Document of
The World Bank

Report No: ICR00003706

IMPLEMENTATION COMPLETION AND RESULTS REPORT
(IBRD-7996 TF-98062 TF-098465)

ON A

LOAN

IN THE AMOUNT OF US$250.625 MILLION

AND

A GLOBAL ENVIRONMENTAL FACILITY GRANT

IN THE AMOUNT OF US$7.1186 MILLION

TO THE UNITED MEXICAN STATES

AND

A CLEAN TECHNOLOGY FUND LOAN

IN THE AMOUNT OF US$50 MILLION

TO NACIONAL FINANCIERA

WITH A GUARANTEE OF THE UNITED MEXICAN STATES

FOR AN

EFFICIENT LIGHTING AND APPLIANCES PROJECT

May 10, 2016

Energy and Extractives Global Practice
Mexico and Colombia Country Management Unit
Latin America and Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective April 29, 2016)

Currency Unit = Mexican Peso (MXN)
MXN 1.00 = US$ 0.0582
US$1.00 = MXN 17.1767

FISCAL YEAR
January 1 – December 31

ABBREVIATIONS AND ACRONYMS

AC	Air Conditioner
BAU	Business As Usual
BP	Bank Policy
CERs	Certified Emission Reductions
CF	Carbon Finance
CFE	*Comisión Federal de Electricidad* (Federal Electricity Commission)
CFL	Compact Fluorescent Lamp
CO	Country Office
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CONAE	*Comisión Nacional para el Ahorro de Energía* (National Commission for Energy Savings)
CONUEE	*Comisión Nacional para el Uso Eficiente de Energía* (National Commission for the Efficient Use of Energy)
COP	Conference of the Parties
CPS	Country Partnership Strategy
CRE	*Comisión Reguladora de Energía* (Energy Regulatory Commission)
CTF	Clean Technology Fund
CY	Calendar Year
DF	*Distrito Federal* (Federal District, officially Mexico City as of 2016)
DPL	Development Policy Loan
EA	Environmental Assessment
EE	Energy Efficiency
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
ENACC	*Estrategia Nacional de Cambio Climático* (National Climate Change Strategy)
ENE	*Estrategia Nacional de Energía* (National Energy Strategy)
ER	Emissions Reduction
ERPA	Emissions Reduction Purchase Agreement

ERR	Economic Rate of Return
ESMAP	Energy Sector Management Assistance Program
FIDE	*Fideicomiso para el Ahorro de Energía Eléctrica* (Trust Fund for Electricity Savings)
FIRR	Financial Internal Rate of Return
FM	Financial Management
FOTEASE	*Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía* (Trust Fund for the Energy Transition and the Sustainable Use of Energy)
FRR	Financial Rate of Return
FY	Fiscal Year
GDP	Gross Domestic Product
GEF	Global Environment Facility
GF	Guarantee Facility
GHG	Greenhouse Gases
GoM	Government of Mexico
GWh	Gigawatt hour
IB	Incandescent Bulb
IBRD	International Bank for Reconstruction and Development
ICR	Implementation Completion Report
IDB	Inter-American Development Bank
IEA	International Energy Agency
IFC	International Finance Corporation
IMF	International Monetary Fund
INDC	Intended Nationally Determined Contribution
IPs	Indigenous Peoples
IPCC	Intergovernmental Panel on Climate Change
IPP	Independent Power Producer
IPPF	Indigenous Peoples Planning Framework
KfW	*KfW Bankengruppe* (German Development Bank)
kWh	Kilowatt hour
LCR	Latin America and the Caribbean
MEDEC	Mexico Low Carbon Development Study
$MtCO_2e$	Megatons of Carbon Dioxide Equivalent
MW	Megawatt
MTR	Mid-Term Review
M&E	Monitoring and Evaluation
NAFIN	*Nacional Financiera* (Mexican Development Bank)
NDP	National Development Plan
NGO	Nongovernmental Organization
NOM	*Norma Oficial Mexicana* (Mexican Official Standard)
NPV	Net Present Value
ODS	Ozone Depleting Substances, such as CFCs, including CFC-12
OECD	Organization for Economic Cooperation and Development
OP	Operations Policy

PECC	*Programa Especial de Cambio Climático* (Special Program for Climate Change)
PEMEX	*Petróleos Mexicanos* (Mexican Petroleum Company)
PIU	Project Implementing Unit
PLS	*Programa Luz Sustentable* (Sustainable Light Program)
PRONASE	*Programa Nacional para el Aprovechamiento Sustentable de la Energía* (National Program for the Sustainable Use of Energy)
PROSENER	*Programa Sectorial de Energía* (Energy Sectorial Program)
PSEE	*Programa de Sustitución de Equipos Electrodomésticos* (Appliance Replacement Program)
SEMARNAT	*Secretaría de Medio Ambiente y Recursos Naturales (*Secretariat of Environment and Natural Resources)
SENER	*Secretaría de Energía* (Secretariat of Energy)
SHCP	*Secretaría de Hacienda y Crédito Público* (Secretariat of Finance and Public Credit)
SIL	Specific Investment Loan
SO_x	Sulfur Oxides
SO_2	Sulfur Dioxide
TA	Technical Assistance
TF	Trust Fund
TRACE	Tool for Rapid Assessment of City Energy
UN	United Nations
UNFCCC	United Nations Framework Convention on Climate Change
UREP	*Unidad Responsable Ejecutora del Proyecto* (Project Implementing Unit)
WB	World Bank

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Practice Manager: Antonio Barbalho
Project Team Leader: Guillermo Hernández González
ICR Team Leader: Guillermo Hernández González

COUNTRY
MEXICO

CONTENTS

Data Sheet

A. Basic Information			
Country:	Mexico	Project Name:	Efficient lighting and appliances
Project ID:	P106424,P120654	L/C/TF Number(s):	IBRD-79960,TF-98062,TF-98465
ICR Date:	04/30/2016	ICR Type:	Core ICR
Lending Instrument:	SIL,SIL	Borrower:	GOVERNMENT OF MEXICO
Original Total Commitment:	USD 250.63M,USD 57.12M	Disbursed Amount:	USD 250.63M,USD 56.95M
Environmental Category: B		**Focal Area**: C	
Implementing Agencies: Secretaria de Energía (SENER) Fideicomiso para el Ahorro de Energía Eléctrica (FIDE)			
Cofinanciers and Other External Partners:			

B. Key Dates

Efficient lighting and appliances - P106424

Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	04/01/2009	Effectiveness:	11/09/2011	11/09/2011
Appraisal:	07/09/2010	Restructuring(s):		07/31/2012 03/04/2014
Approval:	11/23/2010	Mid-term Review:	03/25/2013	04/09/2013
		Closing:	06/30/2014	06/30/2014

MX GEF Efficient lighting and appliances - P120654

Process	Date	Process	Original Date	Revised / Actual Date(s)
Concept Review:	11/19/2009	Effectiveness:	12/02/2011	12/02/2011
Appraisal:	07/09/2010	Restructuring(s):		06/24/2014 06/29/2015
Approval:	11/23/2010	Mid-term Review:	03/25/2013	04/09/2013
		Closing:	06/30/2014	07/30/2015

C. Ratings Summary	
C.1 Performance Rating by ICR	
Outcomes	Satisfactory
GEO Outcomes	Satisfactory
Risk to Development Outcome	Low to Negligible
Risk to GEO Outcome	Low to Negligible
Bank Performance	Satisfactory
Borrower Performance	Satisfactory

C.2 Detailed Ratings of Bank and Borrower Performance (by ICR)			
Bank	**Ratings**	**Borrower**	**Ratings**
Quality at Entry	Satisfactory	Government:	Satisfactory
Quality of Supervision:	Satisfactory	Implementing Agency/Agencies:	Satisfactory
Overall Bank Performance	Satisfactory	Overall Borrower Performance	Satisfactory

C.3 Quality at Entry and Implementation Performance Indicators			
Efficient lighting and appliances - P106424			
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):	No	Quality of Supervision (QSA)	None
DO rating before Closing/Inactive status	Satisfactory		

MX GEF Efficient lighting and appliances - P120654			
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):	No	Quality of Supervision (QSA)	None
GEO rating before Closing/Inactive Status	Satisfactory		

D. Sector and Theme Codes		
Efficient lighting and appliances - P106424		
	Original	**Actual**
Sector Code (as % of total Bank financing)		
Energy efficiency in Heat and Power	100	100
Theme Code (as % of total Bank financing)		
Climate change	67	67
Other social development	33	33

MX GEF Efficient lighting and appliances - P120654		
	Original	**Actual**
Sector Code (as % of total Bank financing)		
Energy efficiency in Heat and Power	70	70
Public administration- Energy and mining	30	30
Theme Code (as % of total Bank financing)		
Climate change	67	67
Other social development	33	33

E. Bank Staff		
Efficient lighting and appliances - P106424		
Positions	**At ICR**	**At Approval**
Vice President:	Jorge Familiar	Pamela Cox
Country Director:	Gerardo Corrochano	Gloria Grandolini
Practice Manager/Manager:	Antonio Barbalho	Philippe Charles Benoit
Project Team Leader:	Guillermo Hernandez Gonzalez	Roberto Gabriel Aiello
ICR Team Leader:	Guillermo Hernandez Gonzalez	
ICR Primary Author:	Eugene D. McCarthy	

MX GEF Efficient lighting and appliances - P120654		
Positions	**At ICR**	**At Approval**
Vice President:	Jorge Familiar	Pamela Cox
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ICR Primary Author:	Eugene D. McCarthy	

F. Results Framework Analysis

Project Development Objectives (from Project Appraisal Document)
The Project Development Objectives are to promote Mexico's efficient use of energy and to mitigate climate change by increasing the use of energy-efficient technologies at the residential level.

Revised Project Development Objectives (as approved by original approving authority)
Not applicable

Global Environment Objectives (from Project Appraisal Document)
The Project's Global Environmental Objectives are to support efforts to mitigate climate change by expanding the use of energy-efficient equipment and services. The Project will promote the development of a sustainable market for energy efficiency equipment among the large and fast growing energy end-use sectors for lighting, refrigeration and air conditioning.

Revised Global Environment Objectives (as approved by original approving authority)
Not applicable

(a) PDO 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 :	Accumulated amount of GWh saved			
Value (quantitative or Qualitative)	0	10,000	N/A	9,242
Date achieved				June 30, 2014
Comments (incl. % achievement)	92.42% achieved			

(b) 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 :	Accumulated associated Carbon Dioxide Emission Reductions			
Value (quantitative or Qualitative)	0	5,140	N/A	5,074
Date achieved				June 30, 2014
Comments (incl. % achievement)	98.72% achieved (Note: the accumulated Carbon Dioxide Emission Reductions reported include those associated with capture of refrigerant gases)			

(c) 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 IBs replaced with CFLs			
Value (quantitative or Qualitative)	0	45 million	N/A	45.8 million
Date achieved				Sept. 30, 2012
Comments (incl. % achievement)	101.78% achieved			
Indicator 2 :	Number of appliances replaced			
Value (quantitative or Qualitative)	0	1.70 million	N/A	1.88 million
Date achieved				Jan. 31, 2013
Comments (incl. % achievement)	110.83% achieved			
Indicator 3 :	Number of Studies Completed			
Value (quantitative or Qualitative)	0	8	N/A	8
Date achieved				July 31, 2015
Comments (incl. % achievement)	100% achieved. Studies completed include the following: (i) Assessment of Energy Efficiency (EE) potential in schools, (ii) Assessment of EE potential in hospitals, (iii) Assessment of EE potential in hotels, (iv) Estimation of market share of Light Emitting Diodes (LEDs) in Mexico, (v) creation of recycling centers for CFLs in Mexico (vi) impact on old imported appliances, (vii) implementation of more than 30 evaluations in Mexican Cities using the Tool for Rapid Assessment of City Energy (TRACE) tool throughout the country (which paved			

	the way for the recently-approved Mexico Municipal Energy Efficiency Project, P149872) , and (viii) project impact evaluation.			
Indicator 4 :	Number of Staff trained			
Value (quantitative or Qualitative)	0	20	N/A	20
Date achieved				Jan. 31, 2013
Comments (incl. % achievement)	100% achieved. During the implementation of Component 2, the Secretariat of Energy (SENER) designed and delivered numerous training modules (supported by the Secretariat of Environment and Natural Resources, SEMARNAT) to enhance the technical skills of workers in charge of the refrigerant gases capture process.			

G. Ratings of Project Performance in ISRs

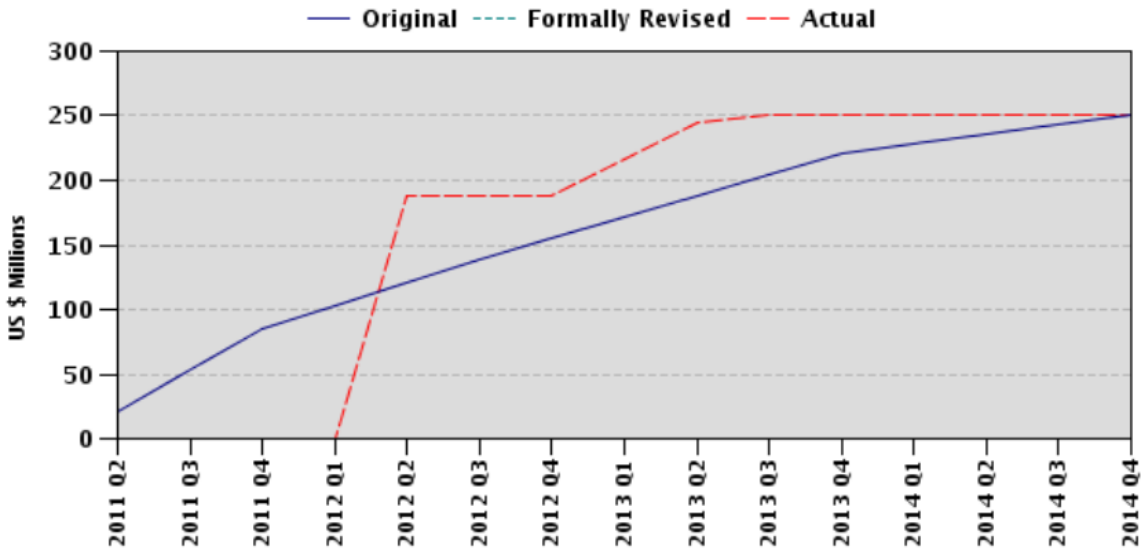
No.	Date ISR Archived	DO	GEO	IP	Actual Disbursements (USD millions)	
					Project 1	Project 2
1	02/27/2011	S		S	0.00	0.00
2	08/13/2011	S		S	0.00	0.00
3	02/08/2012	S		S	188.19	0.00
4	09/11/2012	S		S	215.78	40.44
5	01/23/2013	S		S	245.12	55.00
6	01/25/2014	S		MS	250.00	55.04
7	06/23/2014	S		MS	250.00	55.06
8	02/18/2015	S		MS	250.00	55.25

