguard and Fiduciary Compliance

Safeguards

63. The PCCEP was categorized as a Category 'B' due to potential environmental risks associated with the installation of new chillers including major building renovations or retrofitting, disposal of old CFC-based chillers, health and safety issues emanating from the handling of non-ODS chemicals used in new chillers and worker and building occupant safety risks. The Government in accordance with the Bank's Environmental Assessment (OP/BP 4.01) Safeguard Policy prepared an Environmental Management Framework (EMF), including a template for Environmental Management Plans (EMP) for the chiller owners' compliance monitoring. The Project's Operations Manual outlined the requirement that new chillers comply with the American Society of Heating, Refrigeration and Air-conditioning Engineers (ASHRAE) 15-2007 standard (Safety Standard for Refrigeration Systems) and with the American National Standards Institute (ANSI)/ASHRAE standard 34-2007 (Designation and Safety Classification of Refrigerants). The latter specifies safe design, construction, installation and operation of refrigeration systems including safety requirements for life, limb, health and property. Participation in the Project obliged participants to meet environmental and safety requirements related to the decommissioning of baseline chillers, refrigerant management, including the collection of refrigerant material from all old chillers, and the proper installation of new chillers. The Bank team was able to monitor safeguard concerns related to good refrigerant and site maintenance practices and the impacts of demolition and construction works. In addition, the team also have documented and captured these concerns in the Aide Memoires as part of the Bank's regular Project supervision activities.

64. The Bank's Environmental Specialist conducted several site visits over the course of the Project's implementation and confirmed the project activities complied with the EMF and sub-project EMPs. As anticipated during project preparation, most of the safeguards-relevant impacts were due to civil works required for new chiller installation. These were site specific and deemed to be of a temporary and manageable nature. Conversion activities entailed demolition of non-loadbearing walls, given the large size of the equipment being introduced, and the generation of related dust and noise. Chiller owners were reminded during all supervision visits to observe proper housekeeping in chiller areas. In the case where two chillers being replaced involved replacement of hydrocarbon (HC) refrigerant, occupational safety procedures were followed and qualified contractors were engaged to remove, handle and transport the HC.

65. A due diligence audit of refrigerants recovered was conducted by the PMU to support the Government's compliance requirements under the MP. The fate of recovered refrigerants was tracked through chiller owner/contractor reports, as well as by site visit to the facilities storing the refrigerants.

66. A Grievance Monitoring System to address complaints or grievances was established under the authority of the DENR Undersecretary, and the process by which to enact the system was published on the Project's website and in its promotional brochure.

Fiduciary

67. The Bank's procurement and financial management (FM) specialists regularly carried out expenditure and post procurement reviews. Issues raised were clarified and monitored to ensure their resolution. The Project is considered to have complied with the Bank's policies and guidelines.

68. *Financial management (FM):* At the sub-project level under the Project's restructured design, payment of the subsidy was contingent on the certification of successful operation of the new chiller, along with the dismantling and destruction of the compressor unit of the chiller replaced. Engagement of a FM Specialist within the PMU was critical in determining chiller owners' eligibility and the level of the subsidy to be offered.

69. The Project's financial management system was, for most of the implementation period's duration, rated as moderately satisfactory (MS). This was due to moderate shortcomings, notably delayed submission to the Bank of interim financial reports and audited financial statements as required under the Grant Agreement, and delays in engagement of a dedicated Project FM Specialist. The FM rating was upgraded to satisfactory (S) in the last year of implementation.

70. FM Project implementation support missions found that the project was generally able to maintain adequate FM systems. The project encountered FM issues at the beginning of project implementation. The Project addressed these issues and subsequently improved its FM systems after the Project commissioned a dedicated FM specialist following its restructuring.

71. It is important to note that due to the Project's restructuring and the delayed approval of chiller replacement sub-grants, the Project's implementation period was shortened, even with the extension of the closing date. As a result, the risk surfaced that sub-projects would not be completed on time and that subsidy disbursements would be clustered for settlement around the closing date. The FM Specialist together with the PMU and DENR regularly discussed in order to keep the financing of new chillers moving. Overall, while some issues were noted, these were diligently addressed by the implementing agencies with Bank support and there was no indication of substantial weaknesses in the overall control framework of the Project.

72. The Bank team's FM specialist undertook regular assessment of the Project's FM arrangements including organizational structure and staffing, planning and budgeting, disbursements, accounting and reporting, as well as auditing, to strengthen its internal controls and FM procedures, along with those of DENR.

73. At completion, grant funds were not fully utilized given that the Project was not designed against a typical disbursement protocol of good works and services. This means that the disbursement structure was designed in a conservative manner wherein the full subsidy amount was paid to beneficiaries only upon completion of works (chiller installation), as opposed to a typical disbursement protocol for goods, works and services where funds are disbursed based on a series of milestone achievements. This was due to the small amount of the subsidies offered, and as a means by which to ensure that beneficiaries remained incentivized and that overall transaction costs were kept to a minimum. Overall, the delays incurred coupled with

the drop in the price of chillers ($/TR) and the strict disbursement structure resulted in a surplus at completion. The Project, even once restructured, implied a steep technical learning curve for the PMU, associated ESCOs and chiller owners, which effectively meant that a process of learning by doing was initiated under the guidance of the Bank's strong technical team. As a result, the Project adopted a conservative FM process at restructuring in order to protect the limited grant resources. With the small subsidy value offered, disbursement was only effectuated upon full completion of works to ensure that beneficiaries remained incentivized, as well as to keep transaction costs to a minimum.

74. *Procurement:* The Project's process for procurement of goods and services was straightforward and divided into two parts: consulting services and goods under the OTF grant and goods (chiller replacements) under the GEF grant. Procurement under the GEF grant allowed for the use of commercial practices by private sector beneficiaries, predicated on the application of the Bank's Guidelines for public sector beneficiaries. Ultimately, the majority of the subsidy recipients were private sector entities, with only one Government agency participating.

75. Procurement under the GEF grant suffered delays due principally to the time it took for the Project to reach out to prospective beneficiaries and to get the SGAs signed and implemented. Procurement under the OTF grant also encountered delays, but these were due to the internal processing issues within DENR, which were reconciled with the assistance of the Bank's Procurement Specialist. One instance arose when a goods' contract had to be cancelled as the funds allocated for the procurement were no longer available and no allocation had been provided for these items in the following year. For the chiller replacement component, post review of representative contracts entered into by the private sector beneficiaries showed that procurement was conducted in accordance with acceptable commercial practices and that the required documentations on file were complete. Overall, post review of contracts signed for both the OTF and GEF grants showed that procurement was done in accordance with the Project's agreed procedures.

2.4 Post-completion Operation/Next Phase

76. No additional phases were conceived to continue to incentivize chiller replacement through the use of subsidies following the Project's implementation and completion. The Bank team verified that all CFC-using chillers were replaced and have been dismantled and rendered unusable prior to installation of the new EE chillers. Recovered ODS has been properly handled and stored, in accordance with the government's regulatory requirements and the Philippines' obligations under the MP. ESCOs engaged during Project implementation continued to provide maintenance and monitoring services for a number of facilities. The ESCOs particularly Cofely Philippines provide guaranteed savings in the operation of the chillers enrolled in the PCEEP. The guarantee is part of the agreement between the Chiller Owner and the ESCO. The guarantee is effective until the end of the contract. The ESCO shoulders all expenses including maintenance and improvement of the system to ensure the efficient running of the chillers.

77. Results achieved under the PCEEP have however, served to inform a number of other complementary activities. For one, Project results are informing the preparation of an OTF grant currently under development with the support of the Bank, whose objective will be to ensure a sustainable transition in addressing the phase-down of HCFCs within the context of the Philippines' stage II HCFC Phase-out Management Plan (HPMP). Lessons gained through the PCEEP underscore the value that work in the cooling sector offers in terms of generating multiple environmental and economic benefits when ozone, climate and EE considerations are

weighed together, considerations that form an important aspect of on-going ODS phase-down activities in support of the Philippines' MP commitments.

78. The PCEEP experience and the results it has generated have also piqued the interest of the Bank's Energy and Extractives (E&E) Global Practice. A new Advisory Services and Analytics (ASA) initiative will internalize PCEEP results and outcomes in its design. The 'Improving Energy Efficiency in Public Buildings' (P163822) ASA seeks to promote EE and its integration with renewable energy (RE) and other sustainability aspects in buildings including issues related to construction, retrofitting and energy use. The ASA responds to the Philippine National Energy Efficiency and Conservation Program and the related Energy Efficiency Action Plan for 2016-2020, which set targets for EE improvements in buildings. The ASA will focus on provision of analytic background to guide development of a Bank-supported investment operation on EE in the public sector, with the PCEEP experience providing valuable input regarding estimation of EE potential, as well as providing insight on what the financing needs and economics related to such investments may be.

79. Another complementary initiative that has benefited from association with the PCEEP centers on district cooling (DC). DC systems have emerged as a good cooling option in urban centers to move towards climate-resilient, energy-efficient and low-carbon pathways. Centralized cooling systems in cities – wherein water is chilled at a centralized cooling plant then delivered underground via insulated pipelines to cool the indoor air of commercial, office, and residential buildings within a district - is seen to be a cost-effective, convenient and reliable solution for reducing energy usage and GHG emissions, and encouraging the use of low GWP refrigerants. An externally-funded operation (EFO) financed by the Government of Canada has analysed alternative building cooling options at the DENR compound and the Mactan-Cebu International Airport Authority's (MCIAA) new terminal. This TA is evaluating various cooling options, including DC, with a focus on the technical, economic and environmental aspects of each option with a view to improving the ozone, climate and financial benefits of the technology shift towards higher energy efficiency systems.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

80. Relevance of Objectives. Relevance of Project objectives at both appraisal and completion is High. The PCEEP's outcomes, and the complementarity of its results to other sector-related Bank initiatives underway in the Philippines' (Sect. 2.5), are strongly relevant to the Philippines' Country Partnership Strategy (CPS) 2015-18 across its *Rapid, Inclusive and Sustained Economic Growth* and *Resilience to Climate Change, Environment and Disaster Risk Management* areas of engagement. The PCEEP was consistent with the goals of the Philippines Country Assistance Strategy (CAS) 2010-2012 at approval developed in partnership between the Bank and the government that sought to support the country's goal of achieving growth that is more inclusive to reduce vulnerabilities. Lessons learned contribute to the Bank's role as a partner in the GoP's efforts to manage emissions from the power sector with a focus on EE and renewable energy, as well as the IFC's support for development of green building regulations and the setting of higher, mandatory standards for new building construction and operation.

