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The World Bank

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Report No.: PAD1193

INTERNATIONAL BANK FOR RECONSTRUCTION AND DEVELOPMENT

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$100 MILLION

TO THE

UNITED MEXICAN STATES

FOR A

MUNICIPAL ENERGY EFFICIENCY PROJECT

FEBRUARY 17, 2016

Energy and Extractives Global Practice
Latin America and the Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective February 1, 2016)

Currency Unit	=	Mexican peso (MXN)
MXN18.28	=	US$1

FISCAL YEAR

July 1 – June 30

ABBREVIATIONS AND ACRONYMS

AIA	Activity Initiation Agreement
BANOBRAS	*Banco Nacional de Obras y Servicios Públicos* (National Bank for Public Works and Services)
CFE	*Comisión Federal de Electricidad* (Federal Electricity Commission)
CO_2	Carbon dioxide
CONAGUA	*Comisión Nacional del Agua* (National Water Commission)
CONUEE	*Comisión Nacional para el Uso Eficiente de la Energía* (National Commission for the Efficient Use of Energy)
EE	Energy Efficiency
ENCC	*Estrategia Nacional de Cambio Climático* (National Climate Change Strategy)
ENE	*Estrategia Nacional de Energía* (National Energy Strategy)
EIRR	Economic internal rate of return
EnMS	Energy Management Systems
ESA	Energy Services Agreements
ESMAP	Energy Sector Management Assistance Programme
ESMF	Environmental and Social Monitoring Framework
FIDE	*Fideicomiso para el Ahorro de Energía Eléctrica* (Electricity Energy Savings Trust Fund)
FM	Financial Management
FOTEASE	*Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía* (Energy Transition and Sustainable Energy Use Fund)
GDP	Gross domestic product
GEF	Global Environment Facility
GHG	Greenhouse gases
GoM	Government of Mexico
GRS	Grievance Redress Service
ICB	International Competitive Bidding
IFR	Interim Financial Report
INAFED	*Instituto Nacional para el Federalismo y el Desarrollo Municipal* (National Federalism and Municipal Development Institute)
ISP	Implementation Support Plan

IRR	Internal Rate of Return
LEDs	Light-emitting Diode
LN	Loan
M&E	Monitoring and Evaluation
MB	Municipal Building
MEDEC	*México estudio de Disminución de Emisiones de Carbono* (Low-Carbon Development for Mexico)
MW	Megawatt
MWh	Megawatt-hour
MXN	Mexican Peso
NAFIN	*Nacional Financiera, S.N.C., I.B.D.* (National Development Bank)
NAMAs	Nationally Appropriate Mitigation Actions
NPV	Net present value
O&M	Operation and Maintenance
OM	Operational Manual
OO	*Organismos Operadores de Agua* (Water and Wastewater Utility)
PAD	Project Appraisal Document
PDO	Project Development Objective
PMR	Partnership for Market Readiness
PRESEM	*Proyecto de Eficiencia y Sustentabilidad Energética Municipal* (Municipal Energy Efficiency Project)
PRONASE	*Programa Nacional para el Aprovechamiento Sustentable de la Energía* (National Program for the Sustainable Use of Energy)
PV	Photovoltaic
SENER	*Secretaría de Energía* (Secretary of Energy)
SHCP	*Secretaría de Hacienda y Crédito Público* (Ministry of Finance)
SFP	*Secretaría de la Función Pública* (Ministry of Public Administration)
SIE	*Sistema de Información Energética* (National Energy Information System)
SL	Street Lighting
SW	Staff weeks
tCO2eq	Tons of carbon dioxide equivalent
TESOFE	*Tesorería de la Federación* (Treasury of the Federation)
TF	Trust Fund
TRACE	Tool for Rapid Assessment of City Energy
TWh	Terawatt-hour
UN	United Nations
UREP	*Unidad Responsable Ejecutora del Proyecto* (Responsible Project Implementing Unit)

Regional Vice President:	Jorge Familiar
Country Director:	Gerardo M. Corrochano
Senior Global Practice Director:	Anita Marangoly George
Practice Manager:	Antonio Barbalho
Task Team Leaders:	Janina Franco
	Karen Bazex

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Municipal Energy Efficiency Project (P149872)