H. Restructuring (if any)

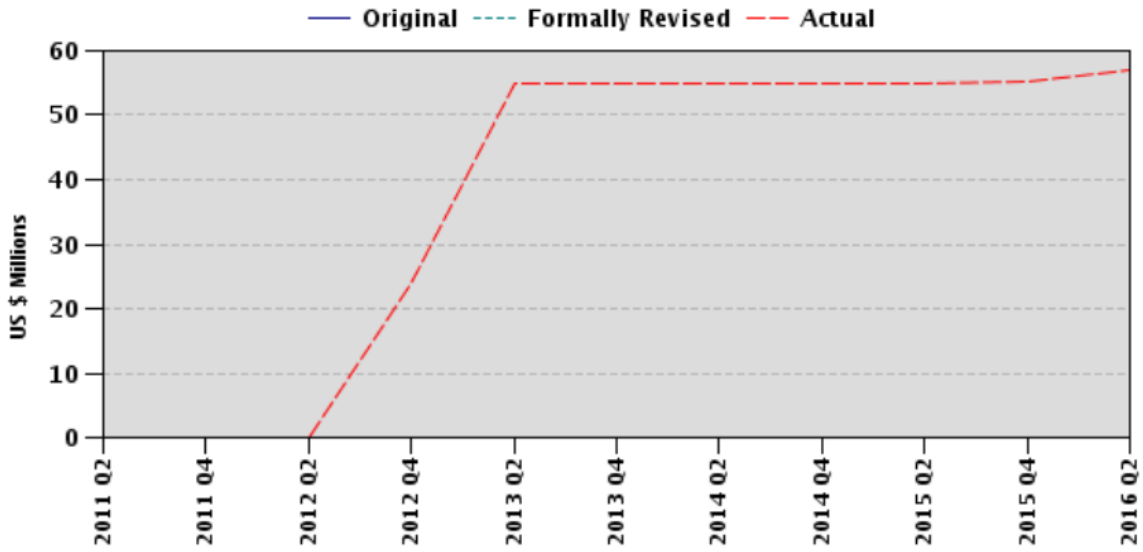
Restructuring Date(s)	Board Approved		ISR Ratings at Restructuring			Amount Disbursed at Restructuring in USD millions		Reason for Restructuring & Key Changes Made
	PDO Change	GEO Change	DO	GEO	IP	Project1	Project 2	
07/31/2012			S		S	215.78		CTF amendment to increase the percentage of expenditures to be financed under category 1 from 60% to up to 90% and reallocation of proceeds among categories.
03/04/2014			S		MS	250.00		Reallocation of proceeds among categories.
06/24/2014					MS		55.06	Extension of 12 months to the closing date of TF098465.
06/29/2015					MS		55.32	Extension of 1 month to the closing date of TF098465.

I. Disbursement Graphs

P106424 - Efficient lighting and appliances



P120654 - MX GEF Efficient lighting and appliances



1. Project Context, Development and Global Environment Objectives Design

1.1 Context at Appraisal

1. *Country Context.* The global financial and economic crisis of 2008 had a severe impact on the Mexican economy. The subsequent loss of employment and income generating opportunities, together with the high level of uncertainty brought about by this crisis, led to a drop in private investment, further denting aggregate demand. During 2009, economic activity in Mexico contracted by 6.5 percent. However, in the second half of 2009, there were signs of economic recovery. Strong external demand for Mexican manufactured goods, particularly in the United States, helped bring about this recovery. Domestic demand started to increase while trade and industrial activity began to grow again, leading to a rebound in employment. By 2010, there were clear signs of recovery of the Mexican economy in both the domestic and external markets.

2. Mexico has been, and still is, a major producer and exporter of energy, mainly in the form of crude oil; it is also a major consumer of energy. As a consequence, the energy sector is of considerable strategic importance to the economy and has historically driven economic growth. Exports of crude oil have also been an important source of government revenue. However, starting in 2004, there was a steady decline in oil production-from a high of 3.4 million barrels per day to 2.6 million barrels per day by 2009. The decline focused attention on the need for improved efficiency in the use of energy resources as well as on the need to diversify the country's energy resources away from oil towards an expanded use of renewable energy sources.

3. Climate change mitigation and adaptation had also become important policy goals for the Mexican government. In 2008, Mexico was the second largest emitter of Greenhouse Gasses (GHG) in Latin America- and the 12th largest globally. Energy-related emissions, including energy use in the transport sector, contributed to over 60 percent of Mexico's total GHG emissions. As a consequence, the government embarked upon an ambitious program of energy efficiency improvements closely linked to its climate change agenda. In December 2008, at the COP 14 meeting in Poland, the government committed itself to reducing its GHG emissions to 50 percent of 2000 levels by 2050. These developments provided the global and national context for this energy efficiency operation.

4. Mitigation and adaptation to climate change actions continue to be a national priority for the government. Mexico's 'Intended Nationally Determined Contribution' (INDC) submitted to the United Nations Framework Convention on Climate Change (UNFCCC) in March, 2015 aims to achieve a GHG emission reduction target of 25 percent by 2030 with respect to a Business As Usual (BAU) trajectory. This target could increase to 40 percent, subject to availability of climate finance and multilateral support, and may reach 50 percent below 2000 levels by 2050. The National Climate Change Strategy (*Estrategia Nacional de Cambio Climático,* ENACC) is the guiding policy instrument that defines a range of actions to achieve these goals, including a renewed focus on efficient

energy use and the transition into the development of sustainable cities, where many of the energy sector emissions take place.

5. *Sector Context*. There are several sector institutions which have an important bearing on the development of Mexico's energy sector, including the electricity subsector. The Secretariat of Energy (*Secretaría de Energía,* SENER) is responsible for energy planning as well as for policy formulation in the sector. SENER is supported by regulatory and technical bodies such as the National Commission for the Efficient Use of Energy (*Comisión Nacional para el Uso Eficiente de la Energía,* CONUEE) which drafts the National Program for the Sustainable Use of Energy (*Programa Nacional para el Aprovechamiento Sustentable de la Energía,* PRONASE) and is tasked with promoting the sustainable use of energy in all sectors and government levels by issuing guidance and providing technical assistance. The Electricity Energy Savings Trust Fund (*Fideicomiso para el Ahorro de Energía Eléctrica,* FIDE) – a private non-profit trust fund (TF) – provides technical and financial solutions for the deployment of energy efficient actions. To support the transition to clean and sustainable energy use, SENER created the Energy Transition and Sustainable Energy Use Fund (*Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía*, FOTEASE) that has become a key instrument for financing renewable energy and Energy Efficiency (EE) investments. The Energy Regulatory Commission (*Comisión Reguladora de Energía,* CRE) is responsible for regulation and oversight of the electricity subsector. Finally, the state-owned power company, Federal Electricity Commission, (*Comisión Federal de Electricidad,* CFE) is responsible for generation, transmission and distribution of electricity throughout Mexico.

6. Most of the country's installed capacity has been owned by CFE. However, since 1990, there has been a sharp increase in investment in new capacity provided by independent power producers (IPPs), which generated power for self-use as well as for sale to CFE under long term contracts. In 2009, IPPs represented approximately 23 percent of total installed capacity and generated 32 percent of total electricity. Access to electricity in Mexico has been high, with around 97 percent in 2009. Finally, the government was actively promoting renewable energy in order to diversify its generation mix and support its climate change goals. In this regard, it planned to expand further the country's installed hydropower capacity, exploit its geothermal potential, and develop its wind energy potential.

7. Mexico's residential sector accounted for over 25 percent of electricity consumption in 2008. Energy consumption in the residential sector was growing faster than GDP, with air conditioning, home appliances, electronics, and lighting sharing equally in residential electricity consumption. In response to the dominant role of the residential sector in electricity consumption, the government had initiated a number of energy efficiency programs, which specifically targeted electricity consumption in the residential sector by using price incentives to replace inefficient lighting and appliances.

8. The pricing of electricity was another area of attention of the government's energy efficiency measures. Mexico was providing significant subsidies to electricity consumers, mainly to residential consumers, despite the fact that average residential electricity tariffs

were comparable with those in countries such as the US, Chile and Colombia-at US$0.08/kWh in low income groups. While reducing electricity subsidies was intended to provide greater incentives to promote energy efficiency, the experience at the time with residential energy efficiency programs suggested that there were a sufficient price incentive to make it attractive for households to replace inefficient lighting and appliances.

9. In the context of its energy efficiency goals, the government had also started to address the level of electricity tariffs, including electricity subsidies. Specifically, it proposed a plan of action comprising (i) a tariff structure that reflected the opportunity costs of other energy sources, encouraged energy efficiency, while protecting low income groups through targeted subsidy programs; (ii) other mechanisms to promote energy efficiency; and (iii) transparent information on the subcomponents of energy pricing.

10. In parallel, the government also committed itself to a National Climate Change Strategy (*Estrategia Nacional de Cambio Climatico, ENACC*) as an integral component of its national development policy. In August 2009, Mexico officially launched a Special Climate Change Program (*Programa Especial de Cambio Climatico*, PECC), an initiative which made ENACC an operational program. Specifically, PECC identified a range of interventions at the sector and subsector levels and quantified their potential impact and related cost. It also set a number of emission reduction targets, including an electricity-related emissions reduction goal of 14 to 28 MtCO2e by 2012. As a longer term goal, it set the formal objective of reducing GHGs by 50 percent by 2050 against a baseline of 2000. Energy efficiency was a key component of the PECC program.

11. In order to help achieve its energy efficiency and climate change mitigation goals, the government developed a national strategy that laid the groundwork for implementation of a comprehensive energy efficiency plan. Its main elements were:

(i) An Energy Efficiency law, which provided the enabling environment on the regulatory side;
(ii) A new national strategy to promote policies, programs and investments aimed at increasing renewable energy use and promoting energy efficiency;
(iii) A five-year Energy Sector Program (2007-2012) which provides a comprehensive policy framework addressing energy security, technical efficiency, environmental sustainability and climate change;
(iv) A special TF to help finance the energy transition from hydrocarbons to renewable energy and energy efficiency; and
(v) The setting up of a special institution, i.e. CONUEE, which would be responsible for promoting the sustainable use of energy in all sectors and at all levels of government.

Rationale for Bank Involvement

12. The Bank's worldwide experience in designing and implementing energy efficiency programs in industrialized developing countries provided a natural partnership for Mexico as it embarked on its own national energy efficiency program. The Bank was already providing support to Mexico for climate change mitigation and clean energy activities through two major Development Policy Loans (DPLs): (i) the Framework for Green Growth Development Policy Loan (US$1.504 billion, P115608); and (ii) the Low Carbon DPL (US$401 million, P121800) . Bank support for this project complemented past involvement by directly supporting the government's programs to increase the use of energy efficient technologies at the residential level. The Project was also a component of a broader program of Bank policy, institutional, and operational support to Mexico aimed at (i) reducing the country's future carbon emissions trajectory; (ii) developing the necessary regulatory and monitoring framework for climate change mitigation in the energy and transport sectors; and (iii) bringing about a lower carbon growth path in transport.

13. The Project also mobilized US$50 million in concessional financing from the Clean Technology Fund (CTF), which was critical to enable scaling up of the government's energy efficiency program. There were several barriers to the adoption of energy efficient technologies which needed to be overcome. These included (i) the high initial costs of more efficient appliances; (ii) a lack of incentives to shift to more efficient appliances; (iii) many potential residential clients did not have credit profiles; (iv) commercial banks were hesitant to lend for such activities; and (v) a lack of expertise and capacity in the country's financial institutions to evaluate energy efficiency investments. The CTF financing component was therefore an essential component in being able to scale up Mexico's energy efficiency program. Finally, a grant from the Global Environment Facility (GEF) in the amount of US$7.11 million was part of the financing package for the project, which had an important impact on the outcome. GEF funds were used to capitalize a Guarantee Facility (GF) within *Nacional Financiera* (NAFIN) against default payments (US$5 million), and to support different Technical Assistance (TA) activities (US$2.11 million).

14. The Project formed part of two major nationwide Programs: (i) "Sustainable Light" (*"Luz Sustentable"*) program intending to phase out all incandescent light bulbs by replacing these with Compact Fluorescent Lamps (CFLs); and (ii) "Replace your old appliance for a new one" (*"Cambia tu viejo por uno nuevo"*), which provided a set of different financial incentives for consumers to replace refrigerators or air conditioners that were at least 10 years old. These Programs had already begun prior to Bank approval of this operation. Finally, the Project components were fully aligned with the two government Programs, ensuring full government commitment and ownership.

Higher Level Objectives to which the Project Contributes

15. The Project contributed to several strategic objectives highlighted in the Country Partnership Strategy (CPS) for Mexico (FY08-13), in particular energy security and competitiveness, reducing GHG emissions, and promoting social inclusion. *First*, by introducing more efficient technologies in the residential sector, the Project reduced electricity consumption and, as a result, contributed to improved energy security and competitiveness. *Second*, the energy efficiency investments directly supported climate mitigation effects. *Third*, by providing free CFLs, vouchers and credits to low income households, the Project supported the government's goal of promoting social inclusion.

16. The Project was also consistent with the GEF's Climate Change Focal Area, in particular, with the GEF's operational program for promoting energy efficiency in residential and commercial buildings. It directly supported activities such as the promotion of energy efficient appliances and efficient lighting in households that were an integral part of the government's ENACC.

1.2 Original Project Development Objectives (PDO) and Key Indicators (as approved)

17. The Project Development Objectives were to promote Mexico's efficient use of energy and to mitigate climate change by increasing the use of energy efficient technologies at the residential level.

18. The project outcome indicator for measuring the achievement of the Project Objective is the accumulated amount of energy saved measured in GWh. The intermediate outcome indicators were: (i) the number of IBs replaced by CFLs; (ii) the number of appliances replaced; (iii) the number of studies completed; and (iv) the number of staff trained.

1.3 Original Global Environment Objectives (GEO) and Key Indicators (as approved)

19. The Global Environmental Objective (GEO) was to support efforts to mitigate climate change by expanding the use of energy-efficient equipment and services. The GEO outcome indicator is the accumulated associated CO2e emissions reduction (in thousands of tons of CO2e) while the intermediate outcome indicators are the accumulated CO2e emission reductions for Components 1 and 2, respectively.

1.4 Revised PDO (as approved by original approving authority) and Key Indicators, and reasons/justification

20. The PDO was not changed.

1.5 Revised GEO (as approved by original approving authority) and Key Indicators, and reasons/justification

21. The GEO was not changed.

1.6 Main Beneficiaries

22. The primary target groups of the Project, in particular the CFL program (Component 1), were low to middle income households; the low income social groups also included indigenous peoples (IP). As part of project preparation, SENER undertook a Social Assessment, which included a detailed analysis of the participants in the CFL and appliance program, broken down by gender. Since specific beneficiaries in the indigenous communities were not known at appraisal, a broad framework, known as the Indigenous Peoples Planning Framework (IPPF), was developed.