81. Furthermore, the targets achieved across the PDO/GEO Outcome Indicators as a result of the replacement of 71 old and inefficient ODS-based chillers (Annex 9) sustain the Philippines' higher level environmental policy aspirations which include:

- On-going compliance obligations under the MP;
- support for NDC declared by the Philippines under the 2015 Paris Agreement, namely to create a policy environment that enables private sector participation to optimize climate mitigation opportunities and reduce business risks towards climate smart development; and,
- underpinning goals expressed in its 2011 National Climate Change Action Plan (NCCAP) that target implementation of actions over the short, medium and long term with respect to environmental stability, climate smart industries and services, sustainable energy, and knowledge and capacity development.

82. Relevance of Design. The relevance of design is also High, given the very high electricity cost in the country (second highest in Asia). Energy efficiency in the chiller sector is the single largest potential contributor to reduced energy consumption, hence GHG reduction. In the design of the project, the main inputs are the subsidies to be provided together with the technical assistance in the form of financial analysis to demonstrate the feasibility of efficient chillers. These inputs led to the singing of sub-grant agreements and eventually procurement of replacement chillers by the beneficiaries. Once installed and commissioned, the new energy efficient chillers started providing significant savings in energy costs and reduction in electricity consumption. The project design of reducing GHG emissions by replacing inefficient chillers has offered a technically streamlined and economically viable approach to achieving abatement of CO_2 emissions, phase-down of the service tail for CFCs, while promoting more energy conscious decision-making by chiller owners and catalyzing potential for expansion across the energy intensive chiller sector. Reduction of targets at restructuring was done pro rata with the reduced amount of funding available, while maintaining the relevance of the design, viability of inputs, activities and outputs vis a vis achievement of the GEO.

3.2 Achievement of Global Environmental Objectives

83. The efficacy demonstrated in achieving the Project GEO has been Substantial (see Sect. F and Annex 2). The full scope of the results achieved have contributed positively to addressing pressing global environmental and socio-economic issues.
    - The objective of the project to reduce greenhouse gas emissions by replacing inefficient chillers including both old CFC-based chillers and non-CFC-based chillers was achieved. These results were achieved through the following indicators: 71 new energy efficient chillers were installed with subsidy grants from the project. This exceeded the target by 71%
    - From the 71 chiller replacements, 45,687 TR of cooling capacity have been transformed to energy efficient cooling resulting in lower energy consumption. This exceeded the target by 49%
    - This resulted in 151.4 GWh savings in electricity with the same cooling capacity. Had these chillers not been replaced, this is the additional amount of energy which would be needed to produce 45,687 TR of cooling capacity. This is a 95% achievement of the target.
    - The replacement of chillers also resulted in the phase out of 6.9 ODP tons of refrigerant exceeding the target by 49%. These refrigerant compounds (CFCs and HCFCs) have a negative impact on the ozone layer and also have high Global Warming Potential. The phase out of these compounds directly contributes to reduction of GHG emissions.

- The contribution of all the indicators above results in 151.4 kT CO2 reduction. This exceeded the target by 136%

84. The Project has met its PDO/GEO by supporting the GoP in achieving significant GHG emission reductions and the phase-out of reliance on ozone depleting refrigerants through replacement of inefficient chillers. The impressive energy and financial gains demonstrated support a number of national climate and environmental policy actions and regulatory processes, along with the comprehensive performance monitoring system instituted by the Project lead to the determination that the risk to the Project's development outcome is low.

85. Application of timely strategic adaptive management allowed the Project to proceed despite the loss of its carbon finance component and cost-effective use was made of both the GEF and MLF grant funds.

86. The management of the PCEEP benefitted from DENR's effective programmatic cooperation and division of responsibilities within the departments concerned, and with private sector beneficiaries and other key agencies, notably, DoE. Its ex-post sustainability was further strengthened by building synergies from results and lessons generated during implementation of earlier, as well as concurrent Bank-supported ODS, climate and energy-focused operations, and its results are informing new operations under preparation, as well as the global dialogue on unrealized EE potential in buildings. The PCEEP results represent a triple win for the Philippines in terms of climate, energy and ozone co-benefits. The financial incentives and technical assistance provided by the Project have allowed the GoP to achieve direct GHG emissions reductions and demonstrate the potential for EE savings gains in building cooling in a cost-effective manner. It contributed positively to sustainability in the cooling sector by helping grow the Philippines' ESCO market, and generated interest amongst some chiller owners in undertaking further chiller replacements to maximize space cooling energy consumption, such the Robinsons Malls that used the opportunity to convert their cooling systems in favour of enhanced EE. Furthermore, anecdotal evidence collected during ICR missions indicates that the Project also incentivized various beneficiaries to explore additional investment in building envelope EE enhancements, such as lighting, to complement the savings from thermal comfort improvements introduced by chiller replacement. In tandem, it has allowed the Philippines to eliminate ongoing reliance on the use of high ozone depleting and high GWP CFCs as refrigerants for servicing of old equipment in this sector, thereby supporting the country's compliance under the MP.

87. The original concept of sequencing financing by using grant funds to demonstrate and buy down risk while leveraging an additional revenue stream with carbon finance, proposed strategic use of concessional funds and offered flexibility in terms of incentives. The adaptive management response and restructuring strategy instituted by the Task Team in the light of the downturn in the carbon market simplified the eligibility criteria for chiller replacement while retaining the essence of the Project's design and maximizing beneficiary access to the reduced level of financial incentives the Project was able to offer. As a result, the Project has been able to demonstrate successful achievement of the PDO/GEO.

88. The Project MIS, a critical tool that enhances the monitoring and management capacity of the government, ensures that chiller owners are benefiting from optimum maintenance standards, and underpins the ongoing sustainability of enhanced EE in the chiller market, is operationally functional and connected to the data loggers of each of the new EE chillers installed. Chiller performance notifications are generated automatically on a monthly basis and inform both individual chiller owners and the ongoing energy policy dialogue within the GoP. The transfer

of its management has assured sustainability of the MIS to DENR's SISMS has assured the sustainability of the MIS even after Project closing.

89. Focused provision of direct technical assistance and organization of training workshops targeting the sustainability of the performance standards of newly installed chillers over the long term has supported capacity building amongst chiller owners, chiller service technicians and ESCOs, as well as within DENR.

90. Furthermore, awareness building in support of Project results and outcomes, as well as on-going sector transformation, has been initiated through partnership building in public-private sector recognition programs, such as the DENR's Philippine Environment Partnership Program (PEPP), to showcase best practices.

3.3 Efficiency

91. Project efficiency is rated Substantial, at witnessed by the fact that target values, though reduced at restructuring, were systematically exceeded across the board. The Project was carried out at an estimated total cost (from grant and government financing) of $2.93 million, instead of the planned $3.6 million (after restructuring). The Project has utilized this amount to subsidize installation of the 71 chillers, which in turn, to date, has generated GHG emission reductions of 111.9 ktCO2eq during the project time period (2011-2016). The cost-effectiveness of this project is $26 per tCO2eq (during the project period), which is in line with the base case for the social value of carbon[7] for this time period. In addition, reduced power demand of 18.95 MW would enable deferred investment in establishing new power generation capacity. This deferred investment, assuming the all-in cost of construction of a natural gas combined cycle power plant in the Philippines, which on average is $863 per kilowatt[8] (in constant US$ 2011), is in the order of $16.3 million (in constant US$ 2011).

92. A cost-benefit analysis (CBA) was conducted to assess the net present value (NPV) and economic rate of return (ERR) of the project. The CBA adopts a comparison of "with" and "without" project scenarios over a thirty-year timeframe (2011-2040). The benefits derived from the early replacement of chillers in the project include: (1) the avoidance of power generation capacity requirements (leading to investment savings) that result from reduced electricity use, and (2) greenhouse gas emission reductions that result from energy savings, ODS recovery, and reduced leakage of ODS from the new chiller. GHG emission reductions through 2040 as a result of the project is therefore expected to be about 604 ktCO2eq. The analysis assumes that energy saved will avoid electricity generated by the cheapest long run marginal cost (LRMC) of power generation technologies in the Philippines[9] and that chillers in the "without project" scenario would have been replaced thirty years after their install date (assumptions for the CBA are contained in Annex 3). The CBA shows an NPV of $19.8 million (in constant 2011 US$) and an ERR of 136% for the thirty-year timeframe. The high ERR is attributable to (1) the low efficiency of the original chillers; (2) the significantly advanced timeframe for replacement of chillers in the "with project" scenario; and (3) the extent of

[7] World Bank (2014). Social Value of Carbon in project appraisal: Guidance note to World Bank Group staff

[8] Based on the All-in cost per kW, which includes engineering procurement construction, owners cost, working capital, and financing cost; Source: Ocampo, 2016; http://energytechnologyexpert.com/cost-of-power-generation/the-ultimate-solution-to-high-electricity-costs-in-the-philippines/)

[9] The LRMC of natural gas-fired combined cycle gas turbine (CCGT) is the lowest of all power generation technologies in the Philippines at 4.424 PHP/kWh (in current 2015 PHP); (Source: Ocampo, 2016; http://energytechnologyexpert.com/cost-of-power-generation/the-ultimate-solution-to-high-electricity-costs-in-the-philippines/)

greenhouse gas emission reductions from the chillers. The analysis demonstrates the potential for triples wins: the economic benefits from energy efficiency activities and GHG emission reductions (as well as the environmental benefits from ODS removal. A sensitivity analysis indicated that the results are robust across a set of assumptions on the social value of carbon and the projected efficiency gains in the regular replacement of the original chillers (in the "without project" scenario). Details of all calculations are contained in Annex 3.

93. The project has demonstrated good value for money (see Table 3, below), with all indicators having surpassed the revised targets defined at Restructuring, and implementation having been achieved in a cost-effective manner. The Project's efficiency is therefore considered Substantial.

Table 3: Costs savings engendered by the PCEEP

(In constant US$ 2011)	**Over Project Period (2011-2016)**	**Over Thirty Year Period (From 2011 to 2040)**
$/MWh saved	$65.11	$3.33
$/avoided t CO2e:	$24.94	$4.62
Deferred investment (assuming $863/kW)	$16,353,912.49	

3.4 Justification of Overall Outcome Rating

94. Based on the high relevance of the Project's objectives, the high relevance of design, its innovative nature and its adaptive implementation, which influenced the substantial efficacy and efficiency achieved, the overall outcome is rated strongly Satisfactory. The Project's shortcomings were, pre-restructuring, due to delays in navigation of, and validation under the CDM process, which were largely beyond the strict implementation control of the Project. The shortcomings following restructuring - and were identified as moderate risks at design and centered on delays in engagement of necessary FM personnel and submission of FM reports - were rectified with the support of Bank supervision and are, overall, considered minor.