PROJECT APPRAISAL DOCUMENT

LATIN AMERICA AND CARIBBEAN

GEE04

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Basic Information			
Project ID P149872	EA Category B - Partial Assessment	Team Leader Janina Franco – Karen Bazex	
Lending Instrument Investment Project Financing	Fragile and/or Capacity Constraints [ ] Financial Intermediaries [ ] Series of Projects [ ]		
Project Implementation Start Date 31-Jul-2016	Project Implementation End Date 31-Oct-2021		
Expected Effectiveness Date 31-Jul-2016	Expected Closing Date 31-Oct-2021		
Joint IFC No			
Practice Manager	Senior Global Practice Director	Country Director	Regional Vice President
Antonio Barbalho	Anita Marangoly George	Gerardo M. Corrochano	Jorge Familiar

Borrower: United Mexican States			
Responsible Agency: Secretaría de Energía (SENER)			
Contact:	Santiago Creuheras Díaz	Title:	Director General de Eficiencia y Sustentabilidad Energética
Telephone No.:	525550006000-2281	Email:	screuheras@energia.gob.mx

Project Financing Data(in US$, million)							
[X]	Loan	[ ]	IDA Grant	[ ]	Guarantee		
[ ]	Credit	[ ]	Grant	[ ]	Other		
Total Project Cost:		156.00		Total Bank Financing:		100.00	
Financing Gap:		0.00					

Financing Source	Amount
Borrower	7.00
International Bank for Reconstruction and Development	100.00
Local Governments (Provincial, District, City) of Borrowing Country [*Subnational Entities*]	49.00
Total	156.00

Expected Disbursements (in US$, million) – Loan

Fiscal Year	2017	2018	2019	2020	2021	2022
Annual	5.00	16.00	26.00	30.00	20.00	3.00
Cumulative	5.00	21.00	47.00	77.00	97.00	100.00

Institutional Data

Practice Area / Cross Cutting Solution Area

Energy and Extractives

Cross Cutting Areas

[X] Climate Change

[ ] Fragile, Conflict & Violence

[ ] Gender

[ ] Jobs

[ ] Public Private Partnership

Sectors / Climate Change

Sector (Maximum 5 and total % must equal 100)

Major Sector	Sector	%	Adaptation Co-benefits %	Mitigation Co-benefits %
Energy and mining	Energy efficiency in Heat and Power	100		100
Total		100		

☐ I certify that there is no Adaptation and Mitigation Climate Change Co-benefits information applicable to this project.

Themes

Theme (Maximum 5 and total % must equal 100)

Major theme	Theme	%
Urban development	City-wide Infrastructure and Service Delivery	50
Environment and natural resources management	Climate change	50

Total	100

Proposed Development Objective(s)

The development objective of the proposed project is to promote the efficient use of energy in the Borrower's municipalities by carrying out energy efficiency investments in selected municipal sectors and contribute to strengthening the enabling environment.

Components

Component Name	**Cost (USD Millions)**
Policy development and institutional strengthening	7.00
Municipal energy efficiency investments	148.75

Systematic Operations Risk- Rating Tool (SORT)

Risk Category	**Rating**
1. Political and Governance	Moderate
2. Macroeconomic	Low
3. Sector Strategies and Policies	Low
4. Technical Design of Project or Program	Substantial
5. Institutional Capacity for Implementation and Sustainability	Moderate
6. Fiduciary	Substantial
7. Environment and Social	Low
8. Stakeholders	Low
9. Other, Crime and violence	Moderate
OVERALL	Substantial

Compliance

Policy

Does the project depart from the CAS in content or in other significant respects?	Yes [ ]	No [X]
Does the project require any waivers of Bank policies?	Yes [ ]	No [X]
Have these been approved by Bank management?	Yes [ ]	No [ ]
Is approval for any policy waiver sought from the Board?	Yes [ ]	No [X]
Does the project meet the Regional criteria for readiness for implementation?	Yes [X]	No [ ]

Safeguard Policies Triggered by the Project	**Yes**	**No**
Environmental Assessment OP/BP 4.01	**X**	
Natural Habitats OP/BP 4.04		**X**
Forests OP/BP 4.36		**X**

Pest Management OP 4.09		**X**
Physical Cultural Resources OP/BP 4.11	**X**	
Indigenous Peoples OP/BP 4.10		**X**
Involuntary Resettlement OP/BP 4.12		**X**
Safety of Dams OP/BP 4.37		**X**
Projects on International Waterways OP/BP 7.50	**X**	
Projects in Disputed Areas OP/BP 7.60		**X**

Legal Covenants

Name	**Recurrent**	**Due Date**	**Frequency**
Institutional Arrangements, Schedule 2, Section I-A- 2(c)		Upon effectiveness	Once

Description of Covenant
The Operator's obligation to enter into an agreement with the CFE (the CFE Implementation Agreement) under terms and conditions acceptable to the Bank, setting forth their respective roles and responsibilities regarding the implementation of Part 2 of the Project.