1.7 Original Components (as approved)

23. The Project comprised *three* main components and several sub-components:

(i) ***Component 1:*** **Replacement of Incandescent Bulbs (IBs) with Compact Fluorescent Lamps (CFLs) in the low and medium residential sector; (Total cost: US$70 million, of which IBRD US$55 million; GoM US$15 million)** CFL replacement program comprised the purchase and replacement of about 45 million CFLs as well as the collection and proper disposal of the replaced IBs. Approximately 11 million low to middle income households were involved in this program.

(ii) ***Component 2***: **Incentives to encourage Replacement of Old and Inefficient Appliances in the Residential Sector. (Total Cost: US$603. million, composed of (i) IBRD US$195 million, (ii) CTF US$50 million, (iii) NAFIN US$127 million, (iv) GoM US$55 million and (v) Consumers US$176 million, complemented by a US$35 million Guarantee Facility (GF), of which US$30 million is funded by GoM and US$5 million by GEF).**

This component had the following subcomponents:

(i) *Component 2(a) (i).* Financing of vouchers for low-income consumers (including IBRD US$195 million). Provision of vouchers to low-income consumers to improve their ability to pay for the replacement of old and inefficient appliances with more energy-efficient appliances.

(ii) *Component 2(a) (ii).* Financing of NAFIN's credit line (including CTF US$50 million). Provision by NAFIN of credits at favorable interest rates to low-income and other qualifying consumers to pay for the replacement of old and inefficient appliances with more energy-efficient appliances.

(iii) *Component 2(b*). Capitalization of the GF (including GEF US$5 million). Provision of funds by SENER to capitalize the existing GF to issue credit guarantees to NAFIN, in support of its lending under the Appliances Replacement Program and protect NAFIN from credit defaults by consumers.

(iii) ***Component 3***: **Technical Assistance (TA) and Institutional Strengthening**. **(Total Cost: US$4.82 million, of which GoM US$2.7 million and GEF US$2.12 million).**

24. This component provided funds to strengthen SENER's capacity to promote energy efficiency activities as well as to strengthen the ability of the different implementing agencies to carry out the Project.

1.8 Revised Components

25. None of the original Project Components, or sub-Components, were revised or dropped from the Project scope. However, the Project underwent *five* Level-2 restructurings, described in detail in footnote 1. The restructurings involved (i) an amendment of the legal agreement prior to effectiveness; (ii) two restructurings involving changes in funding allocations and the disbursement ratio of CTF funds and NAFIN finds; and (iii) two closing date extensions.

1.9 Other significant changes

26. There were no other significant changes made to the project during the implementation period.

2. Key Factors Affecting Implementation and Outcomes

2.1 Project Preparation, Design and Quality at Entry

27. *Soundness of the Background Analysis.* The background analysis was thorough and based on a careful diagnostic of electricity consumption patterns in Mexico. The diagnostic showed that electricity consumption in the residential sector accounted for approximately 25 percent of total electricity consumption in 2008; within the residential sector, 70 percent of household consumption was due to the use of inefficient stoves, heaters, refrigerators, and air conditioners. These end uses, together with lighting, accounted for almost all of residential electricity consumption. Consequently, the analysis of residential consumption in Mexico shaped the project scope and content and helped define the main development objective. In addition, the Bank's experience with energy efficiency programs worldwide enabled it to complement the background analysis with practical lessons based on operational experience.

28. *Project Design.* The design of the Project had a number of innovative features. First, it addressed effectively the different barriers to adopting energy efficiency technologies by providing the needed financial incentives to residential consumers. Specifically, the initial investment cost of more efficient appliances was high, especially for low income consumers. There was also a lack of knowledge amongst consumers about the benefits of energy efficiency programs which was effectively addressed through a nationwide promotional program. Finally, there was also a lack of experience within Mexico's established financial institutions in evaluating energy efficiency programs which made them cautious in extending finance to this new area. Each of these potential constraints was carefully addressed in the project design. Overall, the provision of concessional finance through the blending of IBRD, CTF and GEF resources was an innovative feature, which provided incentives for NAFIN to extend its voucher program, enabled a number of important diagnostic studies to be carried out, and proved important in overcoming the initial barriers to adopting more efficient energy technologies, especially amongst low income segments of the population.

29. In regard to the implementation arrangements, while several different institutions were involved, the presence of NAFIN as the Project's financial agent, provided implementation support and oversight based on its many years of experience with Bank-financed projects. Finally, safeguards concerns were minor and were well handled within the framework of the project implementation responsibilities.

30. *Government commitment.* The government was strongly committed to the Project objectives. It had already taken a series of policy and institutional measures, which laid the ground work for a comprehensive national energy efficiency plan. In November 2008, regulatory legislation, aimed at promoting energy efficiency, was approved. In July 2009, a National Strategy was prepared which established a comprehensive framework for promoting energy efficiency and energy conservation while promoting the increased use of renewable energy. On the financing side, a special TF, i.e. FOTEASE, had been established to provide increased funding for investments in energy efficiency. Finally, an institutional framework was already in place, i.e. CONUEE, whose purpose was to promote the sustainable use of energy at the state, municipal and individual consumer levels.

31. *Assessment of Risks.* During appraisal, a number of risks to the development outcome were identified and specific steps proposed to mitigate these risks. The main risk identified- rated as 'substantial'- was the lack of familiarity of the implementing agency, FIDE, for Component 1 (i.e. replacement of IBs with CFLs) with WB procurement guidelines. A procurement training component was included to mitigate this risk. Several other risks, rated as 'moderate', were also identified and included (i) the speed of market uptake of the CFL and appliance replacement program; (ii) discontinuing the use of CFLs, once the free distribution of CFLs was over; and (iii) the relatively complex implementation arrangements involving a number of different sector entities. Overall, the risks were thoroughly assessed and the proposed mitigation measures- in particular, an effective communications campaign and enacting legislation to phase out the use of IBs were sound, given the limited experience of Mexican trust funds and other sector institutions with implementing energy efficiency programs.

Quality at Entry

32. No Quality at Entry review was carried out by the Bank.

2.2 Implementation

33. Overall, implementation of the project was extremely efficient. Despite a 12 month period to declare the project effective, implementation was not adversely affected. By the end of CY 2011, the initial IBRD disbursement lag had been exceeded and disbursements continued ahead of the forecast schedule until project closing. The IBRD (US$250.625 million) and CTF (US$50 million) loans were fully disbursed by the original closing date of June, 2014 while a one year extension of the GEF grant (US$7.12 million) was required to enable completion of diagnostic studies that laid the basis for extending the energy efficiency program. The main reasons for a successful implementation of the project were (i) a sustained government commitment to the energy efficiency and climate change goals of the operation; and (ii) experienced and well-staffed public sector institutions such as NAFIN, familiar with WB procurement procedures, which coordinated effectively amongst themselves, and maintained a strong commitment to the project's development goals through a change in the federal administration.

34. The implementation of Component 3 (Technical Assistance and Institutional Strengthening, financed with US$2.11 of GEF funding) experienced initial delays due to administrative problems in Mexico in disbursing GEF resources through FOTEASE and, later, to staff changes within the SENER in mid-2013, following a change of administration at the federal level. These delays required a one year extension of the original closing date for the GEF grant (and a final 1-month extension to complete one specific activity within Component 3). Nevertheless, implementation picked up significantly in the final 13 months as a result of close collaboration between SENER and the WB. By October 2015, all of the planned studies had been completed. The analytical results from these studies helped identify priority sectors of the economy on which to base the next phase of the country's energy efficiency program and provide a framework for its longer term sustainability.

35. *Project Restructuring.* The Project was restructured five times through Level 2 restructurings, all relatively minor and summarized in the footnote below [1]. The

[1] **1st restructuri*ng,* August 24, 2011 (prior to effectiveness)**
The first restructuring, approved on August 25, 2011, removed the Energy Efficiency Trust Fund (EE Trust Fund or Fondo de Transición Energética -FTE) as one of the signatories of the "Compact Fluorescent Lamp (CFL) Implementation Agreement" under Component 1 of the Project, and added a remedy in the Legal Agreement to ensure that the transfer of funds from the EE Trust Fund to the CFL Administrator (FIDE) occurred according to the revised CFL Implementation Agreement and the Operational Manual.

2nd restructuring July 31, 2012
The purpose of the restructuring was to reallocate funds between project components and to revise the percentage of expenditures financed in order to improve project results. The project development indicators remained unaltered. There were no implications for the PDO, CTF transformational impact, or the CO2 reduction targets. Specifically, the restructuring: (i) Reallocated US$8.513 million from Component 1: Replacement of Incandescent Bulbs with Compact Fluorescent Lamps (CFLs) to Component 2: Incentives to Encourage the Replacement of Old and Inefficient Appliances in the Residential Sector; and (ii) Changed the disbursement ratio of CTF funds and NAFIN funds from 60% -40% to 90% -10% under the CTF Loan (TF 098062);

restructurings (i) helped streamline implementation arrangements prior to effectiveness; (ii) reallocated unused funds under Component 1 to Component 2 and changed the disbursement ratio between CTF and NAFIN funds; and (iii) extended the closing date of the GEF grant to enable completion of a number of strategic studies that have provided the analytical basis on which to expand further the government's energy efficiency program. Together, the project restructurings were pragmatic steps taken to help achieve the main development objective and the longer term sustainability of the energy efficiency project.

36. *The Mid-Term Review (MTR)* took place as planned in April 2013. With project disbursements well advanced, the MTR mission focused on pending issues that still needed to be addressed to bring the project to a successful conclusion. These included: (i) reaching agreement on steps needed to put in place a national environmental policy for the proper disposal and recycling of CFLs, once their useful life was over; (ii) reviewing a report on the social impact (of Component 1) in very low income regions of the country, including in indigenous communities (see map in Annex 5); (iii) reaching agreement on the specific studies that would be undertaken with the remaining GEF grant funds; and (iv) agreeing on revised methodologies for measuring energy savings and avoided CO2e emissions based on actual energy savings under the two main components of the project.

37. *Bank Supervision.* Overall, the project was closely supervised during the four-year implementation period from 2011-2015. Effective supervision support provided from the local Country Office (CO) to SENER over the final 18 months enabled completion of several GEF funded diagnostic studies, which have provided a rationale for continuation of the government's energy efficiency program into new sub-sectors of the economy and enhanced prospects for its longer term sustainability.

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

38. *M&E Design.* The M&E framework for the project comprised a single outcome indicator for the PDO and a single outcome indicator for the GEO. The key PDO chosen to measure the impact of the different energy efficiency investments was the amount of energy 'saved', measured in GWh; for the GEO, the unit chosen was the emissions

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3rd restructuring, March 4, 2013
This level-two restructuring reallocated US$4.883 million from *Component 1: Replacement of Incandescent Bulbs with Compact Fluorescent Lamps (CFLs)* to *Component 2: Incentives to Encourage the Replacement of Old and Inefficient Appliances in the Residential Sector*. The reallocation did not affect the original targets of either component.

4th restructuring, June 24, 2014
This restructuring extended the GEF Grant's (TF098465) closing date by 12 months from June 30 2014 to June 30 2015. The closing date extension was needed to allow time to complete pending TA activities, which had faced delays due to initial administrative problems in Mexico in disbursing GEF resources through the EE Trust Fund and staff changes within SENER in mid-2013, following a change of government.

5th restructuring, June 29, 2015
The fifth restructuring extended the closing date of the GEF grant a second time by one month, from June 30 until July 30, 2015, in order to allow completion of a public awareness campaign for the promotion of energy efficiency in movie theaters, which was to be the focus of the next phase of the government's energy efficiency program.

reduction in GHG measured in tons of CO2 equivalent. Both indicators were appropriate to measure progress being made towards these objectives. In addition, intermediate indicators were chosen for each of the three project components to monitor physical progress being made: i.e. the number of IBs, refrigerators, and air-conditioners replaced per month or per year. The intermediate indicators selected were the following: (i) *Component 1*: the number of CFLs distributed; (ii) *Component 2*: the number of refrigerators and air conditioners exchanged in the appliance replacement program; and (iii) *Component 3*: development of recycling centers and disposal schemes, number of studies undertaken, and number of staff trained. Overall, the design of the M&/E was appropriate.

39. *M&E Implementation*. Responsibility for M&E implementation was shared between (i) SENER and FIDE for Component 1; (ii) NAFIN and FIDE for Component 2; and (iii) SENER and CONUEE for Component 3. NAFIN already had extensive experience in implementing WB projects, and the energy savings data was collected regularly and closely monitored during implementation.

40. *M&E Utilization.* The data collected on energy savings during implementation had an important influence in adjusting the original estimates made during appraisal in regard to energy savings, in particular under the household appliance replacement program (Component 2). During the MTR, a single methodology for reporting energy savings and avoided tons of CO2e emissions was agreed with SENER, which was subsequently used in all future communications with the Bank (see Annex 2 for details). Reaching agreement on a single methodology was important since the project was receiving public scrutiny due to the findings of independent evaluators using different methodologies. From April 2013 onwards, the reporting methodology agreed by the Bank and the GoM was based on savings estimated from actual data both for replaced IBs[2] and appliances replacement energy savings programs. Consequently, the actual data collected during implementation had an important influence in assessing more precisely the economic benefits derived from these two energy savings programs

2.4 Safeguard and Fiduciary Compliance

Safeguards

41. The Project triggered two safeguard policies: Environmental Assessment (OP/BP/GP 4.01) and Indigenous Peoples (OP/BP 4.10). The Project was classified as a Category B project, with minor adverse environmental impacts and no adverse social

[2] For Component 1, it had been assumed that the CFLs would be 23 Watts (W) and all the IBs replaced would be 100W, with a consequent saving of 77W per replacement. However, in practice there were some 20W IBs, 40W IBs, and 60 W IBs replaced as well as 100W IBs. Consequently, a new replacement 'average' needed to be calculated. Similar 'adjustments' were also made to the original savings estimates for Component 2.

impacts. In contrast, the environmental benefits resulting from energy efficiency improvements were considerable and included reductions in local air pollution and in GHG emissions.

Environmental

42. The two main environmental concerns identified during appraisal were: (i) the proper disposal of used IBs and; (ii) the disposal of old refrigerators and air conditioners. The disposal of the IBs was the direct responsibility of the CFL supplier and was managed effectively in a controlled landfill that was operating properly in Irapuato, Mexico. The disposal of refrigerators and air conditioners was the most important part of the Project´s environmental safeguards and the recovery of refrigerant gases and recycling of materials was achieved in more than 100 recycling centers all over the country. Additionally, in July 2015, a study was completed as a first step in preparing a national strategy for the recycling of CFLs, which would include, inter alia, recommended steps for the safe and environmentally sound disposal of harmful substances such as mercury.