Table 2: Weighting of GEO Rating, pre- and post-Restructuring

Outcome indicators	End Project targets	Actual	Rating before restructuring	Numerical Equivalent	End Project targets	Actual	Rating after restructuring	Numerical Equivalent	Remarks
Number of inefficient chiller replacements (average of 330TR each)	195	1 (as of 05/20/2013)	MU	3					This indicator was dropped in the June 24, 2013 Restructuring
Cooling capacity addressed by project (Number of TR)					30,649	45,687	HS	6	
ODP Consumption Phase-out due to replacement of chillers (ODP ton)	16	0.03 (as of 04/23/2013)	MU	3	5.70	6.9	HS	6	
Cumulative carbon emission reduction as direct benefits from the project (ktCO2)	66.87	0.26ktCO2 (as of 05/20/2013)	MU	3	62.4	151.4	HS	6	
GWh savings and MW demand reduction	240	0.55 GWh (as of 05/20/2013)	MU	3	29.7	35	HS	6	
			Average	**3** (3x4=12/4)			**Sub-total**	**6** (6x4=24/4)	
Disbursement rate before restructuring				21%	Disbursement ratio after restructuring			79%	
Equivalent numerical rating before and after restructuring				0.63 (3 x 0.21)				4.74 (6 x 0.79)	
Overall Numerical Rating Equivalent								5.37 (0.63+4.74)	
Overall Rating								S	

3.5 Overarching Themes, Other Outcomes and Impacts

(a) Poverty Impacts, Gender Aspects, and Social Development

95. The implementation and impacts of the PCEEP contributed to national objectives to improve EE in buildings in support of greater energy self-sufficiency and the uptake of environmentally-friendly technologies, products and equipment with a view to improving Filipinos' way of life. Project results have improved the quality and efficiency of building cooling in a sector challenged by growing demand, including through promotion of EE and strengthened environmental protection and management capacity. Actions initiated have encouraged the adoption of more modern refrigerants and less energy intensive processes, both of which support reversing unsustainable environmental trends and strengthen the sustainability of the Philippines' development. Project components and inputs focused on working with

beneficiaries to identify and address environmental considerations in their operations and primary supply chains. The overall results have been climate, energy and ozone positive.

(b) Institutional Change/Strengthening

96. The Project's institutional strengthening components were effective in building capacity through provision of targeted financial and technical assistance to strengthen the management and operational capabilities of DENR's participating offices and other relevant government agencies. DENR established an effective management framework with well institutionalized functions. This institutional role was successful in bringing together key public and private sector representatives with technical experts, and in ensuring that parties knowledgeable on practical policy and technical issues were involved from the outset in the design and implementation of the PCEEP's components. This was key in allowing the course correction at restructuring to be introduced without compromising the Project's pipeline of chiller replacements. This has also laid the foundations for on-going cooperation in support of EE for development and green growth.

97. The Bank team conducted critical instructional supervision and closely guided Project staff on technology developments, financing guidelines and funding eligibility, approval processes, and verification and reporting requirements, as well as on project and financial management, procurement and disbursement and safeguard requirements. Participation of PCEEP and DENR staff in Bank-organized regional policy and technical workshops provided opportunity for in-depth country-to-country knowledge exchange, as well as the opportunity to interact with international experts on key policy and technical issues. The Bank also facilitated the participation of DENR officials, including PCEEP management staff, in learning missions to Qatar and Colombia that focused on district cooling as a low carbon option to the challenges of centralized cooling for cities.

98. In sum, the Project's implementation contributed positively to the Philippines' interest in building capacity to sustain its higher level environmental and climate policy aspirations and engage the private sector to optimize opportunities for climate smart development.

(c) Other Unintended Outcomes and Impacts

99. The Project facilitated the introduction to DENR of the concept of district cooling systems (see Sect. 2.5) as a low carbon option to encourage EE in building cooling to address public sector challenges associated with the high upfront costs of chiller conversion and the resulting practice of using large-scale, high-value equipment to end of life, regardless of efficiency considerations.

3.6 Summary of Findings of Beneficiary Survey and/or Stakeholder Workshops

The recipient administered a survey on June 13, 2016 and following this, the PCEEP PMU conducted a stakeholders' workshop on July 10, 2016 to document some of the process outcomes indicated in the beneficiary survey. Details are provided in Annex 5.

4. Assessment of Risk to Development Outcome

100. The risk to development outcome at Project completion is rated low. Throughout the implementation, the PCEEP PMU carefully monitored and managed the risk associated to achieve the development outcome. Following the restructuring of the Project's design, the risk

rating gradually diminished based on progress made in maximizing the chiller replacement pipeline. Specific GoP policy actions on ozone, are addressed through the GoP's MP commitments. These are operationalized in DENR Administrative Order (DAO) 2013-25, the revised regulation on chemical control of ODS and its HPMP, as well as on EE and energy conservation in buildings. Both these agency department orders are supported by the 2016-2020 EE Action Plan and new engagement with the Bank that seeks to extend Project results to the public sector context, diminish risks to achievement of the development outcome.

101. The Project's successful development outcome also supports the Philippines' 2011 NCCAP targets on climate smart services, and its NDC commitment to create a policy environment that enables private sector participation to optimize climate mitigation opportunities and reduce business risks towards climate smart development.

102. DENR has in place a solid national management structure to address its MP compliance obligations. The on-going partnership between the Bank and DENR to manage the country's refrigeration and air-conditioning needs through the development of the second stage of the HPMP will draw on Project outcomes to guide the future policy and investment dialogue. And lastly, the elimination of CFCs achieved under the Project has demonstrated the viability of stemming the ongoing reliance on these high ODP and high GWP refrigerants to satisfy the servicing of chillers.

5. Assessment of Bank and Borrower Performance

5.1 Bank

(a) Bank Performance in Ensuring Quality at Entry

Rating: Satisfactory

103. The Project, as conceived, was designed to offer a flexible, incentive-based implementation modality to buy down risk and generate concrete energy savings through demonstration of the viability of chiller replacement in meeting national EE goals. The design proposed by the Bank team clearly responded to national interest in promoting removal of barriers to large-scale application, implementation and dissemination of EE technologies, and by promoting more energy efficient use, including through promotion of new market mechanisms such as ESCOs. The use of familiar financing mechanisms that allowed for strategic sequencing of funds and the potential to leverage reflows was innovative. Furthermore, the Project design benefited from the fact that the approach had generated interest and uptake in other countries associated with the Bank's MLF-funded global chiller demonstration project, which lowered risk and offered the opportunity for valuable global knowledge building and exchange.

104. The Project's M&E structure (including its Results Framework) has been adequate to address and monitor achievement of the GEO. Its indicators have been fully complementary and synergistic, while sufficiently broad to allow for strategic course correction, given the inherent uncertainties associated with the Project's link with the global carbon market.

(b) Quality of Supervision

Rating: Highly Satisfactory

105. For the duration of Project implementation, the Bank team provided the PCEEP PMU and DENR with timely, consistent and the best available policy and technical advice. This was provided through the regular bi-annual supervision missions undertaken, as well as through site-specific technical visits, as evidenced in the aide memoires prepared. This provided first-

hand understanding of on-ground implementation experiences and challenges that the client and beneficiaries encountered. The 'learning by doing' approach to supervision, supported by regular monitoring of performance and achievements, also allowed the Bank team to work effectively with the PMU to address implementation hurdles as they were encountered and encourage course corrections where required.

106. Project supervision was further strengthened by the fact that, for its duration, a core Bank team of technical specialists was maintained. This deepened the Bank-client relationship of trust in the field of building EE and cooling, which had been initiated during implementation of the Philippines' initial ODS National Phase-out Plan.

107. The Bank team also ensured that guidance on financial management, procurement and environmental and social safeguard issues were effectively addressed. Bank specialists on financial management and procurement provided support for the PCEEP PMU and DENR staff on the Bank's fiduciary and procurement requirements. The team monitored compliance with the Bank's fiduciary and safeguard policies, reviewed procurement and disbursement procedures and audit reports. Mission aide memoires and ISRs were completed and disclosed to provide timely project updates and status of the Project's components.

108. The Bank team maintained a consistently high level of implementation support, underpinned by a comprehensive mix of technical, fiduciary and management skills and good team continuity, which have contributed to establishing the basis for the overall sustainability of Project outcomes. Furthermore, supervision and reporting benefited from the valuable technical expertise that was consistently provided with a view to the long-term sustainability of Project efforts and outcomes.

(c) Justification of Rating for Overall Bank Performance
Rating: Satisfactory

109. Given the quality of Bank performance at entry and during supervision, the Bank's overall performance is rated Satisfactory. The innovative, consistent and efficient supervision offered by the Bank team built support and understanding across a complex sector, which underpinned the operation's achievement of its PDO/GEO. This has resulted in the Project's tangible demonstration of the contribution that chiller replacement can offer to higher level national EE policy objectives and raised the relevance of promoting synergy across different, yet complementary environmental and economic policy streams.

5.2 Borrower
(a) Government Performance
Rating: Satisfactory

110. Government performance is considered to have been, overall, fully Satisfactory. Commitment to the Project's objective remained strong throughout implementation, with DENR engaging fully to serve the adaptive management process required to restructure and ensure achievement of Project objectives. The Government is a strong advocate for action in support of its commitments under the MP and its NDC, both of which the Project's results support. Positive cooperation was evidenced through collaboration with DoE on recognition of best practices amongst project beneficiaries as a means to communicate results and build awareness in support of on-going sector transformation, but more strategic inter-ministerial collaboration was found to be weak. Although a Project Steering Committee (PSC), created under DENR Special Order 2010-446 (June 2010), was established to provide operational

guidance and oversight to the Project, the body was not convened during implementation. Chaired by senior DENR and Department of Energy (DOE) management, the PSC included representatives from agencies relevant to the interests of the Project and could have played a formative role in guiding the Project's sustainability agenda in accordance with broad GoP policy actions during implementation. This dialogue has been internalized in the PCEEP sustainability plan.

(b) Implementing Agency or Agencies Performance
Rating: Moderately Satisfactory

111. After the Project restructuring, the EMB Director, who was also the PCEEP Project Director, authorized the creation of a PMU under the Environment Management Bureau (EMB) of the DENR A number of qualified carbon, MMV, MIS and FM consultants were engaged to manage the day-to-day implementation of Project promotion and technical activities as a result of the Project's restructuring. DENR's Foreign Assisted and Special Project Service (FASPS) served as the Project oversight entity, while its Financial Management Service (FMS) managed the Project's overall FM requirements including processing of payments and reporting. This management structure, though somewhat heavy, was in keeping with the practice within DENR to balance grant-funded operations' technical and project management requirements. The PMU performed effectively, with the principal shortcoming being tied to DENR internal processes, which resulted in the delay in engagement of an FM specialist to conduct the financial analysis on realization of return on investment.