Name	**Recurrent**	**Due Date**	**Frequency**
Institutional Arrangements, Schedule 2, Section I-A- 2(e)	X	Upon agreement with subnational entity	Upon agreement with subnational entity

Description of Covenant
The Operator's obligation to, immediately upon the selection of an Energy Efficiency Municipal Subproject pursuant to the eligibility criteria and procedures established in the Operations Manual (OM), enter into an implementation agreement (Energy Service Agreement) with the Borrower, through the SENER, and the corresponding Eligible Municipality or Eligible Water Operator (as the case may be) under terms and conditions acceptable to the Bank which shall include, *inter alia*, the obligation of each said Eligible Municipality or Eligible Water Operator (as the case may be) to reimburse a portion of the cost of the pertinent Municipal Energy Efficiency Subproject through the payments of electricity bills on terms and conditions as provided in the OM.

Name	**Recurrent**	**Due Date**	**Frequency**
Safeguards, Schedule 2, Section I-D	X	Upon signing	Continuous

Description of Covenant

The Borrower - through the SENER- shall, and shall cause the Operator through the Operator Collaboration Agreement to, carry out the Project in accordance with the ESMF.

Conditions

Source Of Fund	**Name**	**Type**
IBRD	*Contrato de Mandato*	Effectiveness

Description of Condition

The *Contrato de Mandato* has been duly executed by the parties thereto.

Source Of Fund	**Name**	**Type**

IBRD	Operator Collaboration Agreement	Effectiveness

Description of Condition

The Operator Collaboration Agreement has been duly executed by the parties thereto.

Team Composition

Bank Staff

Name	Title	Specialization	Unit
Elena Segura	Senior Counsel	Senior Counsel	LEGLE
Victor Ordonez	Senior Finance Officer	Senior Finance Officer	WFALN
Abel Lopez	Urban Transport Specialist	Urban Transport Specialist	GTIDR
César Arreola	Consultant	Consultant, Energy Specialist	GEEDR
Karen Bazex	Senior Energy Specialist	Senior Energy Specialist, Co-TTL	GEEDR
Martina Bosi	Senior Energy Economist	Senior Energy and Carbon Finance Specialist	GEEES
Jas Singh	Senior Energy Specialist	Senior Energy Efficiency Specialist	GEEDR
Janina Franco	Senior Energy Specialist	Senior Energy Specialist, Task Team Leader	GEEDR
Megan Meyer	Energy Specialist	Energy Specialist	GEEDR
Todd M. Johnson	Lead Energy Specialist	Lead Energy Specialist	GEEDR
Carlos Aguilar	Senior Water and Sanitation Specialist	Senior Water and Sanitation Specialist	GWADR
Alonso Zarzar	Senior Social Scientist	Senior Social Scientist	GSURR
Gabriel Penaloza	Senior Procurement Specialist	Procurement Specialist	GGODR
Juan Carlos Serrano-Machorro	Sr Financial Management Specialist	Senior Financial Management Specialist	GGODR
Angelica Nunez	Senior Urban Specialist	Senior Urban Specialist	GSURR
Jose Luis Calderon	Consultant	Consultant, Environmental Specialist	GEN04
Feng Liu	Senior Energy Specialist	Peer Reviewer	GEEDR
Roberto Gabriel Aiello	Senior Energy Specialist	Peer Reviewer	GEEDR
Claudia Vasquez	Senior Energy Economist	Peer Reviewer	GEEDR
Elizabeth Sanchez	Program Assistant	Program Assistant	GEEDR
Iris del Valle	Program Assistant	Program Assistant	GEEDR