Fiduciary

43. The financial management (FM) arrangements, in terms of accounting, budgeting, flow of funds, internal control and financial reporting throughout the Project life, were relatively complex, in particular the flow of funds under Component 2. At the time of appraisal, the residual financial risk was considered as 'Moderate'. During implementation, the FM performance was generally adequate, the main concern being that the project financial management reports were being submitted to the Bank with frequent delays. The FM rating in the final ISR was Moderately Satisfactory. NAFIN, in its capacity as the Project's financial agent, provided the implementation support and oversight, based on its many years of experience with Bank-financed projects.

Procurement

44. Procurement carried out under the project was the responsibility of SENER and FIDE. The procurement bidding was managed satisfactorily and was rated as 'satisfactory' throughout implementation; NAFIN again provided implementation support and oversight. It is also worth noting that procurement carried out under Component 1 involved an innovative strategy: the awarded contractor was responsible not only for supplying the first 22.9 million CFLs but also for distributing them through major retail stores, as well as collecting and disposing the replaced IBs. This approach allowed bidders to benefit from economies of scale and, therefore, make more efficient use of IBRD resources.

45. The procurement process for the IBRD-funded *Luz Sustentable 1* (Component 1) was successfully completed early in project implementation. The contract was awarded and signed and replacement of CFLs began on July 5th, 2011. The GoM implemented *Luz Sustentable 2* using counterpart resources.

2.5 Post-completion Operation/Next Phase

46. *Future Operations.* The Efficient Lighting and Appliances Project has already resulted in follow up interventions which the GoM is financing with its own resources (further replacement of IBs in locations which had yet to benefit from *Luz Sustentable 1* and *2*). In addition, the TA activities under Component 3 included a diagnostic of potential energy efficiency investments in 30 municipalities across the country, through the application of a special diagnostic instrument, i.e. the Tool for the Rapid Assessment of City Energy (TRACE). These diagnostics helped identify priority areas for energy savings as part of a larger national municipal energy efficiency program and paved the way for a new investment program – which was recently negotiated for a US$100 million IBRD loan – and which seeks to reduce energy consumption in selected municipalities by increasing their capacity to prepare, finance and implement energy efficiency investments in these municipalities. The Project would address, inter alia, a core concern of Mexican municipalities- namely, the high expenditures on street lighting, lighting for government buildings, water supply and wastewater treatment -and is a logical extension of the Efficient Lighting and Appliances Project. More generally, the GoM remains interested in continuing its partnership with the WB on the topic of EE. There have been discussions about a new project on EE in hospitals and/or schools (following up on the diagnostic study assessments completed under Component 3).

47. *Performance Indicators for Future Monitoring.* The performance indicators used in the current operation i.e. aggregate amount of energy saved (GWh) together with emissions avoided (tonCO_2e), will continue to be used to monitor energy savings in energy efficiency. An important lesson emerging from the current operation is to make sure (i) good quality baseline data exists against which to measure accurately aggregate energy savings; and (ii) project indicators based on energy savings need to take into account not only 'technical' savings from more efficient lighting and appliances but also possible changes in energy consumption behavior that result from use of more efficient equipment.

3. Assessment of Outcomes

3.1 Relevance of Objectives, Design and Implementation

Rating: High

48. The main PDO, i.e. to promote the efficient use of energy and to mitigate climate change, was highly relevant and closely aligned with the government's own development priorities. The government's five-year (2007-2012) Energy Sector Strategy (*Estrategia Nacional de Energía, ENE*) gave high priority to improving energy efficiency in Mexico's residential sector and to achieving its climate change goals through the development of the country´s renewable energy potential. The GEO was similarly aligned with the government's 2007 ENACC, which made climate change an integral part of its development policy. At the time of project preparation in 2010, the government was already embarked on its five-year ENE whose specific goals were to increase efficiency in

the use of energy, and hence reduce the use of fossil fuels. These goals continue to have a very high priority in the government's current development program. Consequently, the project and global environmental development objectives have high relevance while government commitment to these objectives remains strong.

49. The project's development objectives were fully consistent with the WB's CPS for Mexico for the period FY 2008-2013, which focused on strategic areas such as assuring environmental sustainability and supporting government efforts to integrate climate change considerations into its infrastructure and social programs; these strategic areas continue to be high priority areas in the current CPS for Mexico. Finally, the project was also consistent with the GEF's Climate Change Focal Area- specifically with the GEF Operational Program 5 on EE and its climate change strategic programs.

50. *Project design* was based on a careful analysis of past energy consumption trends, which helped identify the project's two main components. The decision to focus on Mexico's residential sector, where energy consumption had been growing faster than GDP, was critical to achieving the government's energy efficiency goals: home appliances, air conditioners, and lighting were quickly identified as the main contributors to residential consumption. Another important finding of the early diagnostic work was the realization that, despite subsidized electricity tariffs consumers, there would still be sufficient incentive to replace inefficient appliances. In addition, there was an awareness of the barriers to adopting energy efficiency technologies and, consequently, the importance of incorporating financial incentives into the project design to overcome the initial high investment costs and the need for concessional financing; these incentives turned out to be critical to ensuring project success. Finally, the project's scope was not overly complex. It was limited to priority investment areas essential to achieve the development objectives while strengthening further the institutional capacity of the main sector secretariat. Overall, the project design was highly relevant.

51. Project implementation arrangements were also soundly based. The implementation arrangements built on past familiarity with Bank operations in institutions such as NAFIN while using a dedicated Project Implementing Unit (PIU, or UREP for its acronym in Spanish) within a key directorate in SENER to provide monitoring, financial management, and reporting for the project. Capacity building was also provided under the GEF grant to strengthen the capabilities of key directorates within SENER. The implementation arrangements were also highly relevant.

3.2 Achievement of Project Development Objectives and Global Environment Objectives

Rating: High

52. The PDO - namely, to promote the efficient use of energy and to mitigate climate change effects by the promotion of energy efficient technologies at the residential level – has been substantively achieved. By project closing, the accumulated energy savings (measured in GWh) were 92.42 percent of the original target. With regard to Component 1, the number of IBs replaced by CFLs exceeded the original target; this component has

also had an important impact on low income communities, including indigenous communities, in some of the poorest regions of Mexico (See map in Annex 5). Finally, because of the scale of the achievement, the first phase of the CFL program (*Programa Luz Sustentable 1*) entered the Guinness Book of Records for the largest amount of IBs replaced with CFLs at no cost to the final consumer (22.9 million). With regard to Component 2, the target number of appliances replaced exceeded the original estimate though the accumulated energy savings realized for this component were less than those estimated at appraisal. Overall, the achievement of the project outcome and intermediate outcome indicators for Components 1 and 2 is very close to the original targets.

53. With regard to Component 3, the different studies and capacity building activities were completed, though with one year delay when compared to the original schedule. At the same time, the diagnostic studies, carried out with support of GEF funds, have now laid the basis for extending the government's energy efficiency program into new areas, such as the health, hotel and public education sectors of the economy as well as strengthening the institutional capacity of SENER. Based on the above considerations, the achievement of the project development objective is rated **High.**

54. The table below summarizes progress made towards the main PDO/GEO indicators.

Table 1: Achievement of PDO and GEO indicator

PDO Indicator	**Baseline**	**End Project Target**	**Actual**	**% Achieved**
Accumulated amount of GWh Saved	0	10,000	9,242	92.42%
Intermediate Indicators				
Number of IBs replaced with CFLs	0	45 million	45.8 million	101.78%
Number of appliances replaced	0	1.7 million	1.884 million	106.44%
GEO Indicator (Metric tons)				
Accumulated associated CO2 emissions reductions (thousand tons of CO2)	0	5,140	5,074	98.72%

55. With regard to the GEO objective, this indicator (measured in tons of CO2 equivalent) was also achieved, with the calculations carried out using an agreed methodology reached between the Bank and the GoM (SENER and FIDE) during the April 2013 mission. This methodology took into account reductions from the capture of refrigerants gases, which were not included in the original results framework.

3.3 Efficiency

56. An ex-post economic and financial analysis of the Project was carried out to evaluate the efficiency of the Project and verify its financial and economic viability as presented in the Project Appraisal Document (PAD). In line with the methodology used at appraisal, the economic analysis looked at the costs and benefits accruing to Mexico, including not only the actual values related to capital equipment and operating costs, but also the monetized environmental benefits. The financial analysis compared the costs and benefits under Component 2 from the perspective of NAFIN.

57. The economic benefits used at the time of appraisal were: (i) the electricity savings resulting from substituting more efficient CFLs and appliances for the less-efficient models currently in use, valued at the 'economic' price of electricity; and (ii) the global environmental benefits were estimated by using the GHG emissions resulting from reduced fuel consumption and multiplying it by the market price of carbon. Although economic benefits derived from energy efficiency investments in lighting and appliances include a range of additional benefits (such as delays in building new power capacity, health benefits due to reduced local air pollutants, and other social well-being benefits) for the purpose of this ex-post economic analysis, the same economic benefits were used as at the time of appraisal to allow for comparability of ex-ante and ex-post analyses.

58. Tables 2 and 3 below summarize the results of the economic and financial analysis of the Project calculated in the PAD at the time of appraisal in comparison with the results at project closing. The overall economic analysis was computed by adding the costs and benefits of Components 1 and 2. The economic rate of return (ERR) for the Project overall is 62 percent, with a Net Present Value (NPV) of $ 1.62 billion at a 6 percent discount rate[3]. The results for each Component are listed in Table 2 below.

59. The financial analysis was carried out from the perspective of NAFIN as owner of the line of credit to consumers under Component 2. The credit line financed 1,884,129 appliances (i.e. 1,682,802 refrigerators and 201,327 ACs). The Financial Internal Rate of Return (FIRR) of Component 2 is 9 percent and the undiscounted payback occurred after 6.5 years. Discounting Project cash flows at the weighted average cost of capital of 5.4 percent, the NPV of the Component is US$14.92 million. Both analyses are detailed in Annex 3.

[3] The World Bank technical guidance note on discount rates of January 16th 2016 recommends a discount rate in the range between the real GDP per capita growth rate and double that figure. Real GDP per capita growth rates in Mexico have averaged 1.9% over the last five years.

Table 2: Project Economic Results (revised vs. original)

	REVISED		ORIGINAL	
	NPV	**ERR**	**NPV**	**ERR**
Component 1	$1,500,932,659.66	145%	$600,000,000	182%
Component 2	$114,682,328.49	11%	$260,000,000	21%
Project	$1,615,614,988.15	62%	$860,000,000	40%

Table 3: Project Financial Results (revised vs. original)

REVISED		**ORIGINAL**	
NPV(million)	**FIRR**	**NPV(million)**	**FIRR**
US$14.92	9.01%	US$15.00	7.40%

60. The calculation of the Project's economic benefits was based on the electricity savings resulting from substituting more efficient CFLs and appliances for the less-efficient models currently in use, valued at the price of electricity. The Project's environmental benefits were estimated by using the GHG emissions resulting from reduced fuel consumption and multiplying it by the market price of carbon.[4]

61. The CFL and appliance substitution took place over a five-year period with the detailed deployment schedule shown in Annex 3. Electricity savings from CFLs were calculated using the energy savings per CFL compared to the baseline incandescent bulb that they would replace. Actual energy savings for Component 1 turned out to be higher than originally estimated savings (approximately 109 percent of target). At the time of project preparation, it was assumed the Project would replace 40 and 60W IBs. However, 86.74 percent of the IBs replaced under *Luz Sustentable* 1 were 75W and 100W IBs. The average capacity of IBs replaced was 76.27W (compared to 73W as originally assumed) and was applied to both phases, i.e. *Luz Sustentable 1* and *2*. In addition, the life of a CFL was assumed at appraisal to be 3,832 hours instead of the actual 9,000 hours.

62. For Component 1, the increased NPV is due to the (i) higher number of CFLs distributed (45.8 million vs. 45 million); (ii) higher lifetime of the CFL bulbs (7 years compared to 3 years) and (iii) higher energy savings achieved due to replacement of 75W and 100W IBs instead of 40W and 60W IBs. The lower ERR is due to higher cost of Component 1 (US$120 million compared to initial US$70 million).

[4] For the purpose of this analysis an average carbon price of US$7 per ton was used compared to the original assumption of US$10 per ton. The reduction of the market price of carbon represents the average value of a volatile carbon price of the past years (between US$5- $10 per ton).

63. Component 2 has a lower economic benefit than originally assumed because of lower actual energy savings (2,248 GWh vs. 3600 GWh) as compared with estimates at appraisal. At the same time, project costs for Component 2 increased from US$603 million to US$853 million, resulting in a decrease of the ERR (from 21 percent to percent) and NPV (from $260 million to $115 million) for the economic analysis of this component.

64. The higher financial benefit of the Project is due to higher injected capital from NAFIN (US$374 million instead of US$95 million) increasing the loan size under the credit line and increasing the revenues from interest rates.

65. Based on the overall higher economic and financial returns of the Project, the efficiency for the overall Project is rated as **High**.

3.4 Justification of Overall Outcome and Global Environment Outcome Rating
Rating: Satisfactory

66. The main project and global environmental objectives have been substantively achieved. They also continue to have *'high'* relevance for the government in its future development program. Energy efficiency programs are still ongoing while the government's commitment to climate change and the development of is renewable energy potential, as evidenced at the recent COP21 climate summit, is still strong. In addition, re-evaluation of the economic and financial rates of return confirms that the investments undertaken are economically and financially viable. Furthermore, the GoM has committed additional resources to expand the lighting replacement program to low income communities in Mexico, while the appliance replacement is also continuing with finance provided from the government's own resources. Based on the above considerations, the overall outcome rating is rated '**Satisfactory'.**

3.5 Overarching Themes, Other Outcomes and Impacts
(a) Poverty Impacts, Gender Aspects, and Social Development

67. The energy efficiency program has had an important impact on low income communities, including indigenous communities, in some of the poorest regions of Mexico. More specifically in regard to Component 1, approximately 740,000 CFLs (out of a total of more than 45 million CFLs distributed nationwide) have been distributed to (i) 15 municipalities with very high poverty indices, and to (ii) 23 other municipalities, with average poverty indices. These include municipalities in the four poorest states of Mexico: Chiapas, Oaxaca, Guerrero, and Hidalgo. They also include the distribution of CFLs in three largely indigenous communities in the states of Hidalgo, Oaxaca and Yucatan (see Map in Annex 5).

(b) Institutional Change/Strengthening

68. The TA and institutional strengthening component (Component 3), financed with GEF funds, made an important contribution to strengthening the capacity of the main sector secretariat, SENER, which was responsible for implementation and continuation of Mexico's national energy efficiency program. In addition, funds were used to finance training courses to strengthen the technical capacity of the government in areas directly related to the country's energy efficiency program - in particular, technical training courses to capture refrigerant gases as well as training for personnel in commercial banks on lending for energy efficiency investments.