112. The Bank team trained and oriented the PMU on the World Bank operations and procedures. PMU personnel were responsive to Project issues raised during supervision. Overall, the PMU demonstrated commitment and ownership of the Project on behalf of the GoP. Experience gained by DENR staff is applicable to the preparation and eventual implementation of future ozone, climate and energy efficiency operations.

(c) Justification of Rating for Overall Borrower Performance
Rating: Moderately Satisfactory

113. The project was completed in a moderately satisfactory manner, driven by DENR's commitment and leadership to the mission of complying with its commitments to global environmental agreements and a green growth agenda, to the constructive collaboration that was initiated with chiller owners, and to the outreach undertaken to promote Project results and generate scale-up.

6. Lessons Learned

The Project has demonstrated that, under certain conditions, the use of small-scale financial subsidies can be a sound investment option to catalyze interest and support for broader national energy efficiency goals.

The Project's initial offer of two streams of potential funding – grant and market-based - to address the financial, technical and information barriers to the adoption of commercially-available energy efficient alternatives provided more than just diversification of financing. As designed, the Project's investment funding streams offered something of a built-in strategic fail safe, which allowed the Project quickly and efficiently to apply flexibility for course correction through an adaptive management approach using the remaining available funding without compromising the Project's objective or its overall structure.

Technically complex projects benefit not only from dedicated, expert technical support at all stages, but also from upstream identification of other areas of programming with sectoral complementarity where reinforcement of seemingly diverse goals may serve to address a higher level, common objective. The Project's association with the IFC's work in support of ESCOs as part of the replication strategy adopted at Restructuring expanded the base of national expertise to which beneficiaries had access beyond the Project's PMU. This offered beneficiaries access to a wider pool of experts, which accelerated their preparation of the technical applications required for participation in the Project, thereby supporting the conversion of 71 chillers over a 4-year period, while also engaging ESCOs in the development of a sustainable market niche with longer-term growth potential.

The lessons generated by the PCEEP offer valuable insight for future operations in the building cooling sector, particularly where EE goals may be aligned with the future phase-down of hydrofluorocarbons (HFCs) under the Montreal Protocol's Kigali Amendment. The PCEEP yields very useful lessons on how to design such operations including, how to structure access to financing and financial management arrangements, as well as how to hedge risks across multiple sources of funding, possible diverse technical requirements and objectives, as well as governance structures.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners
(a) Borrower/implementing agencies

ICR circulated and reviewed by Borrower. Comments provided were addressed, a revised ICR re-circulated for review and Borrower agreement acknowledged // No comments provided.

(b) Cofinanciers

Not applicable.

(c) Other partners and stakeholders

Not applicable.

Annex 1. Project Costs and Financing[10]

(a) Project Cost by Component (in USD Million equivalent)

Components	Appraisal Estimate (USD millions)*	Actual/Latest Estimate (USD millions)	Percentage of Appraisal**
1. Investments to Chillers Replacement	43.85	19.28	44.0%
2. Measurement, Monitoring and Verification	1.82	0.04	1.92%
3. Performance Standards and Technical Assistance	0.20	0.18	87.7%
4. Project Management	1.82	0.52	28.8%
5. Contingency	0.21	00.00	0
Total	47.90	20.02	41.8%

.* Appraisal estimate includes the terminated ERPA contract and the corresponding conversions and conversion costs by chiller owners who would have participated under the carbon finance option rather than the 15% subsidy option.

** Percentages are based on actual values before rounding.

(b) Financing

Source of Funds	Type of Co-financing	Appraisal Estimate (USD millions)	Actual/Latest Estimate (USD millions)	Percentage of Appraisal
Borrower		0.32	0.04	12.5%
Global Environment Facility (GEF)		2.60	1.93	74.2%
Germany: Kreditanstalt fur Wiederaufbau (KFW)		7.31	0.00	0
Montreal Protocol Investment Fund		1.00	0.78	78.4%
U.S. Environmental Protection Agency		0.05	0.00	0
Private Commercial Sources (unidentified)*		36.62	10.11	27.6%
Total		47.90	12.86	41.8%

* The private commercial financing is the financing provided or acquired by chiller owners to finance their share of the conversions costs (any amount not covered by the 15% incentive payment). These are mainly capital expenditure requirements to replace the chillers. The chiller owners used their own internal funds, borrowed the money from a third-party lender, or entered into a performance-based contract with an ESCO whereby the ESCO financed the conversion itself and other related operations and maintenance costs The project did not compile details of the actual financing or sources. The amount is based on the estimated or normative conversion costs.

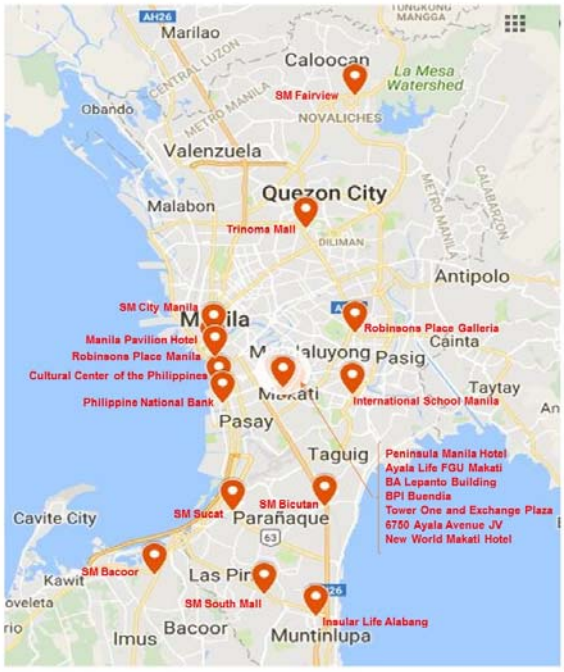
[10] For tables a & b, the Project costs and financing include the original figures during appraisal stage. These would include sources from the GEF, MLF, CDM and Industries before the Project restructuring.

Annex 2. Outputs by Component

Component 1 – Investments in Chiller Replacements

Inputs/Objectives: Provision of financial incentives to chiller owners to lower their opportunity and up-front capital costs in an effort to accelerate the replacement of inefficient chillers with energy efficient models.

Project Outputs: At project design, a national survey of chillers established a baseline for potential chiller replacement. Survey results and the proposed Project structure was vetted through consultations with chiller owners, suppliers, manufacturers, ESCOs and government institutions. Establishment of this baseline information was key as it generated a mapping of eligible chiller sites across the country (see maps below), identified the tons of refrigerant targeted and, using a recognized emission rate (~ 0.47 tCO2/Mwh), allowed for calculation of projected carbon emission reductions (CERs), required for the ERPA with KfW.



Source: PCEEP PCR

Upon restructuring, Project design was simplified, allowing for prioritization of replacement of old chillers with large capacity to maximize ODS and emission reduction impacts. At closure, the Project had replaced a total of 77 old chillers, representing cooling capacity of 45,687 TRs, with 71 new chillers offering total cooling capacity of 45,345 TRs.

Of the total GEF grant funding available for investment in new chillers (US $2.6M), US $2.067 M (80%) was disbursed. The savings made were not due to the inability of the Project to generate a robust pipeline of chiller replacements but rather due to the fact that the ex-works cost of new chillers decreased over the course of implementation from the US $400.00/TR value at

restructuring to US $299.00/TR. While this contributed to a savings against the GEF grant, it also allowed the Project to surpass its cooling capacity target of 30,649 TR by achieving replacement of 71 chillers as opposed to the 53 projected at restructuring.

While the Project demonstrated that chiller replacement is a sound EE investment for building owners, it also demonstrated that the chiller replacement cycle is time consuming, requiring between 6 months to 1 year to complete following submission of expression of interest. This was largely due to the need for subproject grant agreements (SGAs) - the legal basis for the disbursement of the subsidy – to undergo legal review by chiller owners and the process to be followed for international procurement of equipment. This has offered a tested 'realism' element to ongoing work in this sector.

Another important output concerns ESCO market development and expansion, which flourished within the circumscribed Project objective. Profile was put on the role of ESCO as market drivers. The Project helped build familiarity amongst participating building owners with private sector ESCOs and their willingness to bear the risk that projected energy savings are not achieved, which is one of the major barriers to EE investments. ESCO willingness to either invest upfront or ensure best practice maintenance in return for a contractual payment of a percentage of the energy savings realized helped building owner to buy-into, and grow, the ESCO market. Ultimately, this created the incentive for the ESCO market to expand from 2 to 4 companies.

Effective disposal of refrigerants was also assured by the Project. CFCs extracted from retired units were inventoried and properly stored, with any future use restricted to ongoing servicing other RAC equipment, as per specified national guidelines. Chiller owners agreed to bear the cost for the environmentally-sound management of the recaptured CFCs in return for receipt of a subsidy towards the cost of a new chiller. The requirements and monitoring arrangements associated with ODS recovery were detailed in the Project's Environment Management Framework (EMF) and included in the agreements signed with each chiller owner. This process was managed by DENR and supported by guidance developed under a complementary TA project funded by the MLF regarding the safe disposal of ODS stocks.

Component 2 – Measurement, Monitoring and Verification (MMV)

Inputs/Objectives: Develop an online management information system (MIS) to track chiller replacement and generate reports to verify and certify emission reductions.

Project Outputs: MMV was a key component of the Project's sustainability. Outputs generated included: (i) installation of data loggers for every new chiller covered by Project funding (see snapshot below); (ii) routine collection of monitoring reports from Project beneficiaries; (iii) organization of annual supervision visits to Project beneficiaries; (iv) establishment and maintenance of a dedicated MIS and (v) consistent reporting of project results. Forty-one (41) chillers of the 71 procured were connected to the PCEEP MIS at the end of 2016, with the remainder coming online following installation and initiation of performance maintenance.

The EMB-PMU conducted MIS training activities for all chiller monitoring personnel associated with the 71 chiller units procured under the PCEEP, as well as for regional EMB offices. Training was conducted in Metro Manila, covering EMB Regions NCR and IVA, and for beneficiaries in the Visayas-Mindanao area, covering EMB regional offices (EMB-VI, EMB-NIR, EMB-VII and EMB-XI). Training focused on thoroughly introducing the operation and functionality of the MIS to ensure the proper uploading and submission of chiller monitoring data, as well as to educate the EMB offices of the monitoring and reporting required by DENR. Participants were informed that MIS management was shifting, post-Project, from the PCEEP-PMU to the EMB-SISMS, and they were also introduced to the new focal point for the system.

Component 3 – Performance Standards and Technical Assistance

Inputs/Objectives: Build the capacity of relevant Project stakeholders regarding energy efficiency and refrigerant management.