Non Bank Staff

Name	Title	City

Locations					
Country	**First Administrative Division**	**Location**	**Planned**	**Actual**	**Comments**
Mexico	Guerrero	Acapulco	x		
Mexico	Aguascalientes	Aguascalientes	x		
Mexico	Campeche	Campeche	x		
Mexico	Tabasco	Centro Villahermosa	x		
Mexico	Chihuahua	Ciudad Juárez	x		
Mexico	Colima	Colima	x		
Mexico	Quintana Roo	Cozumel	x		
Mexico	Morelos	Cuernavaca	x		
Mexico	Sinaloa	Culiacán	x		
Mexico	Mexico	Delegación Miguel Hidalgo	x		
Mexico	Durango	Durango	x		
Mexico	Mexico	Ecatepec	x		
Mexico	Zacatecas	Fresnillo	x		
Mexico	Jalisco	Guadalajara	x		
Mexico	Sonora	Hermosillo	x		
Mexico	Tlaxcala	Huamantla	x		
Mexico	Guanajuato	León	x		
Mexico	Baja California	Los Cabos	x		
Mexico	Yucatán	Mérida	x		
Mexico	Coahuila de Zaragoza	Monclova	x		
Mexico	Nuevo León	Monterrey	x		
Mexico	Michoacán	Morelia	x		
Mexico	Oaxaca	Oaxaca	x		
Mexico	Hidalgo	Pachuca	x		
Mexico	Puebla	Puebla	x		

Mexico	Querétaro	Querétaro	x		
Mexico	Tamaulipas	Reynosa	x		
Mexico	San Luis Potosí	San Luis Potosí	x		
Mexico	Nayarit	Tepic	x		
Mexico	Baja California	Tijuana	x		
Mexico	Chiapas	Tuxtla Gutiérrez	x		
Mexico	Veracruz	Veracruz	x		

I. STRATEGIC CONTEXT

A. Country Context

1. **The global economic environment remains challenging and continues to weigh on Mexico's economic growth.** A modest and gradual recovery of economic activity is expected to continue over the next few years, with gross domestic product (GDP) growth strengthening from 2.5 percent in 2015 to 3.0 percent in 2017. Low oil prices and tighter external financial conditions are leading to fiscal and monetary policy adjustments to maintain solid macroeconomic framework. Flexible exchange rate remains the key external shocks absorber and pass-through of currency depreciation to domestic prices with limited effects. In anticipation of a longer-lasting low oil prices outlook, the government has implemented significant spending cuts in the public sector budgets for 2015 and 2016. Strong commitment to sound public finances is at the core of the government's economic policy response to challenges posed by a complex external environment, despite the possible dampening impact on the pace of economic growth.

2. **The official multidimensional poverty indicator[1] has stagnated since 2010.** The most recent official figures confirm this trend: the multidimensional poverty indicator has increased in 2014, moving to 46.2 percent of the population, up from 45.5 percent in 2012 and from 46.1 percent in 2010, whereas extreme poverty stagnated at 9.5 percent (down from 9.8 percent two years earlier). This change, primarily observed in urban areas, results from rising monetary poverty combined with fall in labor income and earnings. However, the social dimensions of multidimensional poverty linked to access to basic services, infrastructure, and food security have continuously progressed over time, because of the ongoing social programs.

3. **Structural reforms in the energy, telecommunications and financial sectors and a supporting competition policy are being implemented.** The impact of the reforms with regard to increased productivity and potential output growth is likely to materialize over the medium to longer term. The opening of the energy sector to participation of private investors and operators is particularly promising for boosting growth, which is expected to increase production of oil and gas and provide Mexican manufacturers with more competitive energy inputs.

4. **Mitigation and adaptation to climate change actions continue to be a national priority to President Peña Nieto's administration**. Mexico's 'Intended Nationally Determined Contribution' submitted to the United Nations Framework Convention on Climate Change (March, 2015) aims to achieve greenhouse gas (GHG) emission reduction target of 25 percent by 2030. This target could increase up 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*, ENCC) 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 (see annex 6).

[1] The index uses the same three dimensions as the Human Development Index: health, education, and standard of living, which are measured using 10 indicators.

B. Sectorial and Institutional Context

5. **There are several key institutions in Mexico's energy efficiency (EE) sector, led by the Ministry of Energy (*Secretaría de Energía*, SENER), the entity responsible for planning and formulating national energy policies.** The 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). The CONUEE 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, the SENER has 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 crucial instrument to finance renewable energy and EE investments.

6. **Mexico passed energy reform legislation (2013-2014) aimed at increasing productivity, competition, and overall efficiency in the energy sector**. The reform is opening-up domestic energy markets to private sector participation, especially for exploration and production of hydrocarbons and electricity generation, to increase energy production and enhance energy security. The main state-owned energy companies – the Federal Electricity Commission *(Comisión Federal de Electricidad*, CFE) and the Mexican State-owned Oil Company (*Petróleos Mexicanos, PEMEX*) – have become 'productive state enterprises' with budgetary and operational autonomy enabling them to compete in the recently opened energy sector. The CFE will continue to focus on the generation, transmission and distribution of electricity throughout the country. The reform also seeks to support the reduction of energy consumption through energy savings and efficiency initiatives. The National Energy Strategy (*Estrategia Nacional de Energía*, ENE 2014-2028) has included EE as a transformational priority area for reducing the country's vulnerability by decreasing electricity demand, thereby helping lower GHG emissions in all sectors and government levels, including local governments.