(c) Other Unintended Outcomes and Impacts

69. There have been a number of smaller, indirect impacts arising from the project. There was an increase in jobs -albeit temporary- due to the operation of the recycling centers for appliances; the recycling plans for CFLs could have a similar effect. The project itself has led to an updating of energy efficiency standards countrywide. There have also been important follow up interventions in different municipalities of the country indicating the successful expansion and consolidation of the energy efficiency program. Also, the communication campaigns designed during project implementation had a profound behavioral impact on the general population and, as a result, a significant portion of the Mexican population is now more aware of energy efficiency measures, impacts and benefits. Finally, as noted earlier in Paragraph 52, the GoM was given a World's Guinness Book of Record award for the largest IB exchange program at no cost to the final consumer (*Luz Sustentable 1*); such a recognition strengthened Mexico's international image as a country fully committed to fight climate change and its associated impacts.

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

70. A consulting firm, specializing in the design, implementation, evaluation and financing of energy efficiency programs and projects, was hired by SENER to carry out an impact assessment of the Mexico Efficient Lighting and Appliances Project. This assessment was carried out from June-October, 2015, and included the surveys for both beneficiaries and non-beneficiaries of the project. The main findings are summarized below and described more fully in Annex 5.

- **Component 1: Benefits of using CFLs** – 47 percent of the beneficiaries reported that the most important benefit of CFLs in comparison to incandecent bulbs was that the CFL light was brighter. This result was expected as CFLs are more light-intense than IBs. 25 percent resported that the quality of light increased with CFLs, and 1 in 5 (22 percent) answered that CFLs lasted longer than an incandescent bulb.

- **Component 2**

  (a) Refrigerators

  - **Beneficiaries Satisfaction** – 9 out of 10 (87 percent) survey respondents were satisfied with their participation in the program "*Cambia tu viejo por uno nuevo*"; in fact 57 percent rated the program with the highest possible score (10 out of 10). In general, beneficiaries were highly satisfied with the different aspects of this program. A vast majority gave a rating of 8 or more out of 10 to the most relevant aspects of the program (standby time of their appointment to collect their appliance (9.1); employees' responsiveness to requests and inquiries in a timely manner (9.0); the dealer ability to provide information (8.9)).

  (b) Air Conditioners

  - **Beneficiaries Satisfaction** – Almost all survey respondents (94 percent) were satisfied with their participation in the program; in fact, 2 out of 3 (63 percent) gave the highest rating level. Among the people less satisfied with the program (40 percent), the main reason was that they did not notice any energy savings in their power bills. 23 percent of the survey respondents were not completely satisfied due to technical problems with the replaced air conditioners. In general, beneficiaries were highly satisfied with different aspects of the program (standby time of their appointment to collect their appliance (9.2); employees responsiveness to requests and inquiries in a timely manner (9.2); and the dealer ability to provide information (9.1).

4. Assessment of Risk to Development Outcome and Global Environment Outcome

Rating: Low to Negligible

71. At the time of project approval in 2010, the government was already strongly committed to energy efficiency investments. In parallel, it was also strongly committed to climate change goals and to the development of the country's renewable energy potential. During the 5-year project implementation period, government commitment to the project development goals has strengthened. Additional resources are being committed to the appliance replacement program as well as to the IB lighting replacement program, which is being expanded into rural areas of Mexico. Finally, the government has taken a number of measures which will help strengthen prospects for the program's sustainability. These measures include phasing out the use of IBs completely and updating the country's energy efficiency standards.

72. The government's commitment to climate change measures has also strengthened, with specific undertakings under the COP 21 agenda in December 2015. The experience of sector and financing institutions in energy efficiency activities has grown while an effective monitoring system to measure progress is now in place. These programs are

continuing without Bank support. Based on progress made over the past 5 years, the risk to the development outcomes in the future is considered 'low to negligible'.

5. Assessment of Bank and Borrower Performance

5.1 Bank Performance

(a) Bank Performance in Ensuring Quality at Entry
Rating: Satisfactory

73. The main contribution of the Bank during project preparation was in identifying the need for concessional financing in helping scale up the investment program. The provision of concessional financing was a key factor in overcoming consumer barriers-such as the high initial cost of more efficient appliances and the lack of incentives to purchase more efficient equipment. The Bank was able to address each of these barriers effectively during preparation, channeling concessional finance through NAFIN and providing GEF funds to capitalize an existing guarantee facility to protect NAFIN from credit defaults by consumers. These early design inputs were critical to ensuring the effectiveness of the government's ongoing energy efficiency program and proved to be vital inputs that led eventually to a successful outcome.

74. At the time of preparation, the Bank was already an active partner with Mexico in providing support for different energy savings and climate change programs. It was also actively involved in supporting energy efficiency programs in other developing countries. As a consequence, it was not only familiar with Mexico's energy efficiency and climate change programs but it was also able to apply the benefits- and lessons- in designing and implementing similar energy efficiency programs in other developing countries. Finally, the provision of concessional finance and Bank experience elsewhere with energy efficiency programs brought value added to its partnership with Mexico in these programs.

75. Based on the above considerations, Bank performance in project preparation is rated *Satisfactory.*

(b) Quality of Supervision
Rating: Satisfactory

76. Bank supervision covered a 5-year period from Board approval in November 2010 until the final disbursements from the GEF in October 2015. Components 1 and 2 were completed within the original 4-year implementation period while a one-year extension of the GEF grant was required to enable completion of Component 3. A small amount the original US$7.12 million GEF grant was canceled, i.e. US$150,000, mainly due to the appreciation of the USD with respect to Mexican peso during the last year of implementation.

77. Over this period, a total of 8 Bank supervision missions were undertaken, the final supervision mission taking place in February 2015 and focusing on the remaining GEF funded activities under Component 3. There were three changes in task team leaders during the supervision of the project; however, the presence of procurement, financial management, and environmental specialists in the Mexico CO provided continuity and additional support for the Bank supervision effort. During the supervision of the project, two minor restructurings of the project were undertaken efficiently and did not adversely affect implementation. Working relations between Bank supervision teams and the main implementing agencies was effective.

78. The Bank took a pro-active role with the government in regard to the extension of the closing date for the GEF grant. In the final 12 months, these funds financed valuable diagnostic studies which have provided the analytical basis on which to continue the government's energy efficiency program into new areas. Hence, despite earlier implementation delays with the GEF grant, the funds were productively used. They have also strengthened the capacity of the main government institution, SENER, which will play the main leadership role in expanding the energy efficiency program. Based on the above considerations, Bank performance during supervision is also considered Satisfactory.

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

79. Based on satisfactory ratings during both preparation and supervision, the rating for overall Bank performance is also considered *Satisfactory.*

5.2 Borrower Performance

(a) Government Performance
Rating: Satisfactory

80. The Borrower for the IBRD loan (US$250.625 million) and for the GEF grant (US$7.115 million) was the GoM while the Borrower for the CTF loan ($50 million) was NAFIN, one of Mexico's national development banks.

81. GoM was strongly committed to the project development goal of increasing efficiency in the use of energy and mitigating climate change effects. Prior to any Bank financial involvement, the government had already taken concrete steps to put in place key policy, institutional, and financing instruments needed to achieve this development goal. A regulatory law to provide an enabling environment for energy efficiency had been signed into law in November 2008. A national strategy had been prepared, aimed at promoting energy efficiency and energy conservation. A 5-year energy sector program had also been prepared with three main goals: primary energy diversification; a doubling of energy savings; and promotion of energy efficiency in the residential sector. Finally, in the financing and institutional areas, a special trust fund had been established to facilitate this energy transition and a new commission for the efficient use of energy was established to

promote the efficient use of energy at the national level. Together, these measures provided the enabling sector framework to achieve the project's development goal.

82. By the time of Board approval in late 2010, implementation of the different energy efficiency programs was already underway. GoM, through SENER, continued to provide strong support during implementation of key energy efficiency programs, including through a change of national government in 2012. An example of GoM commitment was that the Mexican Official Standard NOM-028-ENER-2010 (*Norma Oficial Mexicana, NOM*) was amended to phase out IBs completely by 2014. Despite delays in utilizing the TA and institutional component, which required a one year extension of the GEF, the government was able to make almost full use of these funds in financing diagnostic studies that have laid the basis for new investment in energy efficiency programs. NAFIN also played an effective financial intermediary role in assuring concessional funding for the government's priority energy efficiency programs. Based on the above considerations, overall Borrower performance is rated *Satisfactory*, while its policy and institutional commitment to the goal of improved energy efficiency and climate change mitigation serves as an example for other middle income developing countries to follow.

(b) Implementing Agency or Agencies Performance
Rating: Satisfactory

83. The main responsibilities for implementation were as follows: (i) *Component 1*, CFL replacement program, was the responsibility of FIDE, an independent trust fund with responsibility for implementing energy efficiency programs; (ii) *Component 2*, Appliance Replacement program, was shared between FIDE, CFE, and NAFIN; and (iii) *Component 3*, Technical Assistance (TA) and Institutional Strengthening, was the responsibility of the Directorate of Research, Technological Development and Environment within SENER (which was later replaced by the Directorate of Energy Efficiency and Sustainability).

84. The implementation arrangements were relatively complex, involving several energy sector and financing institutions, with SENER responsible for overall oversight. Despite the large number of institutions participating in the overall project, coordination between these entities was effective. Notwithstanding two extensions to the original effectiveness date of the IBRD loan, implementation of Components 1 and 2, already underway, continued on track with the planned schedule. When the project eventually became effective in late 2011, disbursements picked up quickly and then exceeded the original disbursement schedule. The past experience of FIDE in implementing energy savings investments in different regions of Mexico, together with the effective working partnership it maintained with CFE and NAFIN, was the main reason implementation proceeded smoothly over the 4-year implementation period. In addition, this working partnership enabled close and effective relationships with consumers in different regions of Mexico, which involved explaining the cost and design options of the appliance exchange on a house to house basis.

85. The large procurement contract -for the supply of CFLs to replace IBs under *Luz Sustentable 1*- elicited broad international interest from six suppliers, and, as a result, a low

unit replacement cost to the consumer than had been estimated at appraisal; the bidding process and contractual award were well handled. NAFIN was also effective in providing consumer credit on a large scale for the appliance replacement schemes.

86. The main concerns during supervision were delays in submitting financial reports to the Bank, and the delays incurred in carrying out the GEF funded TA component.

87. Despite delays in implementing the TA and Institutional Strengthening component, SENER had completed a series of diagnostic studies by project closing which has provided a framework to justify further investment in energy efficiency in areas of the economy, such as hospitals and hotels, which had not previously been addressed.

88. Overall, based on the progress made in implementing the three components of the project, the implementation performance of the different implementing agencies is considered *Satisfactory.*

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

89. Based on satisfactory ratings of the government and the different implementing agencies, the overall performance of the Borrower in preparing and implementing the project is also considered *Satisfactory.*

6. Lessons Learned

90. *Value of Strong Government Commitment to the PDO*. The Project demonstrates the importance of strong government commitment in helping achieve the project objectives. It also underscores the basic steps, and accompanying policy actions, that comprise 'strong government commitment'. At the time of project preparation in 2009, Mexico had already developed a national strategy, which laid the groundwork for the implementation of an energy efficiency and climate change investment program, supported at the highest levels of government. Essential policy and institutional steps needed to achieve the goals of this program were in place. The participating institutions were well staffed to enable investment program coverage countrywide. Given the commitment of the government to the project, the main challenge for the Bank was how to most effectively target its financial support for the government investment program -in terms of concessional financing instruments and experience gained in similar programs elsewhere- to improve prospects for achieving the development objectives. The basic lesson from this project is that government commitment - in terms of putting in place essential policy and institutional steps - improve considerably prospects for achieving the development objectives.

91. *Value of a full package of Bank financing instruments for successful design and implementation.* A key element during preparation, which helped achieve the project objectives, has been the design of the project, in particular the combination of financial,

institutional, and promotional instruments brought together to enable successful interventions in bringing about energy savings. The barriers to adopting energy efficiency technologies in Mexico were carefully studied. They included: (i) the high initial investment costs of more efficient appliances; (ii) a lack of incentives to use more efficient appliances; (iii) the absence of credit profiles of the potential residential customers; and (iv) lack of any banking experience in energy efficiency savings. Each of these potential constraints was addressed before any Bank financial involvement. The IBRD loan helped shifting the market for CFLs and provided relevant subsidies for low-income appliance customers; the CTF loan provided concessional financing without which NAFIN would have pulled out of the appliance replacement or would have sought other sources of financing such as the IDB; the GEF grant helped design and implement a solid financial package (through the capitalization to the GF) and contributed to strengthen Mexico's institutional capacities (through the TA activities).

92. Collectively, the attention given to these potential barriers in the early design phase enabled effective use of different Bank financing instruments. The main lesson is that careful analytical work, invested at the early stages of project preparation, provides the best prospects for achieving the development objectives. A clear example of such success is that the GF for component 2 was rarely used, as the collecting payment mechanism (through the electricity bill) proved to be highly effective. Nevertheless, future interventions might draw from this experience to mitigate risks against payment defaults.

93. *Value of Effective Promotional Campaigns in National Energy Efficiency Programs.* An active and sustained promotional program using the national communications media has been a key factor in bringing about a major social change in the way Mexico's population consumed energy. It has also been a key factor underlying the success of this project. Given the government's decision not to increase energy prices to the consumer, it was essential to develop a national awareness of the adverse effects of unlimited energy consumption across all strata of the population. The promotional campaign had an added urgency in the context of declining national petroleum production and increased fiscal pressures on public resources. The government's sustained promotional campaign has been key to the success of its energy efficiency program. In a country with enormous diversity in income and literacy levels, the government mounted an extremely effective promotional campaign, including through popular national '*telenovela*' programs, which were successful in building an awareness of the importance of energy savings in remote, low income communities, including in indigenous communities. The promotional campaign was complemented by household to household consumer visits by the appliance suppliers, explaining the benefits of more efficient refrigerators and ACs, the financing terms for their purchase, and the benefits that would be realized in terms of lower energy consumption and monthly bills. In summary, an effective promotional campaign is a critical input for all energy efficiency programs. The particular campaign carried out by Mexico can benefit other developing countries contemplating a national energy efficiency program.

94. *Importance of a well-designed Monitoring and Evaluation Framework for Energy Efficiency Programs.* Given the relative complexity involved in measuring accurately the

impact of different energy efficiency programs, a carefully designed M&E framework is important to assess the overall cost effectiveness of a national program. In addition to savings resulting from the more efficient design of refrigerators, air conditioners, and other appliances, possible behavioral changes of the consumer need also to be considered. This is particularly important if the unit energy cost of electricity to the consumer is unchanged. Consequently, an effective monitoring and evaluation framework should measure not only energy savings attributable to more efficient appliances but also possible changes in the consumption behavior of the consumer following the acquisition of these appliances. Such behavioral changes may offset the energy savings resulting from the purchase of more efficient appliances; hence, the importance of monitoring the monthly consumption patterns. Beyond these behavioral changes, there is also a need to capture other project impacts related to well-being. These might include longer periods of night time illumination in homes and businesses; greater safety from improved street lighting; and more comfortable living levels for greater periods of time. In summary, the main lesson is that energy savings measured in isolation are not sufficient to assess the effectiveness of an energy efficiency program. Behavioral changes in energy consumption need also to be taken into account in order to have a true measure of the cost effectiveness of a national energy efficiency program.