Project Outputs: The PCEEP developed a number of tool kits that were used to assess the eligibility of baseline chiller units in the Project including: (a) a Power-Output Function (POF) Regression Analysis tool and, (b) Investment Analysis worksheets. The POF Regression Analysis was used by the PMU during pipeline development to assess the efficiency of the baseline chiller units, while the Investment Analysis was used to assess the financial viability of each chiller replacement proposed. Access to the toolkits was given to prospective beneficiaries through an online interface, which instigated upstream capacity building amongst chiller owners and helped them arrive at well-informed decisions, tailored to their specific circumstances with regard to replacing old and inefficient chillers.

Once an SGA was signed and equipment was procured, targeted technical assistance was provided by PMU consultants and technical staff, as well as by technical personnel within DENR, to ensure proper installation, inspection and commissioning of chiller units enrolled in the Project.

Substantive assistance was also extended to chiller partners to expedite the submission of the suspensive condition documents that were required under the SGA to release payment of subsidies.

PMU and DENR staff, as well as beneficiaries and manufacturers, participated in knowledge exchange in support of longer-term Project sustainability through participation in a variety of international thematically-related study tours and through participation in Bank-organized regional workshops. This helped to place the challenges faced by the Project, and the results achieved within a broader global EE dialogue.

Development of a Project logo and a dedicated Project website established a brand for the PCEEP, which was cemented through organization of an annual PCEEP Awards and Recognition initiative, and partnership with related, well-established national energy sector awards. Various promotional materials produced under the Project including brochures, tote bags, desk calendars and videos expanded brand recognition further. Materials were distributed to DENR offices as well as to representatives of the project beneficiaries during the MIS training sessions, as well as to other government offices (i.e. DoE) and institutions, including the Pollution Control Association of the Philippines. The results-based videos produced will be featured in the various shopping malls that benefited from Project funding in order to educate the general population of the importance of EE in the cooling of buildings.

In preparation for Project completion, the PCEEP developed a Sustainability Plan that aims to support the chiller replacements achieved while exploring the development of policies that can enable further replacements in the absence of grant incentives as part of a broader national EE strategy. Approaches outlined include use of market instruments and enforcement of regulatory directives to influence consumer behavior. Efficiency standards for energy efficient chillers are under consideration in partnership with the Department of Energy and the Bureau of Standards in the Department of Trade and Industry.

Annex 3. Economic and Financial Analysis

The economic analysis of the project includes an assessment of the costs and benefits of the project from a country perspective over a thirty-year timeframe (2011-2040). This project includes: 1) subsidies for chiller replacement (accounting for about 15% of new chiller cost) to accelerate replacement of inefficient chillers to non-ODS energy efficient ones; 2) measurement of data monitoring related to the power-output function of inefficient chillers to be replaced, electrical consumption of the new chiller, and cooling output; 3) knowledge enhancement and capacity building activities for project participants, and 4) project management activities.

Project activities led to the early replacement of 71 chillers with 66 new energy efficient chillers. The benefits include: (1) the avoidance of power generation capacity requirements (leading to investment savings) that result from reduced electricity use from early replacement of chillers, and (2) greenhouse gas emission reductions that result from energy savings, ODS recovery, and reduced leakage of ODS from the new chiller. Table 1 below shows the evolution of the energy savings, the expected cost savings from generation avoided, and GHG emission reductions during the project period (2011-2016).

Table A3-1: Net benefits during project period
(for assumptions used, see the "with project" scenario in Table 2)

	2011	2012	2013	2014	2015	2016
Energy savings (GWh/yr)	0.00	0.00	0.13	2.50	16.81	23.43
Net Cost savings from generation avoided from project (in 2011 constant US$)	0.00	0.00	12,534.39	241,003.77	1,621,035.29	2,259,169.16
Net GHG emission reductions from generation savings, reductions from ODS recovery, and avoided leakage	0.00	1.03	0.28	18.34	32.82	59.41
Net benefits from changes in GHG balance (as a result of the project) (in 2011 constant US$) using base case for social value of carbon[11]	0.00	26,424.41	7,576.15	505,565.36	935,933.53	1,750,641.29

The replacement of chillers was completed in 2016. The costs were estimated taking into consideration the total disbursement for the GEF, MLF, and government financing under the project, amounting to $2.79 million[12] (in constant US$ 2011), as reported in the Government completion report.

The CBA adopts a comparison of "with" and "without" project scenarios over a thirty-year timeframe (2011-2040). Table 2 contains the assumptions used:

Table A3-2: Assumptions of Economic Analysis

Assumption	"Without Project" Scenario	"With Project" Scenario
Marginal Generation Cost	4.423 PHP/kWh (in current 2015 PHP)	4.423 PHP/kWh (in current 2015 PHP)
Sources of GHG emission reductions	(1) Reduction from energy generation savings (assumes a factor of 0.5 ktCO2e/GWh based on	(1) Reduction from energy generation savings (assumes a factor of 0.5 ktCO2e/GWh based on

[11] World Bank (2014). Social Value of Carbon in project appraisal: Guidance note to World Bank Group staff
[12] This amount includes the projected disbursement during 2017 and therefore is subject to change

Assumption	"Without Project" Scenario	"With Project" Scenario
	current energy mix in the PH) (2) From recovered refrigerant in year of replacement (the w/o project case assumes same actual leakage as in "with project" scenario) and GWP values from IPCC AR5[13] (3) Avoided leakage of old chiller (assumes 20% per year) minus the leakage from the recharge and maintenance of new chiller (assumes 1% per year)	current energy mix in the PH) (2) From recovered refrigerant in year of replacement (the w/o project case assumes same actual leakage as in "with project" scenario) and GWP values from IPCC AR5[13] (3) Avoided leakage of old chiller (assumes 20% per year) minus the leakage from the recharge and maintenance of new chiller (assumes 1% per year)
Date of chiller replacement	Thirty years after installation date of old chiller[14]	Based off actual replacement date
O&M Costs	Assumed to be the same in both scenarios and therefore cancel out.	Assumed to be the same in both scenarios and therefore cancel out.
Replacement chiller details	Replacement chillers are projected to: • be 5 to 20% [15] more energy efficient than the old chiller, to account for potential differences in the type of chillers purchased in a BAU scenario (see sensitivity analysis); • have the same cooling capacity and same refrigerant as the new chiller in the "with project" scenario; • operate based on the number of hours of old chiller provided by PMU (same as "with project" scenario) • lead to energy savings starting with the first year of install	Energy savings from replacement chillers are derived directly from the CMIS readings connected chillers that are connected to the CMIS for the project period. For those that have not been connected to CMIS, annual energy savings from the new chiller = (the difference in the rated efficiencies of new and old chiller) * (80%, the expected average load)* (the cooling capacity of new chiller) * (projected operating hours per year, which are based off historical values of old chiller provided by PMU)
Social value of carbon	Assessed based on all three cases for social value of carbon, as per	Assessed based on all three cases for social value of carbon, as per

13 For R-11: 4660; R-12: 10200; R-22: 1760; R-123: 79; R-134a: 300

[14] While optimal lifetime of chillers is about twenty years, this analysis assumes that old chillers will not be replaced until after thirty years of install year (based off of experiences in other Article 5 countries)

15 20% is slightly greater than the average energy efficiency gains of chillers in the "with project" scenario, which amounts to about 16%

Assumption	"Without Project" Scenario	"With Project" Scenario
	guidance note from CCSA (see sensitivity analysis)	guidance note from CCSA (see sensitivity analysis)

Table A3-3 outlines the results of the analysis. ERR of the investments is 136% and NPV is US$19.8 million (in constant 2011 US$), assuming a 5% efficiency increase in the replacement chillers in the "without project" scenario and base case for social values of carbon.

Table A3-3: Economic analysis (*assuming a 5% efficiency increase in the replacement chillers in the "without project" scenario and base case for social values of carbon*)

Year	Cost (in 2011 constant US$) [ASHRAF comment: FYI: If the cost of the project is all in year 1, then the ERR goes down to about 48%] *"Without Project Scenario"*	Net Benefits from Cost Savings from Generation Saved (in 2011 constant US$)	Net Benefits from GHG Emission Reductions (in 2011 constant US$)
2011	-35,040.70	0.00	0.00
2012	-172,185.47	0.00	26,424.41
2013	-554,179.60	12,534.39	7,576.15
2014	-408,144.63	241,003.77	505,565.36
2015	-388,978.51	1,621,035.29	935,933.53
2016	-64,830.34	2,259,169.16	1,750,641.29
2017	-1,167,935.20*	3,980,182.92	1,197,301.24
2018		3,980,182.92	1,234,716.90
2019		3,620,155.19	659,764.72
2020		3,620,155.19	1,090,444.35
2021		3,597,138.44	1,101,894.38
2022		3,597,138.44	1,167,422.30
2023		3,565,924.34	1,090,669.41
2024		3,520,554.95	322,310.62
2025		3,409,033.05	827,566.75
2026		3,223,127.73	729,419.40
2027		3,105,314.12	812,854.06
2028		3,098,782.97	926,972.37
2029		3,052,394.17	734,589.90
2030		3,016,094.58	812,900.98
2031		2,903,346.86	676,550.43
2032		2,891,614.67	745,351.05
2033		2,891,614.67	839,583.81
2034		2,891,614.67	862,691.62
2035		2,891,614.67	885,799.44
2036		2,891,614.67	908,907.25
2037		2,756,736.03	681,266.07
2038		2,756,736.03	842,500.28

Year	Cost (in 2011 constant US$) [ASHRAF comment: FYI: If the cost of the project is all in year 1, then the ERR goes down to about 48%] *"Without Project Scenario"*	Net Benefits from Cost Savings from Generation Saved (in 2011 constant US$)	Net Benefits from GHG Emission Reductions (in 2011 constant US$)
2039		2,756,736.03	862,883.35
2040		2,756,736.03	883,266.43
ERR		**136%**	
NPV (with discount rate of 12%)		**$19,818,243.40**	

Sensitivity Analysis: A sensitivity analysis was carried out to examine the robustness of the economic viability of the project.

This analysis considered energy efficiency gains of replacement chillers in the "without project" scenario at 20%, a significantly more optimistic scenario than the value assumed (5%) for the reference case (which take into account potential expected efficiency gains resulting from new technologies not yet under development or on the market). The analysis also considered no, lower and higher social values of carbon over the thirty-year time period, in line with the reference cases in the World Bank Guidance Note. The results in Table 4 show that that the project remains economically justifiable even assuming higher energy efficiency gains of replacement chillers and no or low social value of carbon used.