7. **In an urbanized context such as Mexico, expanding the provision of public sector services will likely increase municipalities' energy expenditures.** Cities in the country account for almost three fourths of the population (72 percent)[2] and are expected to increase to 88 percent by 2050.[3] During this period, the number of cities with population of over 1 million people will almost double – from 11 to 20. Cities will also remain the main driver for economic growth in Mexico; 93 cities with over 100,000 inhabitants each, account for 88 percent of the country's GDP.[4] The significant demographic and economic growth will drive municipalities to expand high quality and affordable public services, such as transport, energy, water and sanitation, increasing

[2] United Nations (UN) United Nations Habitat. 2011. Estado de las Ciudades de México. México DF.

[3] *Comisión Nacional de Vivienda* (National Housing Commission), *Secretaría de Medio Ambiente y Recursos Naturales* (Ministry of the Environment and Natural Resources). Supported Nationally Appropriate Mitigation Actions (NAMA) for Sustainable Housing in Mexico – Mitigation Actions and Financing Packages. Mexico City 2011.

[4] UN Habitat. 2011. *Estado de las Ciudades de México*. Mexico D.F.

dependency on reliable and additional energy supplies. The expansion of services could also add strains on municipalities' budgets.

8. **EE is a cost-effective way for municipalities to manage energy consumption and help in achieving GHG emissions reduction goals.** Mexican municipalities' highest expenses after salaries are street lighting (SL), water supply, and wastewater treatment. SL and water tariffs are among the highest of public sector services and tariffs (annex 6).[5] According to *Sistema de Información Energética* (National Energy Information System, SIE), in 2014 SL amounted to 58 percent of total municipal public sector electricity consumption, while water-pumping and related activities represented the remaining 42 percent.[6] Since 2002, these subsectors have seen considerable growth: SL energy consumption has increased by 32 percent, and the use of electricity for water services has increased by 78 percent (annex 6). Furthermore, the water supply and sanitation sector is plagued by large inefficiencies and low level of cost recovery. Water utilities often rely on the municipal budget as the last resource to cover their expenses.

9. **There are untapped opportunities to realize energy savings potential for municipalities and water utilities.** The Low-Carbon Development for Mexico[7] (*México: estudio sobre ladisminución de emisiones de carbono*, MEDEC) study showed savings of up to 50 percent for efficient street lights and up to 40 percent for efficient water pumps based on information from municipal pilot projects undertaken by the FIDE. A large number of municipalities have limited investment capacity spending most of their municipal budget to cover administrative costs (annex 6). EE projects could, therefore, free up a portion of these resources for other uses which is also a key added benefit.

10. **City governments are in a unique position to lead the transition to more EE cities.** The political visibility of municipal authorities can help influence society, even if they represent only 4.5 percent of the electricity consumption within the country. Moreover, there is strong potential for project replicability that is important for creating an EE market.

11. **There have been efforts to improve EE in Mexican municipalities with limited results.** Municipal EE has focused mainly on SL retrofits and water pumping. The CONUEE and the National Bank for Public Works and Services (*Banco Nacional de Obras y Servicios Públicos*, BANOBRAS) have supported[8] a SL retrofit program for municipalities since 2010. It has achieved mixed results with about 15 proposals implemented, out of which less than 10 have used the SENER's direct support (15 percent of total investment cost). Challenges encountered in implementing the program include high transaction costs, municipalities' lack of borrowing capacity, and insufficient/inadequate timing of direct support. Other SL retrofits have included

[5] Public sector tariffs exist for three sectors only: (a) water pumping, (b) SL for Mexico City and Guanajuato, and (c) SL for the rest of the country. There is no public sector tariff for public buildings. Even if special tariffs for SL and water supply and treatment exist, some operators have switched to medium voltage tariffs to reduce costs.

[6] Public sector services sales exclude those for municipal buildings (MB), as the SIE does not disaggregate energy consumption data for buildings. Tariffs applicable to the public buildings subsector may include different low and medium voltage tariffs (such as tariffs 2 or 3 – low voltage- and OM or HM-medium voltage).