95. *Value of innovative procurement strategy.* Component 1 involved an innovative and holistic procurement strategy, which went beyond conventional strategies: the awarded contractor was responsible not only for supplying 22.9 million CFLs but also for distributing them through major retail stores, as well as collecting and disposing the replaced IBs. In addition, the same contractor was also responsible for a dissemination campaign. Such an approach allowed bidders to benefit from economies of scale and therefore make efficient use of IBRD resources. This innovative procurement approach, together with the knowledge derived from its design and implementation, constitutes a useful example of a public good service for all WB country clients.

7. Comments on Issues Raised by Borrower/Implementing Agencies/Partners

***(a) Borrower/implement*ing agencies**

Comments have been received from SHCP, SENER, NAFIN and FIDE, and were included in the main text.

(b) Co-financiers

Not applicable.

(c) Other partners and stakeholders

(e.g. NGOs/private sector/civil society)

No issues were raised by other partners / stakeholders.

Annex 1. Project Costs and Financing

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

Efficient lighting and appliances - P106424			
Components	**Appraisal Estimate (USD millions)**	**Actual/Latest Estimate (USD millions)**	**Percentage of Appraisal**
Component 1	70.00	120.01	171.44%
Component 2	602.99	848.38	140.70%
Component 3	4.82	4.82	100%
Total Baseline Cost	**677.81**	**973.21**	**143.58%**
Physical Contingencies[5]	0.00	0.00	NA
Price Contingencies	32.28	0.00	0 %
Total Project Costs	**710.09**	**973.21**	**137.05%**
PPF	0.00	0.00	0.00
Front-end fee IBRD	0.63	0.63	**100%**
Total Financing Required[6]	**710.72**	**973.84**	**137.02%**
MX GEF Efficient lighting and appliances - P120654[7]			
Components	**Appraisal Estimate (USD millions)**	**Actual/Latest Estimate (USD millions)**	**Percentage of Appraisal**
Component 1	70.00	120.01	171.44%
Component 2	602.99	848.38	140.70%
Component 3	4.82	4.82	100%
Total Baseline Cost	**677.81**	**973.21**	**143.58%**
Physical Contingencies[1]	0.00	0.00	NA
Price Contingencies	32.28	0.00	0 %
Total Project Costs	**710.09**	**973.21**	**137.05%**
PPF	0.00	0.00	0.00
Front-end fee IBRD	0.63	0.63	**100%**
Total Financing Required[2]	**710.72**	**973.84**	**137.02%**

[5] The Project did not include physical contingencies at appraisal.

[6] Total Project cost does not include the US$35 million GF (US$30 million provided by the GoM and US$5 million provided by the GEF Grant).

[7] P106424 and P120654 are two different codes for the same project. P120654 includes both the CTF loan and the GEF grant and was merged into the "parent" code P106424 (IBRD loan).

(b) Financing

P106424 - Efficient lighting and appliances				
Source of Funds	**Type of Financing**	**Appraisal Estimate (USD millions)**	**Actual/Latest Estimate (USD millions)**	**Percentage of Appraisal**
Borrower		229.70	602.62	262.35
Clean Technology Fund		50.00	50.00	100.00
Global Environment Facility - IBRD as Implementing Agency		7.12	7.12	100.00
International Bank for Reconstruction and Development		250.625	250.625	100.00
LOCAL: BENEFICIARIES		176.00	95.64	54.34
P120654 - MX GEF Efficient lighting and appliances[8]				
Source of Funds	**Type of Financing**	**Appraisal Estimate (USD millions)**	**Actual/Latest Estimate (USD millions)**	**Percentage of Appraisal**
Borrower		229.70	602.62	262.35
Clean Technology Fund		50.00	50.00	100.00
Global Environment Facility - IBRD as Implementing Agency		7.12	7.12	100.00
International Bank for Reconstruction and Development		250.625	250.625	100.00
LOCAL: BENEFICIARIES		176.00	95.64	54.34

[8] Ibídem

Annex 2. Outputs by Component

Target Values							Targets from PAD	Achievement
Project outcome Indicators	Baseline	YR 1	YR 2	YR 3	YR 4	YR 5		
Accumulated amount of GWh saved	0	85.87	396.89	1,825.06	5,477.77	9,242.31	10000	92.42%
Acummulated associated CO2 emission reductions (thousand tons of CO2)	0	42.73	197.58	927.83	2,783.21	5,074.31	5140	98.72%

Intermediate Outcome Indicators	Baseline	YR 1	YR 2	YR 3	YR 4	YR 5	Accumulated	Expected targets according to PAD	Achievement per component	Expected targets per year according to PAD	Achievement of annual targets
Component 1											
Number of IBs replaced with CFLs	0		15 m	30 m							
GWh saved *	0	0	0	914.993	2,991.257	3,087.612	6,993.86	6400	109.28%	3000	102.92%
CO2 emission reductions * (thousand tons of CO2)	0	0	0	469.063	1,519.357	1,543.497	3,531.92	3289	107.39%	1550	99.58%
Component 2											
Number of appliances replaced	0	450,000	450,000	400,000	400,000						
GWh saved	0	85.87	311.02	513.17	661.46	676.93	2,248.45	3600	62.46%	1436	47.08%
CO2 emission reductions (thousand tons of CO2)	0	42.73	154.85	261.19	336.02	747.60	1,542.39	1851	83.33%	738	45.53%
Component 3											
Studies completed (#)	None					8	8 studies		100%		
Information and dissemination (I&D) activities conducted	None					Completed			achieved		
Monitoring and evaluation (M&E) systems in place	None					Completed			achieved		
Number of staff trained	None					20	20		100%		

Note 1: CO2 emissions reductions for component 2 in YR5 include 409,000 tonCO2e from refrigerant gases capture. Since refrigerant gases capture happened only once during the lifetime of the project, it cannot be inlcuded in the computation of annual emissions. Rather, it can only be accounted for in the accumulated emissions.

Note 2: From the beginning, the results framework relied heavily on Component 1 (64% versus 34% for Component 2). The final percentage of achievement is a weighted average of Component 1 (at 64%) and Component 2 (at 34%) both for energy savings and avoided emissions. The underachivement of targets for Component 2 is heavily compensated by the overachievement of targets for Component 1.

The outputs by component have been obtained using the methodology that was agreed during the MTR in April 2013. Essentially, this methodology is the same as the one used at appraisal (the PAD methodology), with some adjustments based on actual replacement data both for Component 1 and Component 2. The GoM and the WB decided to use this MTR methodology in order to be consistent with the original results framework design, irrespective of the results that the impact evaluation (commissioned by SENER and carried out by Econoler) yielded. Below is a summary of the different methodologies for Component 1: (i) methodology at appraisal, (ii) MTR methodology (and the one used for assessing the project outcomes), and (iii) the methodology used in the impact evaluation.

Table A2-1: Methodologies used for computing the outcomes of Component 1

Item	PAD (appraisal)	MTR (used in the ICR)	Impact assessment (commissioned by SENER and carried out by ECONOLER)
Universe	The total amount of CFLs expected to be replaced by the program (45 million)	The total amount of CFLs delivered by the program (45.8 million)	Representative sample = 8,139,560 beneficiaries
Methodology description	Savings are computed from the difference between the expected power consumption of the CFL and the average power consumption of the expected IBs replaced. Such a difference would later be multiplied by the expected use (3.5 hours per day) and the result would be multiplied by the number of expected replacements during implementation (on a monthly basis). Avoided emissions per month would be obtained only by multiplying the energy savings times the emissions factor of the Mexican grid. At appraisal, the emissions factor used was 0.514 tonCO2e/MWh.	The MTR methodology follows the same principles as the methodology used at appraisal. Only difference is that the average power consumption of replaced IBs is updated using actual data (rather than the estimations used at appraisal). Updated average power consumption was obtained using actual data from *Programa Luz Sustentable 1*, and later used also for *Programa Luz Sustentable 2*. Avoided emissions per month were obtained by multiplying the energy savings per month times the emissions factor for that year, according to the data provided by *Programa GEI Mexico* initiative, which was the most reliable information during implementation. Emissions factors used were the following: 2011 – 0.5002 (tCO2e / MWh)	The Methodology used was that of the Uniform Methods Project (UMP). Such methodology consists of calculating the energy impact of a lighting replacement program and determining the power displaced by the replacement of an IB by a CFL. Avoided emissions were obtained by multiplying energy savings times the emission factor of the Mexican grid. The emissions factor used was an average of 0.50835 (tCO2e / MWh)

		2012 – 0.5165 (tCO2e / MWh) 2013 to 2015 – 0.4999 (tCO2e / MWh)	
Power levels exchanged	Expected: 60W (30%), 75 W (60%) and 100W (10%). Power consumption of a CFL was assumed as 20W. Power displacement (difference between average IBs consumption and CFL consumption) is 53W.	Actual: 25 W (0.36%), 40 W (1.88%), 60 W (11.02%), 75 W (71.69%) and 100 W (15.05%). Power consumption of a CFL was measured by FIDE during lab tests and determined as 23.5 W. Power displacement is 52.77 W	25 W, 40 W, 60 W, 75 W and 100 W. A power consumption of 23 W per CFL was used. Power displacement per stage of the program is Stage 1 – 53.26 W Stage 2 – 51.12 W Stage 1 and 2 – 52.73 W
Gross Energy Savings (purely attributable to technical considerations)	Savings were calculated based on a displacement of power, hours of operation, include a percentage of losses in distribution and transmission, the IBs impact on the peak demand, average discount factors on the CFL useful lifetime and its performance	Savings were calculated based on a displacement of power and hours of operation	Gross energy savings were calculated for each stage of the Program and considered the power displaced, the total of CFLs installed, the installation rate, and the CFLs annual operation hours. Stage 1 – 1,104 GWh / year Stage 2 – 1,060 GWh /year Stage 3 – 406 GWh /year Total – 2,569 GWh /year (is the sum of each stage)
CFLs – Hours of operation	3.5 hours/day	Confirmed as 3.5 hours/day based on the "Small scale methodology: demand side activities for efficient lighting technologies" (UFCCC)	ECONOLER decided to use the upper range limit hours of operation recommended by the UMP, which is 3 hours of use per day, in the absence of more accurate information for the Mexican market.

Net energy savings (taking into account economic considerations)			ECONOLER took into account "distorting effects" such as (i) opportunistic or "free riders", (ii) collateral effects or "internal spillover", and (iii) rebound effect or "external spillover". a) The gross energy savings were: Stage 1 – 1,336 GWh/year Stage 2 - 1,174 GWh/year Stage 1 and 2 – 446 GWh/year Total – 2955 GWh /year(is the sum of each stage)
Gross peak demand reduction			It is calculated by subtracting the CFLs power installed to the IBs power replaced for each beneficiary, multiplied by a coincidence factor (CF - represent the proportion savings in the demand curve during the peak demand period, according to the Interconnected National System). The CF was consulted from the Power Electric Sector Prospective 2013-2017 published by SENER. The gross peak demand reduction is estimated as: Stage 1 – 0.583 GW Stage 2 – 0.602 GW Stage 1 and 2 – 0.217 GW Total – 1.402 GW (is the sum of each stage)

Net peak demand reduction			The net peak demand reduction was estimated as: Stage 1 – 0.706 GW Stage 2 - 0.668 GW Stage 1 and 2 – 0.238 GW Total – 1.612 GW (is the sum of each stage)
Results			
Energy Savings per year	**3,000 GWh**	**3,087 GWh**	**2,955 GWh**
Emission Reductions per year	**1,550 tonCO2e**	**1,543.49 tonCO2e**	**1,502.03 tonCO2e**

There was a fourth methodology developed by researchers with the Energy Institute at Haas (University of California, Berkeley) based on assessing the energy consumption of a sample population prior to the "intervention" and after the IB replacement. Such methodology yielded savings of 2254.95 GWh per year.

Table A2-2: Methodologies used for computing the outcomes of Component 2

Item	PAD (appraisal)	MTR (used in the ICR)	Impact assessment (commissioned by SENER and carried out by ECONOLER)
Universe	The total amount of appliances expected to be replaced by the program (1,700,000)	The total amount of appliances delivered by the program (1,884,129)	The sample include electricity consumers of low, medium and high income, refrigerators (1,682,802) and air **c**onditioners (201,327)
Methodology description	Savings are computed from the difference between the expected energy consumption of the appliances and the average energy consumption of the expected appliances to be replaced. Avoided emissions per month were obtained by multiplying the energy savings times the emissions factor of the Mexican grid. At appraisal, the emissions factor used was 0.514 tonCO2e/MWh. The original results framework did not account for emission reductions from captured refrigerant gases.	The MTR methodology follows the same principles as the methodology used at appraisal. Only difference is that the average energy consumption of replaced appliances was updated using actual data (rather than the estimations used at appraisal). Updated average energy consumption was obtained using actual data from *Programa de Sustitución de Equipos Electrodomésticos (PSEE)*. Avoided emissions per month were obtained by multiplying the energy savings times the emissions factor for that year, according to the data provided by *Programa GEI Mexico* initiative, which was the most reliable information during implementation. Emissions factors used were the following: 2011 – 0.5002 (tCO2e / MWh) 2012 – 0.5165 (tCO2e / MWh) 2013 to 2015 – 0.4999 (tCO2e / MWh) The final, accrued avoided emissions included those from capture and disposal of refrigerant	The Methodology was based on international best practices, the Uniform Methods Project (UMP) and the beneficiaries' database provided by FIDE. Such methodology consists of conducting beneficiary and non-beneficiary surveys, and identifying a list of variables that should be taken into account for assessing the impact of the program. Avoided emissions were obtained by multiplying energy savings times the emission factor of the Mexican grid. The emissions factor used was an average of 0.5041 (tCO2e / MWh). This methodology also takes into account the avoided emissions from refrigerant gases capture once during the lifetime of the project.

		gases. Such accounting can only be reported once during the lifetime of the project, and therefore avoided emissions from refrigerant gases capture cannot be reported in the avoided emission per year.	
Gross energy savings			Gross energy savings were calculated for each stage of the Program and considered only energy consumption displaced. Refrigerators Total – 179.30 GWh /year Air Conditioners Total – 49.89 GWh/year
Net energy savings (taking into account economic considerations)			ECONOLER took into account "distorting effects" such as (i) opportunistic or "free riders", (ii) collateral effects or "internal spillover", and (iii) rebound effect or "external spillover". The net energy savings were: Refrigerators Total – 261.26 GWh/year Air Conditioners Total – 62.95 GWh/year
Net peak demand reduction			It is calculated by multiplying the total amount of appliances installed, the peak demand due to free riders, the coincidence factor (CF - represent the proportion

			savings in the demand curve during the peak demand period, according to the Interconnected National System) The gross peak demand reduction is estimated as: For Refrigerators Total – 0.01647 GW For Air Conditioners Total - 0.00218 GW
Results			
Energy Savings per year	**1,436 GWh**	**676.926 GWh**	**324.210 GWh**
Emission Reductions per year	**338 tonCO2e**	**747.601 tonCO2e**	**163.436 tonCO2e**

There was a fourth methodology developed by researchers with the Energy Institute at Haas (University of California, Berkeley) based on assessing the energy consumption of a sample population prior to the "intervention" and after the appliance replacement. Such methodology yielded savings of 185.22 GWh per year.