Table A3-4: Results of Sensitivity Analysis (*at 12% discount rate, and in US$2011 constant*)

Assumptions	No Social Value of Carbon	Social Value of Carbon (Low)	Social Value of Carbon (Base/Reference)	Social Value of Carbon (High)
Increased Efficiency of Replacement Chiller in "Without Project" Scenario – 5% (Reference)	ERR: 95% NPV: $14,340,395.08	ERR: 116% NPV: $17,353,599.17	ERR: 136% NPV: $19,818,243.40	ERR: 163% NPV: $23,745,022.44
Increased Efficiency of Replacement Chiller in "Without Project" Scenario – 20%	ERR: 93% NPV: $8,404,114.23	ERR: 114% NPV: $10,601,974.29	ERR: 135% NPV: $12,511,678.71	ERR: 163% NPV: $15,360,789.62

The high ERRs are attributable to (1) the low efficiency of the original chillers; (2) the significantly advanced timeframe for replacement of chillers in the "with project" scenario; and (3) the extent of greenhouse gas emission reductions from the chillers. The analysis demonstrates the potential for triples wins: the economic benefits from energy efficiency activities and GHG emission reductions (as well as the environmental benefits from ODS removal. A sensitivity analysis indicated that the results are robust across a set of assumptions on the social value of carbon and the projected efficiency gains in the regular replacement of the original chillers (in the "without project" scenario).

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Preselyn Abella	Senior Finance Officer	WFALN	
Agnes Albert-Loth	Sr Financial Management Specialist	GGOGI	
Mary-Ellen Foley	Senior Environmental Specialist	GCCFM	
Minneh Mary Kane	Lead Counsel	LEGES	
Samuel Haileselassie Kebede	Senior Procurement Specialist	OPSPF	
Noel Sta. Ines	Senior Procurement Specialist	GGOGI	
Maria Consuelo Sy	Program Assistant	EACPF	
Maya Gabriela Q. Villaluz	Senior Environmental Engineer	GEN2B	
Viraj Vithoontien	Lead Environment Specialist	GEN2B	
Qing Wang	Senior Environmental Specialist	GEN2A	
Supervision/ICR			
Gerardo Francisco Pio Parco	Senior Environmental Engineer (Team Leader)	GEN2B	
Dominique Isabelle Kayser	Senior Operations Officer	OPSPF	
Rene SD Manuel	Senior Procurement Specialist	GGO08	
Samira El Khamlichi	Senior Energy Specialist	GCCFM	
Viraj Vithoonthien	Lead Environment Specialist	GEN2B	
Aisha Lanette N. de Guzman	Financial Management Specialist	GGO20	
Maria Liennefer Rey Penaroyo	Financial Management Specialist	GGO20	
Shiela dela Torre	ICR Consultant	GEN2B	
Bernardita Ledesma	Operations Analyst	GFA04	
Fnu Hanny	Program Assistant	GEN2B	

(b) Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Supervision/ICR		96,101
Total:		96,101

Annex 5. Beneficiary Survey Results

Summary of PCEEP Satisfaction Survey
(Source: National ICR)

The recipient administered the survey on June 13, 2016 in Iloilo City. Following the administration of a Satisfaction Survey, the PCEEP PMU conducted a stakeholders' workshop on July 10, 2016 to document some of the process outcomes indicated in the beneficiary survey.

Survey Conclusions

1. Sixteen (16) beneficiary respondents participated in the satisfaction survey. The respondents were a mix of technical and management staff involved in the implementation and supervision activities. The following institutions participated in the survey and the focus group discussions:

    - Ayala Property Management Corporation
    - BA Lepanto Condominium Corporation
    - Cofely Philippines
    - Cultural Center of the Philippines
    - Engie Services Philippines
    - ISM
    - Phil Energy
    - Radisson Blu Cebu
    - Robinsons Land Corporation
    - SM City Iloilo
    - SM Prime Holdings
    - Social Security System
    - The Peninsula Manila
    - Tower One and Exchange Plaza

2. Majority of the respondents found out about the project through Chiller suppliers/Energy saving companies. This means that the other means of communication such as the use of DENR Web Site and there was no social networking advertisement as expected by some of the respondents were not fully maximized.

3. All participants agreed that PCEEP would address climate change as well as depletion of the the ozone layer.

4. The majority of the participants claimed that the support from government environmental advocacy motivated them to join the PCEEP project, and some of the respondents said that the subsidy attracted them, as well as the notion that the old chillers will be replaced anyway. Some also mentioned that they were motivated because PCEEP is supportive of the corporate social responsibility goals of the chiller owners.

5. The majority of the participants strongly agreed that the project is appropriate for big buildings like hotels, mall, office buildings, hospitals, passenger terminals, manufacturing industries, and the like. A majority also said that the project helped in reducing greenhouse gas (GHG) emission and claimed that the project resulted in significant reductions of energy consumption and electricity cost, as well as the promotion of the use of energy efficient chillers. Some of the participants believed that the project facilitated the cholorofluorocarbon (CFC) phase-out obligation with lesser cost to the chiller owners. In addition, the project facilitated compliance with DENR's administrative order 2013-25 and the revised regulation on the chemical control

of ozone depleting substances, and some respondents agreed that the project accelated the replacement of inefficient ozone depleting substances (ODS) based chillers.

6. Most of the participants strongly agreed that the chiller eligibility criteria were not biased towards a specific brand of chiller, and some agreed that the criteria can easily be complied with. A majority also claimed that these criteria are appropriate and was provided and explained by the PMU, although some said that the eligibility criteria were too many.

7. Some of the respondents said that the confidentiality of information is one of the problems and challenges that they encountered in complying with the eligibility criteria. A few of them said that the problem is because there was inadequate support from the chiller owner management.

8. A majority of the respondents strongly agreed that the DENR witnessed the commissioning of the new chillers. Some of them believed that the World Bank procurement methods used by the project are acceptable to the chiller owners. In general, most of the participants agreed that the chiller suppliers offered complete chiller set-up, and can deliver, install, commision the chillers on schedule.

9. Some of the participants said that the number one problem that they encountered during the procurement of the new chillers is related to importation issues and port congestion, followed by other matters like checking of more efficient units and delayed commissioning. A few mentioned also the delay of budget approval by chiller owner management and the inconsistency in procurement docucuments (i.e., purchase order, delivery, receipts, sales invoice, etc.). While some mentioned cases of non-compliance with technical speficifations by the chiller suppliers, no one claimed that there were failures in the terms for bidding.

10. The majority of the participants claimed that the PMU's technical assistance provided timely and reliable response to project related issues, and facilitated submission of project documents as well as of monitoring reports.

11. Most of the respondents stated that they stongly agreed that the protocols for recovery of reinfrigerant and destruction of the old compressor are acceptable and can be easily complied with. Some of the participants agreed that the contractors for the refrigerant recovery and destruction of the old compressors submit reports on time, however the respondents disagreed that the recovery of the refrigerant and destruction of the old compressors would entail additonal cost.

12. Majority stated that the number one issue that the respondents encountered during the recovery of the refrigerant and destruction of the old compressors is related to the availability of the contractors for the refrigerant recovery and destruction of the old compressors, followed by having an additional cost to recover the refrigerant and destruction of the old compresors

13. Majority of the respondents generally agreed that the PCEEP CMIS is accesible, helpful, and the monitoring report format is acceptable, as well as the monitoring protocol is doable and reasonable.

14. Majority of the participants said that they encountered monitoring issues and challenges that usually happen after sales and/or because of no proper turnover. While there are some who said that there is a need for an additional personnel in charge of monitoring.

15. Majority of the respondents agreed that the SCDs to be submitted are cleary understood, doable, acceptable, and the templates prepared by the PMU is helpful.

16. Most of the responses related to the issues and challenges in complying in SCDs pertains to the confidentiality of information, while some of the concerns include other issues like no proper turnover.

17. Most of the respondents agreed that the timeframe for the processing of the subsidy is reasonable, while some of them strongly agreed that the 15% subsidy is attractive. Although it is evident that some would want the subsidy to be higher but other content that they are not personally benefiting from it anyway.

18. Majority of the respondents strongly agreed that their participation in the PCEEP helped improve the company image. Some said there is an added income in terms of electricity savings and subsidy provided funds to their company, as well as improving the ambiance temperature in the building and enhancing the tenants' satisfaction.

19. All of the respondents would recommend the chiller replacement because this will improve the ambiance of the building, will provide additional income in terms of electricity savings, will create a safe environment for all living things, this is eco-friendly, efficient, and could address climate change.

20. Overall the companies reported satisfaction on the implementation of the project. The positive response during the workshop was due to increase in savings because of the reduction on electricity expenses. In addition to the savings, companies represented in the satisfaction survey allowed to provide much evidence to advocate the benefits of the project to other interested stakeholders.

Highlights of the beneficiary survey respondents' focus group discussions

As with other projects designed to provide subsidy to create demand for a project, the 15% incentive provided by the World Bank had contributed to the interest to participate in the Project.

Generally, the respondents have affirmed the successes and gains of project implementation, particularly in the quality of assistance extended by the PCEEP PMU. This had resulted to the timely compliance of project requirements. Majority of the respondents likewise have confirmed the efforts of the DENR in actively advocating the benefits of the projects to the chillers suppliers.

One of the Project's direct outcomes was on electricity savings by companies and institutions that have upgraded and replaced old chillers. One respondent reported a 15%-45% reduction on power consumption.

While there had been issues regarding the timeliness on project evaluation and approval processes, these were resolved internally.

Annex 6. Summary of Borrower's ICR and/or Comments on Draft ICR

Philippines Chiller Energy Efficiency Project GLOBAL ENVIRONMENT FACILITY TF095991 OZONE TRUST FUND TF096093

EXECUTIVE SUMMARY

The **Philippines-Chiller Energy Efficiency Project** (PCEEP) was in line with the country's strategies to achieving the objectives of the Montreal Protocol, Kyoto Protocol and Paris Agreement and consistent with the goals of the Medium Term Philippine Development Plan (MTPDP CY2005-2010) which contributed to the achievement of a more inclusive growth by supporting the country among others, to reduce the vulnerabilities by expanding the country's social safety net, improving disaster risk management, and piloting and expanding climate change adaptation measures. It contributed to the phase-out of chlorofluorocarbons (CFCs) and abatement of carbon dioxide (CO_2) emission through the accelerated replacement of energy inefficient and ozone-depleting substances (ODS)-based chillers through the provision of financial and technical assistance to various chiller applications. In a way, the Project synergized the phasing-out of ODS, reduction of GHG emissions to the atmosphere and promotion of energy efficiency throughout the country.

The Project Development Objective (PDO) and Global Environment Objective (GEO) were to reduce GHG emissions by replacing inefficient old ODS-based chillers. The Project was to monitor quantifiable indicators which included (i) number of inefficient chillers replaced by the Project; (ii) phase-out amount of ODS in the RAC servicing sector and (iii) CO2 emission reductions as direct and indirect Project benefits and (iv) Megawatt-hour (MWh) saved and MW demand reduced through chiller replacement.