Annex 3. Economic and Financial Analysis

A. Overview

1. An ex-post economic and financial analysis of the Project was carried out to evaluate the efficiency of the Project and verify its financial and economic viability as presented in the Project Appraisal Document (PAD). The economic analysis looked at the costs and benefits accruing to Mexico, including not only values related to capital equipment and operating costs, but also monetized values for environmental benefits. The financial analysis compares the costs and benefits from the perspective of NAFIN.

B. Project Economic Analysis

2. The baseline economic analysis involved estimating costs and benefits for the Component 1: "Replacement of Incandescent Bulbs (IBs) with Compact Fluorescent Lamps in the Low to Medium Income Residential Sector" as well as Component 2: "Incentives to Encourage the Replacement of Old and Inefficient Appliances in Residential Sector".

3. *Costs*. At the time of the PAD, costs were estimated using market prices for CFLs, refrigerators and air conditioners (AC), exclusive of value added tax of 15 percent. The World Bank's estimated costs used for the economic analysis were as follows:

- For *Component* 1, a cost of US$1.56/CFL was used, i.e., US$70 million for the replacement of 45 million CFLs.
- For *Component 2*, an average cost of US$359/refrigerator and US$316/AC was used. The analysis assumes a 90:10 ratio for refrigerators and ACs, which implies a total of 1.53 million refrigerators and 0.17 million ACs. This yields a total cost for Component 2 of US$602.998 million

4. For the purpose of this analysis, the actual costs for the Project were confirmed and are listed in Table 1. The total Project cost (Components 1 and 2) increased from US$673 million to US$973 million. The costs for the economic analysis are exclusive of a revised value added tax of 16 percent.

Table A3-1:

Project Costs	**678,487,000**	**973,386,036**
Component 1	70,000,000	120,008,754
WB	55,000,000	41,604,000
GoM	15,000,000	78,404,754
Component 2	608,487,000	853,377,282
IBRD	195,487,000	208,883,000
CTF	50,000,000	50,000,000
NAFIN	95,000,000	374,000,000
KfW	32,000,000	65,000,000
GEF	5,000,000	5,000,000
Consumer	176,000,000	95,637,000
GoM	55,000,000	54,857,282

5. *Benefits.* In calculating the economic benefits, the same approach adopted during appraisal was followed- namely, the economic benefits are attributable primarily to the electricity savings that result from substituting more efficient CFLs and appliances for the less efficient models currently in use. The global environmental benefits were estimated by using the GHG emission reductions.

6. Other economic benefits include (i) delaying or avoiding new power generation infrastructure; (ii) reduced fuel consumption for power generation; (iii) consumers' electricity bills are reduced through the adoption of CFLs and the replacement of inefficient appliances; (iv) mitigation of the burden of the electricity subsidies; and (v) energy security is enhanced by reducing the overall energy needs. However, for the purpose of this ex-post economic analysis, the same identified economic benefits were used as during time of appraisal in order to allow for comparability of ex-ante and ex-post analysis.

7. Specifically, the economic benefits derived from investments under the Project used at the time of appraisal were the following: (i) electricity savings resulting from substituting more efficient CFLs and appliances for the less-efficient models currently in use, valued at the 'economic' price of electricity; and (ii) the Project's global environmental benefits estimated by using the GHG emissions resulting from reduced fuel consumption and multiplying it by the market price of carbon.

8. The CFL and appliance substitution took over a five-year period with the following deployment schedule:

***Table A*3-2: Deployment schedule**

Deployment schedule CFL			**Deployment schedule Appliances**		
Year	**Original**	**Revised**	**Year**	**Original**	**Revised**
Year 1 (2010)	0	0	Year 1 (2010)	450,000	861,214
Year 2 (2011)	15,000,000	13,692,544	Year 2 (2011)	450,000	559,731
Year 3 (2012)	20,000,000	32,107,456	Year 3 (2012)	400,000	463,184
Year 4 (2013)	1,000,0000	0	Year 4 (2013)	400,000	67
Year 5 (2014)			Year 5 (2014)	0	0
Total	**45,000,000**	**45,800,000**	**Total**	**1,700,000**	**1,884,196**

Table A3-3: Energy savings

	Energy savings CFL (in GWh)		**Energy savings Appliances (in GWh)**	
Year 1 (2010)	0	0	200	86
Year 2 (2011)	400	0	600	311
Year 3 (2012)	1700	915	900	513
Year 4 (2013)	2800	2991	1200	661
Year 5 (2014)	1500	3088	700	677
Total	6400	6994	3600	2248

9. Actual energy savings are higher than originally estimated savings. At the time of project preparation, it was assumed the Project would also replace 40 and 60W IBs; hence, lower savings were assumed at the time of the PAD compared to the actual savings (i.e. 53.27 watt per bulb compared to 53 watt per bulb). In addition, the life of a CFL was only assumed to be 3,832 hours instead of the actual 9,000 hours. These per-bulb savings were multiplied by the number of hours per use per day (3.5), times the number of days in the year, times the number of CFL bulbs deployed, arriving at the higher kWh savings than initially assumed (68.05 kwh per annum per bulb instead of 67.71 kwh). In the case of appliances, the actual energy savings are almost 40 percent lower than originally assumed in 2010.

10. To calculate the benefits for both the CFLs and the appliances, the energy savings were valued using an "economic price" of electricity in Mexico of US$0.12 per kilowatt-hour. The climate mitigation benefits were calculated by multiplying the amount of energy savings (GWh) by the estimated emission factor for Mexico, i.e., 514 tons CO2e/GWh. These GHG reductions were in turn multiplied by the market price of CO2, using a value of US$7/tCO2. This Carbon Emission Reduction (CER) Price represents an average from

the volatile prices in the past years (between US$5-10) and is lower than that assumed at the time the project preparation: US$10/tCO2.

Table A3-4: Emission Reductions

	CFLs		Appliances	
	(in thousand tonCO2e)			
Year 1 (2010)	0	0	103	43
Year 2 (2011)	205	0	308	155
Year 3 (2012)	876	469	463	261
Year 4 (2013)	1439	1519	617	336
Year 5 (2014)	771	1543	360	748
Total	3291	3532	1851	1542

11. *Results.* The overall economic analysis was computed by adding the costs and benefits of Component 1 and 2. The economic rate of return (ERR) for the Project is 62 percent, with a Net Present Value at a social discount rate of 6 percent of US$1.62 billion. The results per Component are listed in Table A3-5 below.

Table A3-5: Project Economic Results (revised vs. original)

	REVISED		ORIGINAL	
	NPV	**ERR**	**NPV**	**ERR**
Component 1	$1,500,932,659.66	145%	$600,000,000	182%[9]
Component 2	$114,682,328.49	11%	$260,000,000	21%
Project	$1,615,614,988.15	62%	$860,000,000	40%

12. The much higher NPV results in Component 1 are due to the higher amount of CFLs distributed (45.8 million vs. 45 million), increased lifetime of the CFL bulbs (7 years) compared to earlier estimates (3 years) and the higher energy savings achieved due to more replacement of 75W and 100W IBs instead of 40W and 60W IBs, which led to an increase of energy savings of 10 percent. At the same time, the ERR of the Component decreased substantially due to the increase in costs from US$70 to US$120 million and due to a

[9] For the residential lighting Component of this Project, the economic rate of return is well over 100 percent; this ERR is consistent with other residential CFL lighting programs worldwide.

different disbursement schedule chosen in the economic model.[10] Component 2 has lower results than originally assumed because of the lower energy savings (2,248 GWH vs. 3,600 GWH) while costs increased by almost 40 percent as reported above.

C. Project Financial Analysis

13. The financial analysis was conducted from the perspective of NAFIN as owner of the line of credit to consumers under Component 2. The credit lines financed 1,884,129 appliances (1,682,802 refrigerators and 201,327 ACs). Table A3-6 shows the disbursement schedule:

Table A3-6: Disbursement Schedule

	Year 1	**Year 2**	**Year 3**	**Year 4**
Number of Appliances	210,783	650,431	559,731	463,184
Value of Loans issued (in US$ million)	33.058	164.854	136.225	155.781

14. NAFIN issued a total of US$489.92 million in loans. Loans had a 4-year maturity and carried a 14 percent per annum interest rate. As loans were issued throughout a calendar year, consumer debt service occurred over 5 calendar years. This results in US$558.51 of consumer debt NAFIN received over 8 years.

Table A3-7 Consumer Debt (in US$ million)

	2010	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**Total**
2010	6.2	8.26	8.26	8.26	2.07				33.05
2011		10.3	41.21	41.21	41.21	30.91			164.84
2012			25.54	34.06	34.06	34.06	8.51		136.23
2013				9.74	38.95	38.95	38.95	29.21	155.8
Return	6.2	18.56	75.01	93.27	116.29	103.92	47.46	29.21	489.92
Interest	0.86	2.6	10.5	13.06	16.28	14.55	6.64	4.09	68.58
Benefits	7.06	21.16	85.51	106.33	132.57	118.47	54.1	33.3	558.51

The US$489.918 million in new cash that NAFIN injected were funded as follows: (a) US$50 million from CTF, (b) US$65 million from KfW and (c) US$374 million of

[10] The model of the economic analyses captures two disbursements reflecting the two phases of the Program – Phase 1 financed by the WB, Phase 2 financed by the GoM - instead of one single disbursement as per original model.

NAFIN's own funds. The two loans were available to NAFIN at the beginning of the Project. As repayment and interest rates for the loans does not happen within the lifetime of the Project; repayment amount was accounted in the final year, while interest rates are not included.

15. It shall also be noted that the original calculation assumed that an average loan of US$104 would be issued per appliance; however, the average loan amount resulted to be much higher (US$260). That explains also the increase of the credit line from US$177 million to US$489.918 million and the increased benefit for NAFIN due to the revenues earned through interest charged on a higher injected capital. The FIRR of Component 2 is 9 percent and undiscounted payback occurred after 6.5 years. Discounting Project cash flows at the weighted average cost of capital of 6.4 percent, the NPV of the Component is US$14.92 million.

Table A3-8: Project Financial Results (revised vs. original)

REVISED		**ORIGINAL**	
NPV	**FIRR**	**NPV**	**FIRR**
US$14.92	9.01%	US$15.00	7.40%

Annex 4. Bank Lending and Implementation Support/Supervision Processes

(a) Task Team members

Names	Title	Unit	Responsibility/ Specialty
Lending			
Roberto Gabriel Aiello	Senior Energy Specialist	GEEDR	Task Team Leader
Maria Alexandra Planas	Consultant	GEEDR	Co-Task Team Leader
Todd Johnson	Lead Energy Specialist	GEEDR	
Jas Singh	Sr. Energy Specialist	GEEDR	
Ashok Sarkar	Sr. Energy Specialist	GEEDR	
Alan Poole	Sr. Energy Efficiency Specialist, Consultant		
Arianna Legovini	Adviser	DECIE	
Mame Fatou Niasse	Program Assistant	GCGDR	
Dinesh Aryal	Sr. Natural Resources Management Specialist	GEN01	
Jozef Draaisma	Sr. Country Economist	GMF04	
Chandra Shekhar Sinha	Lead Climate Change Specialist	GSU18	
José Andreu	Sr. Carbon Finance Specialist	GCCCF	
Adrien de Bassompierre	Sr. Carbon Finance Specialist	GCCCF	
Luis de la Plaza	Lead Financial Officer	FABBK	
Dolores López-Larroy	Lead Financial Officer	CMD	
Rohit Khanna	Practice Manager	GEESO	
Alonso Zarzar	Sr. Social Scientist	GSU04	
Jose Luis Calderon Bartheneuf	HQ Consultant ST	GEN04	Environment
Evelyne Rodríguez	Social Specialist, Consultant		
Mariana Montiel	Sr. Counsel	LEGLE	
Juan Carlos Serrano	Financial Management Specialist	GG022	
José Janeiro	Sr. Financial Officer	WFALA	
Tomás Socias	Sr. Procurement Specialist		
Diomedes Berroa	Lead Specialist	OPSPF	
Luis Vaca-Soto	Sr. Energy/Procurement Specialist, Consultant	GEE04	
Gabriel Penaloza	Sr. Procurement Specialist	GGO04	
Khalid Siraj	Financial Intermediary Lending, Consultant		
Pamela Sud	Junior Professional Associate		
Shern Frederick	Junior Professional Associate		
Rodrigo Aragón Salinas	Energy Consultant		
Alma Domenech	Senior Executive Assistant	GEE01	
Diana Gabriela Jiménez Cruz	Program Assistant	LCC1C	
Karina Kashiwamoto	Language Program Assistant	LCC1C	
Supervision/ICR			
Ariel Yépez	Senior Energy Economist	GEEDR	TTL
Karen Bazex	Senior Energy Specialist	GEEDR	TTL
José Luis Calderón Bartheneuf	Environmental Specialist	GEN04	Environmental Safeguards
Alonso Zarzar	Senior Social Scientist	GSU04	Social Safeguards

Juan Carlos Serrano Machorro	Senior FM Specialist	GG022	FM
Luis Barajas	FM Specialist, Consultant	GGODR	
Daniel Chalupowicz	FM Specialist	GGO22	
Gabriel Penaloza	Senior Procurement Specialist	GGO04	Procurement
Eugene McCarthy	HQ Consultant	GEEDR	ICR Author
Lara Born	Junior Professional Associate	GEE01	Economic and Financial Analyses
Karla Olguín Hernández	Energy Specialist, Consultant	GEEDR	Technical revision
Diana Gabriela Jiménez Cruz	Program Assistant	LCC1C	
Fernanda Pacheco	Senior Program Assistant	GEE04	
Guillermo Hernández González	Energy Specialist	GEE04	Technical supervision and TTL

(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)
Lending		
FY 09	31.60	180.98
FY 10	37.45	268.60
FY 11	18.49	133.55
Total:	**87.54**	**583.13**
Supervision/ICR		
FY 11	20.60	75.41
FY 12	10.93	104.98
FY 13	31.94	123.23
FY 14	11.08	47.81
FY 15	4.77	20.60
FY 16	5.80	28.70
Total:	**85.12**	**400.74**

Annex 5. Beneficiary Survey Results

1. A global consulting firm, specializing in the design, implementation, evaluation and financing of energy efficiency programs and projects, was hired by SENER to carry out an impact assessment of the Mexico Efficient Lighting and Appliances Project. The assessment included the application of surveys for both beneficiaries and non-beneficiaries of the project.