PCEEP was comprised of key components, namely: (i) Component 1 – Investments to Chiller Replacement which provided financial incentives (or about 15% of new chiller cost) to accelerate replacement of inefficient chillers to non-ODS energy efficient ones; (ii) Component 2- Measurement, Monitoring and Verification which involved the measurement and data monitoring related to the power-output function of inefficient chiller to be replaced, electrical consumption of the new chiller, and cooling output; (iii) Component 3- Performance Standards and Technical Assistance which aimed to enhance the knowledge and build capacity of Project participants (i.e. government regulators, chiller manufacturers/suppliers and contractors) on significant rate-of-return on investment of chiller replacement, different MMV requirements and technical assistance from the Project, replacement and maintenance of new chillers, adoption of environment friendly and energy-efficient technologies and ensure sustainability through building the capacity of relevant stakeholders in energy conservation measures and refrigerant management, and (iv) Component 4- Project Management which was involved on the daily supervision of Project management activities.

Project financing was from Global Environment Facility (GEF) with an allocation of USD 2,600,000.00 and the Multilateral Fund (MLF) for the Implementation of the Montreal Protocol with an allocation of USD 1,000,000.00. With the restructured phase of the Project, the closing date for the GEF Trust Fund (TF) was extended from January 1, 2015 to January 1, 2017 to coincide with the closing date of the MLF/OTF Trust Fund (TF) and of Project termination date.

The PCEEP was a 6-year Project which effectively started on January 05, 2011 with a physical completion on 01 January 2017.

Overall Performance

PDO Level Achievement. At end of 2016, the Project exceeded its end-of- project targets. Under the PDO Level Results, the PCEEP reflected the following performance: (i) 149% for addressing 45,687 tons of refrigeration (TR) of its target cooling capacity of 30,649 TR; (ii) 121% or 6.9 tons of ozone depleting potential (ODP) of the 5.7 tons ODP consumption target; (iii) 243% for achieving a cumulative carbon emission reduction as direct Project benefit of 151.4 kilotons of carbon dioxide equivalent (ktCO2e) from 62.4 ktCO2e end-of-project target and (iv) 118% or 35.0 Gigawatt-hour (GWh) savings from the 29.7 GWh target and 189% which means an actual reduction of 18.95 MW from the target of 10 MW.

Under the Intermediate Results Level, the Project achieved for Component 1: (i) a 200% or an actual number of 40 Sub-grant Agreements (SGAs) signed from the end-of-project target of 20 SGAs and (ii) 134% being able to install 71 new energy efficient chillers from its 53 chiller unit's end-of-project target. Under Component 2, the Project was able to have 41 chillers connected to the Chiller Management Information System (CMIS) or 58% of 71 chillers expected to generate energy savings. This is 23% higher than the 35% targeted to be connected to the CMIS. Under Component 3, (i) 193% or having an actual number of recipients participating in recognition program of 29 from target of 15 recipients and (ii) 216% for conducting 26 training and workshops out of the 12 end-of-project target. Under Component 4, the Project (i) engaged of six (6) project consultants and five (5) project support staff throughout the project life, (ii) submitted at least 23 interim financial reports and 5 COA management reports since its inception in 2011 and (iii) WB was able to conduct 15 review missions to assess progress in project implementation.

Financial Accomplishment. For the total SARO of PhP162,000,000.00 issued to the Project, 88% or PhP 142,270,527.00 was actually obligated as of December 31, 2016. About 52% or PhP 73,572,423.00 of the obligated amount was disbursed and this was approximately 45% of the total allotment to the Project. Of the total Project cost (exclusive of GOP) of USD 3,600,000.00, the Project was able to disburse 45% equivalent USD 1,618,319.00 or PhP 73,572,423.00 as of 31 December 2016. GEF actual total disbursement as of 31 December 2016 was USD 1,005,886.00 or PhP 45,711,808.00 which was 39% of total GEF financing allocation of USD 2,600,000.00. The MLF/OTF reflected a 62% disbursement rate equivalent to USD 612,434.00 or PhP 27,860,616.00 from USD 1,000,000.00 allocation.

Compliance with grant covenants

The DENR as the implementer was able to comply with the Grant Effectiveness conditions and legal covenants. The following were called for under the GEF and MLF/OTF Grant Agreements.

Project relevance

PCEEP was relevant as it was consistent with the Medium Term Philippine Development Plan (MTPDP) in terms of provision of climate change mitigations that would address emission of GHG and replacement of old ODS-based chillers. The Project was in accordance with the country's commitment to the Montreal Protocol (MP) on Substances that Deplete the Ozone Layer where MP mandated a complete phase-out of production and consumption of new ODS 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. At end of Project life, an ODP abatement of 121.9% or 6.9 ODP ton from the 5.7 ODP ton consumption target was realized and about 239.5% was achieved for a cumulative carbon emission reduction (i.e. as direct Project benefit) of 147.3 ktCO_2e from 62.4 ktCO_2e end-of-project target.

Project Efficiency

Project was quite efficient in achieving its revised PDO Level and Intermediate Results targets at 100% level or more without completely consuming its GEF and MLF/OTF financing allocations. This was also attributed to the lower value for the ex-works for chillers with more than 1000 TR from the originally estimated normative price of USD 400.00/TR to an actual price average USD 299.00/TR which led to lower subsidy payments for the actual 45,687 tons of refrigerants achieved by the Project. Moreover, in terms of Project schedule, PCEEP was still implemented within the intended 6-year Project implementation period even if there was restructuring in CY 2013 to improve GEF disbursements and extend the GEF financing to coincide with the termination of MLF/OTF in January 2017. The implementation of the Project also contributed to the Philippine commitment to Montreal Protocol relative to DENR Administrative Order 2013-25 which was within Project timeframe.

Project Effectiveness

Project was effective in pursuing a good partnership with chiller owners, suppliers and manufacturers for the replacement of old and inefficient ODS-based chillers. Said partnership contributed to the achievement of Project PDO Level and Intermediate Results Based on the PCEEP Satisfaction Survey, the Project facilitated the cholorofluorocarbon (CFC) phase-out obligation with lesser cost to the chiller owners, in the same manner that the project facilitated the compliance to DENR Administrative Order (DAO) 2013-25 or the Revised Regulation on the Chemical Control of ODS, and that the Project accelated the replacement of inefficient ODS- based chillers. Likewise, the Project resulted to a significant reduction of energy consumption and electricity cost, as well as the promotion of the use of energy efficient chillers. Moreover, the Project also contributed to market transformation in the chiller industry, particularly on ESCOs market development and expansion.

Preliminary Assessment of Sustainability

The fielded World Bank Mission in July 2016 reiterated the allocation of sufficient funds by the DENR to close the Project in January 2017 and be able to mainstream the post-PCEEP activities into the regular programs of the DENR and/or EMB. The DENR Memorandum Circular No. 36 dated September 30, 1994, prescribed for the development of that sustainability plan that would provide for the smooth integration of the Project's activities into the regular activities of the agency. A workshop for the development of the PCEEP Sustainability Plan was conducted on October 17-18, 2016. The workshop was participated in by personnel from the DENR and EMB Central Offices and selected EMB regional offices, namely, EMB IV-A, EMB VI, EMB-VII, EMB-XI, EMB-Negros Island Region and EMB-National Capital Region. Said Plan provided the blueprint of various activities that may be adopted and undertaken by the DENR and EMB during the post-PCEEP implementation. The development of sustainability strategies would ensure continuity of the various economic and environmental benefits created by the PCEEP furthering the market transformation in the chiller sector. These benefits include abatement of ODS consumption and reduction of CO_2 emission. Further consultation with EMB divisions and other DENR offices/services/units concerned need to be conducted with the assistance of DENR-FASPS.

Annex 7. Comments of Cofinanciers and Other Partners/Stakeholders

Not applicable.

Annex 8. PCEEP Completed Chiller Replacements

(Source: Data Source: PCEEP PMU)

Chiller Owners	No. of Old Chillers Enrolled	Total Cooling Capacity of Old Chillers (TR)	No. of New Chillers Installed	Total Cooling Capacity of New Chillers (TR)
Chiller Replacement Completed in 2013				
The Peninsula Manila	1	577	1	550
Chiller Replacements Completed in 2014				
BPI-Buendia	1	550	1	500
Marco Polo Davao	1	400	1	400
Waterfront Cebu Hotel & Casino	4	1,205	3	1,200
New World Makati Hotel	1	700	1	700
BA Lepanto Building	1	335	1	335
TriNoma Malls	3	3,450	3	3,600
Manila Pavilion	2	1,200	2	1,000
SM City Iloilo	2	2,000	2	2,000
SM City Iloilo (Batch 2)	1	1,000	1	1,000
International School Manila	3	1,600	3	1,600
6750 Ayala Ave. Joint Venture	2	960	2	1,000
CY2014 Pipeline but Replacement Completed in 2015				
Tower One & Exchange Plaza	2	1,000	2	1,000
Cultural Center of the Philippines	1	500	1	500
Ayala Life FGU Center	1	700	1	700
Chiller Replacements in CY2015 (Completed)				
Radisson Blu Cebu Hotel	2	1,000	2	1,000
SM City Fairview (Batch 1)	1	1,000	1	1,000
Robinsons Place Manila	5	2,450	5	2,500
Insular Life Alabang	2	750	2	800
CY2015 Chiller Pipeline but Replacements to be completed in CY2016				
Philippine National Bank	2	1,800	2	1,800
Robinsons Place Iloilo	3	1,350	2	1,400
Robinsons Place Bacolod	4	1,520	2	1,400
Robinsons Galleria	10	4,250	8	4,000
SM City Southmall (Batch 1)	2	2,000	2	2,000
CY2016 Chiller Pipeline				
Radisson Blu Cebu Hotel (Batch 2)	1	500	1	500
Insular Life Alabang (Batch 2)	2	900	2	810
SM City Southmall (Batch 2)	2	2,000	2	2,000
SM City Fairview (Batch 2)	2	2,000	2	2,000
SM City Bicutan	1	1,000	1	1,000
SM City Sucat	2	800	2	800
SM City Sucat (Batch 2)	2	800	2	800
SM City Bacoor	2	2,000	2	2,000
SM City Manila	2	1,600	2	1,600
SM City Manila (Batch 2)	1	800	1	800
Robinsons Summit Center	3	990	3	1,050
TOTAL	**77**	**45,687**	**71**	**45,345**

Annex 9. Project Component 1: CDM Criteria for Investments to Chiller Replacement

For participation in the Project, as originally conceived, the technical conditions applied included:

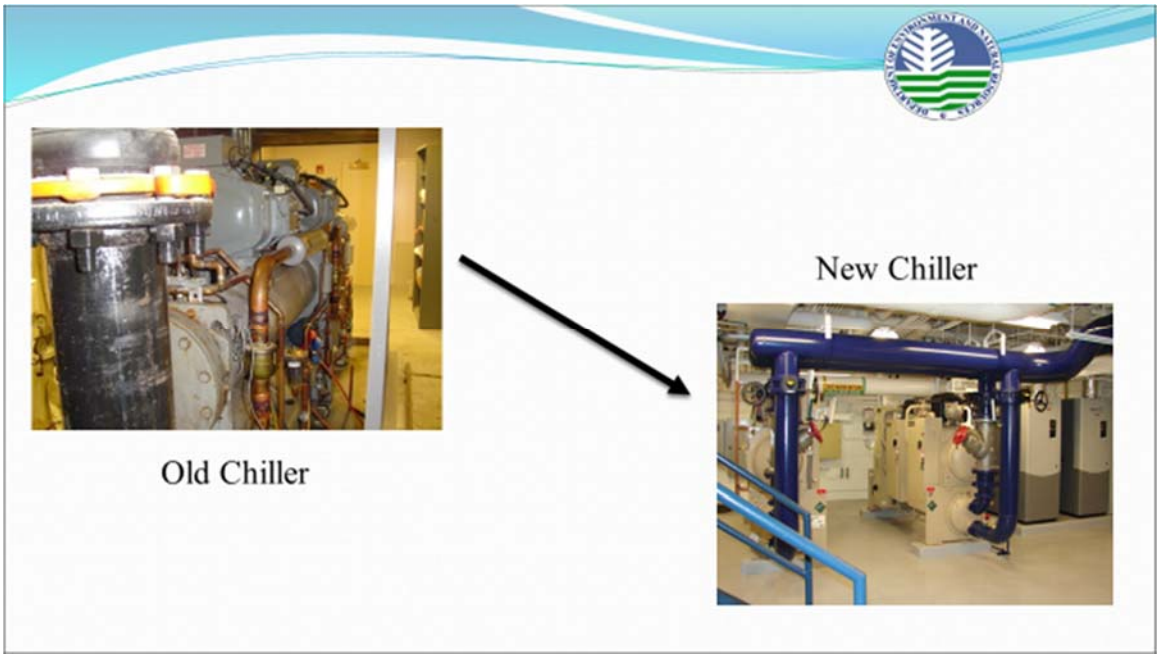
(a) Any old chiller that met the eligibility criteria of approved technology AM0060[16] of the CDM (electrically powered and of compression type) was eligible to apply for financial incentive under Component 1. Old CFC-based absorption chillers however, were not eligible, pending approval of a CDM methodology covering this type of chiller;
(b) Inefficient chillers identified for replacement had to have a minimum of 5 years life remaining, assuming a 20-year business-as-usual equipment life. In order to simplify identification of chillers that met this criterion, the CDM Methodology specified that eligibility would be restricted to those chillers installed after 1995[17];
(c) To be eligible for the grant incentive under the Project, new chillers had to meet the eligibility criteria of AM0060, be non-CFC based and have specific energy consumption equal or lower than 0.63 kW /TR at current Air-conditioning and Refrigeration Institute (ARI) condition or at the site condition confirmed during commissioning;
(d) Size of Chillers:
(i) The size of old chillers, in terms of cooling capacity, had to be 100 tons refrigeration (TR) or above;
(ii) The size of new chillers had to be the same as that of the old chiller, plus or minus 5%. If less than the old chiller, the incentive offered would be proportionately less, while if more than the old chiller it would remain unadjusted.

Revised Eligibility Criteria for New Chillers, as defined at Restructuring
(as presented in Annex 2 of the June 24, 2013 Restructuring Paper)

Criteria	Eligibility
Starting Date	To be eligible, the new replacement chillers should have been installed on or after January 1, 2012 but before December 31, 2014.
Chiller Process	The new chiller generates chilled water or a water/antifreeze mixture (e.g, water and glycol) for process cooling or air conditioning
Power Source and Compression	The replacement chiller should be electrically powered and of the vapor compression type.
Efficiency	Energy consumption ratio of the new chiller should be equal to or lower than 0.63 kW/TR and a difference of at least 0.3 kW/TR between the efficiency of old and new chiller.
Cooling Capacity	The rated cooling capacity of the new chiller must be within ± 10% of the rated cooling capacity of the existing chiller to be replaced.
Operating Hours	New chiller must operate to ensure investment payback period of less than four (4) years
Refrigerant Type	The new chiller must use non-CFC based refrigerant.
Data Measuring Device	The new chiller is fitted with data measuring device that would measure compression motor kWh (energy efficiency), temperature of in and out chilled water, chilled water flow rate based on flow meter or pressure drop.
Installation	The new chiller is installed in the applicant's facility where the old chiller was located. New chiller location need not be in the exact same place of the old chiller, as long as it is serving the same facility/building.

[16] CDM Methodology AM0060: Power saving through replacement by energy efficient chillers.
[17] Simplification in Project design at restructuring (2013) allowed for older, less efficient chillers with higher cooling capacity to be included.

Annex 10. Photos



Annex 11. List of Supporting Documents

Memorandum and Recommendation of the President of the International Bank for Reconstruction and Development to the Executive Directors on a Proposed Global Environment Facility Grant to the Republic of the Philippines for the Chiller Energy Efficiency Project, May 4, 2010.

The World Bank, Global Environment Facility Grant Agreement, June 28, 2010.

Restructuring Paper, June 24, 2013.

The World Bank, Amendment to the GEF Grant Agreement, September 10, 2013.

The World Bank, Ozone Projects Trust Fund Grant Agreement, June 28, 2010.

Project Appraisal Document, May 4, 2010.

The World Bank, Country Assistance Strategy for the Republic of the Philippines for the Period FY2010-2012.

The World Bank, Country Partnership Strategy for the Republic of the Philippines for the Period FY2015-2018

The World Bank, Supervision Mission Aide Memoires (November 2010-December 2016).

The World Bank, Implementation Status Reports (ISRs) (2010-2016).

Recipient ICR, prepared by DENR, 2017 (*Executive Summary of which reproduced in this report in Annex 7).*

MAP


IBRD 33466R5
PHILIPPINES
SELECTED CITIES
PROVINCE CAPITALS
REGION CAPITALS
NATIONAL CAPITAL
RIVERS
MAIN ROADS
RAILROADS
PROVINCE BOUNDARIES
REGION BOUNDARIES
INTERNATIONAL BOUNDARIES
I Ilocos Region
1 Ilocos Norte
2 Ilocos Sur
3 La Union
4 Pangasinan
CAR Cordillera Admin. Reg.
5 Abra
6 Apayao
7 Benguet
8 Ifugao
9 Kalinga
10 Mountain Province
II Cagayan Valley
11 Batanes
12 Cagayan
13 Isabela
14 Nueva Vizcaya
15 Quirino
III Central Luzon
16 Aurora
17 Bataan
18 Bulacan
19 Nueva Ecija
20 Pampanga
21 Tarlac
22 Zambales
NCR National Capital Reg.
IV-A CALABARZON
23 Batangas
24 Cavite
25 Laguna
26 Quezon
27 Rizal
MIMAROPA
28 Marinduque
29 Mindoro Occidental
30 Mindoro Oriental
31 Palawan
32 Romblon
V Bicol
33 Albay
34 Camarines Norte
35 Camarines Sur
36 Catanduanes
37 Masbate
38 Sorsogon
VI Western Visayas
39 Aklan
40 Antique
41 Capiz
42 Guimaras
43 Iloilo
VII Central Visayas
44 Bohol
45 Cebu
46 Siquijor
VIII Eastern Visayas
47 Biliran
48 Eastern Samar
49 Leyte
50 Northern Samar
51 Samar
52 Southern Leyte
IX Zamboanga Peninsula
53 Zamboanga del Norte
54 Zamboanga del Sur
55 Zamboanga Sibugay
--- City of Isabela
X Northern Mindanao
56 Bukidnon
57 Camiguin
58 Lanao del Norte
59 Misamis Occidental
60 Misamis Oriental
XI Davao Region
61 Compostela Valley
62 Davao del Norte
63 Davao del Sur
64 Davao Oriental
65 Davao Occidental
XII SOCCSKSARGEN
66 Cotabato
67 Sarangani
68 South Cotabato
69 Sultan Kudarat
--- Cotabao City
XIII Caraga
70 Agusan del Norte
71 Agusan del Sur
72 Dinagat Islands
73 Surigao del Norte
74 Surigao del Sur
NIR Negros Island Region
75 Negros Occidental
76 Negros Oriental
ARMM Autonomous Reg. in Muslim Mindanao
77 Basilan
78 Lanao del Sur
79 Maguindanao**
80 Sulu
81 Tawi-Tawi
** Shariff Aguak (Maganoy) and Sultan Kudarat serve as co-capitals of the province.
Luzon
Mindoro
Palawan
Samar
Leyte
Cebu
Bohol
Panay
Negros
Mindanao
Basco
Batan Islands
Luzon Strait
Babuyan Islands
Babuyan Channel
Laoag City
Kabugao
Tuguegarao
Vigan
Bangued
Tabuk
Ilagan
Bontoc
Lagawe
Cabarroguis
San Fernando
La Trinidad
Bayombong
Baguio
Lingayen
Baler
Palayan
Tarlac
Iba
San Fernando
Malolos
Balanga
Quezon
Pasig
MANILA
Antipolo
Trece Martires
Santa Cruz
Calamba
Lucena
Batangas
Daet
Virac
Pili
Calapan
Boac
Mamburao
Legaspi
Sorsogon
Romblon
Masbate
Catarman
Catbalogan
Borongan
Tacloban
Kalibo
Roxas City
San Jose de Buenavista
Iloilo
Jordan
Bacolod
Cebu
Maasin
Tagbilaran
Dumaguete
Siquijor
Mambajao
San Jose
Surigao
Tandag
Butuan
Prosperidad
Cagayan de Oro
Oroquieta
Dipolog
Iligan
Malaybalay
Marawi
Pagadian
Tubod
Ipil
Nabunturan
Tagum
Mati
Cotabato City
Davao
Kidapawan
Digos
Shariff Aguak (Maganoy)
Isulan
Koronadal
Malita
General Santos
Alabel
Isabela City
Zamboanga
Basilan
Jolo
Sulu
Tawi-Tawi
Bongao
Panglima Sugala
Puerto Princesa
Bugsuk
Balabac
Cagayan Sulu
Philippine Sea
Sulu Sea
Celebes Sea
Moro Gulf
Leyte Gulf
Davao Gulf
Sibuyan Sea
Visayan Sea
Mindanao Sea
Mindoro Strait
Polillo Islands
Lubang Islands
Semirara Islands
Cuyo Islands
Busuanga
Culion
Linapacan
Dumaran
Tablas
Romblon
Burias
Ticao
Catanduanes
Marinduque
Siargao
Camiguin
Sarangani
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XIII
ARMM
20°N
10°N
5°N
125°E
120°E
0 50 100 150 Kilometers
0 50 100 Miles
PHILIPPINES
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