Methodology, Geographical Distribution Samples and Execution Period

2. The surveys were carried out through phone interviews with the sample population. The sample for Component 1 (*Programa Luz Sustentable, or PLS)* consisted of 400 beneficiaries and 400 non-beneficiaries; the sample for Component 2 (*Programa de Sustitución de Equipos Electrodomésticos, or PSEE)* consisted of 300 non-beneficiaries (air conditioners and refrigerators) and 400 beneficiaries (air conditioners and refrigerators). For both components, the topics were: program awareness, barriers to participation, barriers to equipment acquisition, incentives to participate in the programs; participant satisfaction, influence of the program on purchase decisions, common practices for equipment replacement, verification of technical data, socio-demographic household data and common practices in regard to the use of equipment.

3. *Component 1,* i.e. the PLS program, was implemented in municipalities of more than 100,000 habitants, so the survey was conducted in those municipalities only. The distribution of non-beneficiaries was established only based on geographical parameters since climate conditions have a negligible impact on energy consumption of CFLs. However, the criteria for determining the beneficiaries sample included climate considerations as IBs could have been used as an alternative for heating. Consequently, the non-beneficiary sample was distributed among 8 states, whereas the beneficiary sample was distributed among 15 of the states with greater participation.

4. *Component 2,* i.e. the PSEE (replacement of refrigerators and air conditioners) was implemented across the entire country. For refrigerators, the distribution of surveyed non-beneficiaries was determined based on geographical and climatic parameters, as climate influences energy consumption. The surveys were mostly focused on those states with the highest rate of substitution and those states with the largest population. For air conditioners, the surveys were applied in those states with warm, sub-humid and dry weather, and which had the highest rate of equipment replacement.

5. For both programs (PLS and PSEE), the survey for non-beneficiaries started on May 18, 2015 and concluded on June 5, 2015. The survey of PLS beneficiaries started on June 9, 2015 and ended on June 19, 2015, whereas the survey for PSEE beneficiaries started on June 6, 2015 and ended on June 29, 2015.

Surveys results for PLS and PSEE program

6. PLS (Component 1)

- **Beneficiaries**

Benefits of using CFLs – 47 percent of the beneficiaries reported that the most important benefit of CFLs in comparison to incandecent bulbs was that the CFL light was brighter. This result was expected as CFLs are more light-intense than IBs. 25 percent resported that the quality of light increased with CFLs, and 1 in 5 (22 percent) answered that CFLs lasted longer than an incandescent bulb.

Handling of CFLs – Once the CFLs are no longer useful, 1 in 3 (38 percent) survey respondents simply threw them away, whereas 35 percent used sealed plastic bag before throwing them away.

- **Non-Beneficiaries**

Handling of CFLs – 3 out of 4 (76 percent) survey respondents disposed of CFLs simply by throwing them directly into the trash can at home. Only 1 in 10 took the used CFLs to a recycling facility.

Factors Influencing the purchase of CFLs –Information and promotion campaigns implemented by FIDE had the greatest influence on those non-beneficiaries who were already familiar with FIDE for choosing CFLs over IBs. These campaigns had an average rating of 6.6 (out of 10), where 10 means "highly influential" and 1 means "not influential at all".

Barriers for purchasing CFLs, purchase intention and reasons for not buying CFLs – Nearly 1 in 2 (45 percent) survey respondents said they did not buy CFLs due to its high cost, and 40 percent responded that a low quality lighting was the reason for not buying CFLs. Another important barrier was related to the lack of habit and the lack of time (22 percent). 9 out of 10 (94 percent) survey respondents (among those with undergradate education) had a clear intention to buy CFLs on their next purchase. 43 percent of survey respondents said that the main reason for not purchasing a CFL was the cost.

7. PSEE (Component 2)

Refrigerators

- **Beneficiaries**

Beneficiaries' Satisfaction – 9 out of 10 (87 percent) survey respondents were satisfied with their participation in the program "*Cambia tu viejo por uno nuevo*", in fact 57 percent rated the program with the highest possible score (10 out of 10). Among those who were less satisfied with the program, the main reason was that the fridge broke and therefore they could not benefit from energy and economic savings. In general, beneficiaries were highly satisfied with the different aspects of PSEE. A vast majority gave a rating of 8 or more out of 10 to the most relevant aspects of the program (standby time of their appointment to collect their appliance

(9.1); employees' responsiveness to requests and inquiries in a timely manner (9.0); the dealer ability to provide information (8.9)).

Suggestions for program improvement – 41 percent of survey respondents expressed that the PSEE program should include other appliances (irons, blenders and washing machines) and other models of refrigerators. Some suggestions from the survey respondents were related to economic aspects, i.e. increasing the discount (9 percent) and funding support (8 percent) in addition to diversifying the payment alternatives (increasing or decreasing the repayment period). Also, 4 out of 5 (77 percent) beneficiaries recommended the program "Cambia tu viejo por uno nuevo" to friends and family.

Intention to participate in other energy efficiency programs – 9 out of 10 survey respondents declared their intention to participate in other energy efficiency programs. This trend is higher among those beneficiaries with undergraduate education (95 percent) and households with monthly incomes between $5,000 and $15,000 MXN (97 percent).

Air Conditioners

- **Beneficiaries**

Beneficiaries' Satisfaction – Almost all survey respondents (94 percent) were satisfied with their participation in the program; in fact, 2 out of 3 (63 percent) gave the highest rating level. Among the few people less satisfied with the program (40 percent), the main reason was that they did not notice any energy savings in their power bills. 23 percent of the survey respondents were not completely satisfied due to technical problems with the replaced air conditioners. In general, beneficiaries were higly satisfied with different aspects of the program (standby time of their appointment to collect their appliance (9.2); employees responsiveness to requests and inquiries in a timely manner (9.2); the dealer ability to provide information (9.1)).

Suggestions for program improvement – 25 percent of survey respondents expressed that the PSEE program should include other models of air conditioners. 29% of the survey respondents' suggestions were related to economic aspects, i.e. increasing the discount and funding support. 12percent of the beneficiaries mentioned that dissemination campaigns should be strengthened. Also, 9 out of 10 beneficiaries recommended the program "*Cambia tu viejo por uno nuevo*" to friends and family.

Intention to participate in other energy efficiency programs – 9 out of 10 survey respondents declared their intention to participate in other energy efficiency programs. The intention to participate in other energy efficiency programs is more pronounced in households with undergraduate studies (97 percent) and techcnical studies (94 percent), compared to households with basic education (87 percent).

Use of the new air conditioner – 53 percent of survey respondents reported a similar level of use for the new air conditioner (when compared to the use of the old appliance), whereas a third (29 percent) reported a more frequent use of the new air conditioner.

Refrigerators and Air Conditioners

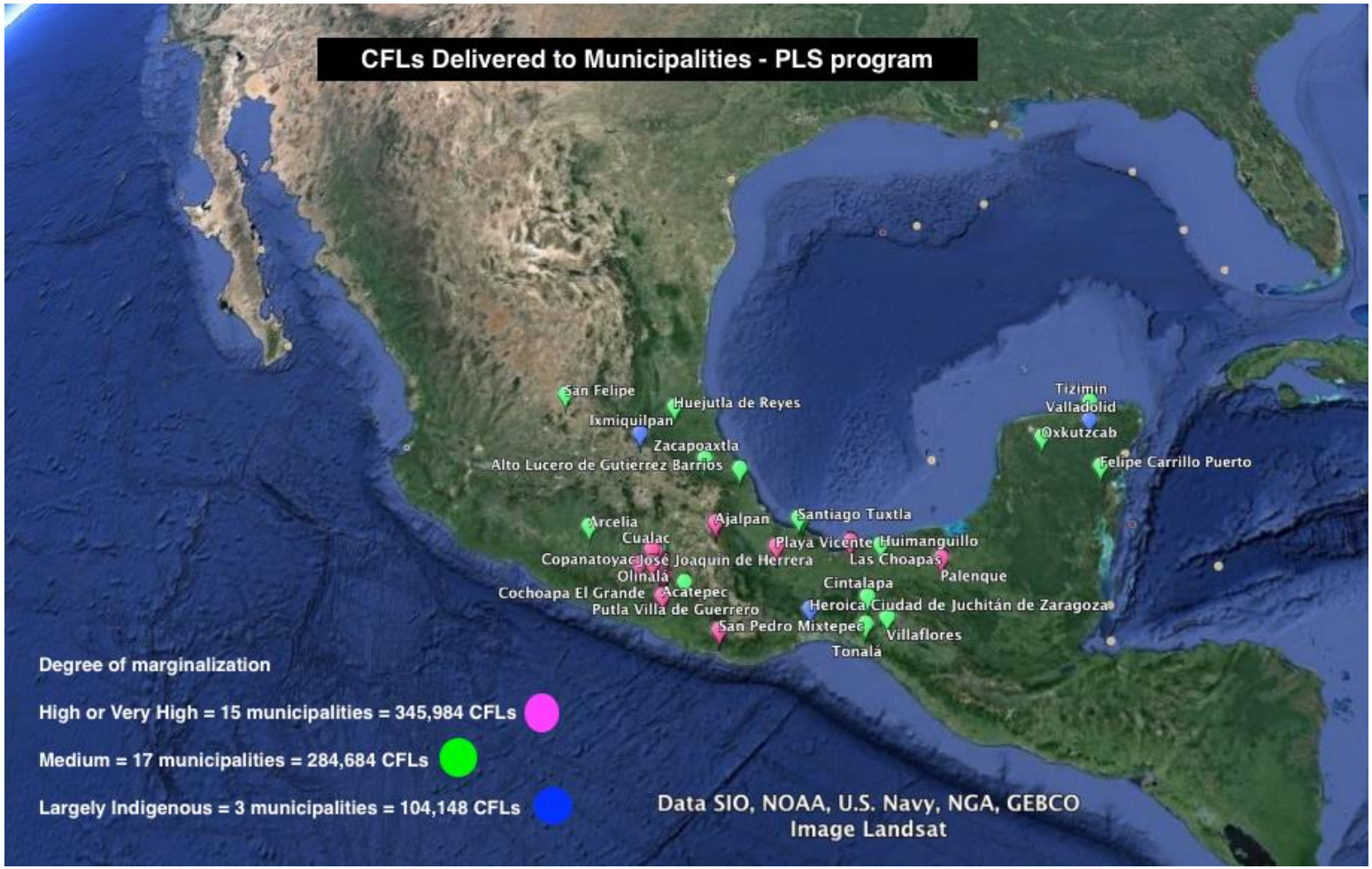
- **Non-Beneficiaries**

  Factors involved in the purchase decision –General information about energy efficiency and promotion provided by FIDE, as well as the information provided by the appliance dealer at the retail store, as well as massive advertising campaigns, were the most influential factors for purchasing a new appliance.

  Barriers for purchasing a new appliance – Only 3 survey respondents mentioned that one barrier is the high cost of the refrigerators. For air conditioners, only one survey respondent mentioned that a new unit was not convenient due to its low durability.

Map of beneficiary municipalities with medium, high or very high degree of marginalization

The following map shows those municipalities with medium, high or very high degree of marginalization which were benefited from IBs exchange under Component 1 (*Programa Luz Sustentable 1* and *2*). Three of those municipalities are largely indigenous.



Annex 6. Stakeholder Workshop Report and Results
No Stakeholder Workshop was undertaken

Annex 7. Summary of Borrower's ICR and/or Comments on Draft ICR

Comments have been received from SHCP, SENER, NAFIN and FIDE, and were included in the main text.

Annex 8. Comments of Cofinanciers and Other Partners/Stakeholders

Not applicable

Annex 9. List of Supporting Documents

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MAP


UNITED STATES OF AMERICA
MEXICO
Gulf of Mexico
PACIFIC OCEAN
Gulf of California
Bay of Campeche
Gulf of Honduras
Gulf of Tehuantepec
BAJA CALIFORNIA
BAJA CALIFORNIA SUR
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
DURANGO
ZACATECAS
SAN LUIS POTOSI
AGUASCALIENTES
NAYARIT
JALISCO
COLIMA
MICHOACAN
GUANAJUATO
QUERÉTARO
HIDALGO
DISTRITO FEDERAL
TLAXCALA
VERACRUZ
PUEBLA
MORELOS
GUERRERO
OAXACA
CHIAPAS
TABASCO
CAMPECHE
YUCATAN
QUINTANA ROO
SINALOA
Sierra Madre Occidental
Sierra Madre Oriental
Sierra Madre del Sur
Río Bravo
Río Grande
Yaqui
Conchos
Fuerte
Salado
Lerma
Balsas
Usumacinta
Tijuana
Mexicali
Ensenada
San Felipe
Sonoita
Nogales
Agua Prieta
Ciudad Juárez
Hermosillo
Guaymas
Santa Rosalia
Navojoa
Loreto
Los Mochis
Culiacán
La Paz
Cabo San Lucas
Mazatlán
Durango
Ojinaga
Chihuahua
Laredo
Frontera
Torreón
Saltillo
Monterrey
Matamoros
Ciudad Victoria
Tampico
Zacatecas
San Luis Potosi
Aguascalientes
Tepic
Puerto Vallarta
Guanajuato
Guadalajara
Querétaro
Pachuca
Morelia
MEXICO CITY
Jalapa
Veracruz
Toluca
Tlaxcala
Citlaltépetl (5,747 m)
Colima
Cuernavaca
Puebla
Acapulco
Chilpancingo
Oaxaca
Tuxtla Gutiérrez
Tehuantepec
Puerto Escondido
Villahermosa
Tapachula
Merida
Cancun
Cozumel
Campeche
Chetumal
BELIZE
GUATEMALA
HONDURAS
EL SALVADOR
To Los Angeles
To Gila Bend
To Albuquerque
To Alamogordo
To Midland
To San Antonio
To Houston
To San Salvador
115°W
110°W
105°W
100°W
95°W
90°W
85°W
30°N
25°N
20°N
15°N
0 100 200 300 Kilometers
0 50 100 150 200 Miles
This map was produced by the Map Design Unit of The World Bank. The boundaries, colors, denominations and any other information shown on this map do not imply, on the part of The World Bank Group, any judgment on the legal status of any territory, or any endorsement or acceptance of such boundaries.
MEXICO
SELECTED CITIES AND TOWNS
STATE CAPITALS
NATIONAL CAPITAL
RIVERS
MAIN ROADS
RAILROADS
STATE BOUNDARIES
INTERNATIONAL BOUNDARIES
NOVEMBER 2008
IBRD 33447R