[7] Johnson, T.M., Alatorre, C., Romo, Z., Liu, F. 2010. *Low Carbon Development for Mexico*. The World Bank. Washington D.C.

[8] This program includes a direct support from the SENER (through the FOTEASE) of up to 15 percent of the total investment cost with a ceiling of US$800,000.

some form of public private partnership structure with mixed results; in some cases they are underperforming public lighting systems because of noncompliance with national Mexican norms.[9] Water and wastewater efficiency programs often focus on improving operational and commercial efficiency of the operator, and the incentive for energy savings in pumping systems for extraction, transport and distribution of water remains quite limited.[10]

12. **There are various barriers affecting the implementation of municipal EE initiatives.** Some of the key difficulties encountered by municipalities when implementing EE initiatives, in particular SL and water pumping improvements, include the following:

(a) *A lack of information and awareness* on EE opportunities and potential, measures and technologies, expected benefits, energy use and methods of financing and implementation;

(b) *Low technical and implementation capacity* to identify, design, finance, implement, monitor and verify savings from EE investment projects;

(c) *Misaligned incentives*, such as the absence of metering for most SL infrastructure and the principal-agent problem of municipalities receiving the benefit in another administration given the short three-year administration period;

(d) *Restrictive procedures* with regard to budgeting, such as being able to retain operational cost savings in subsequent budget years to service debt payments, and procurement, such as selecting equipment and service providers based on their ability to provide lowest life cycle costs rather than only lowest up-front costs; and

(e) *Access to financing* including low or marginally creditworthy municipalities along with constrained debt capacity and the difficulty accessing long-term credit to finance upfront investment costs.

13. **A new public-financed EE program integrating lessons learned from previous programs could help overcome these barriers, demonstrate impacts and help develop a market for private sector investments**. A federal program with strong involvement of the SENER, the CFE, the CONUEE, and the FIDE could help improve the institutional framework, increase transparency, enhance procurement process, and design and implement financial structures that verify repayments through achieved savings and create trust in EE initiatives. Important areas where such a program can help are in: (a) establishing clear rules for determining energy consumption baselines; (b) testing project budgeting and finance structures; (c) enhancing technical capacity at the federal and local level on procurement and, monitoring and verification (M&V) of savings; and (d) building trust and performance history for municipal repayments. The program will help develop, test and institutionalize rules and financial mechanisms, therefore creating a transparent and conducive framework for private sector investment. It will also allow a critical mass of projects to be implemented so that the market can assess actual costs, risk profiles, expected savings, and contractual mechanisms, allowing for the gradual development of a more dynamic and sustainable EE market.

[9] See the FITCH Rating article that highlights the risks on SL public-private partnership schemes, such as those leaving municipalities with a significant debt and underperforming public lighting systems.

[10] As cities in the country face water scarcity, their need to transport large volumes of water from further away will increase.

14. **The World Bank has experience in the development of analytical tools and operational work in EE at the national and municipal levels in Mexico.**[11] The MEDEC study contributed to developing several Bank-financed operations addressing EE, such as the Low Carbon Development Policy Loan and the Efficient Lighting and Appliances Project. The Bank is also collaborating with Mexico's participation in the Partnership for Market Readiness (PMR) that is developing Nationally Appropriate Mitigation Action Plans (NAMAs) on urban EE and refrigerator efficiency. The Bank supported the SENER in the implementation of the Energy Sector Management Assistance Programme's (ESMAP)'s Tool for Rapid Assessment of City Energy (TRACE) in 32 municipalities in Mexico.[12] The strong partnership of the government of Mexico (GoM) and the Bank in end-use EE and low-carbon development have opened-up the opportunity to support the design and implementation of a national municipal EE program that supports the long-term energy strategy.

C. Higher Level Objectives to which the Project Contributes

15. **The proposed Municipal Energy Efficiency Project (*Proyecto de Eficiencia y Sustentabilidad Energética en Municipios*, PRESEM) is aligned with the Bank's Country Partnership Strategy for FY14-19.**[13] In particular, the project would support Pillar I, 'Unleashing Productivity', by promoting enhanced public sector services and facilitating access to finance, and Pillar IV, 'Promoting Green and Inclusive Growth', by supporting efficient use of energy and natural resources.

16. **Improving EE in cities can help meet the Bank's twin goals of poverty reduction and shared prosperity.** Most cities would like to cut their excess energy use and optimize their limited budgets, which is often the primary incentive for pursuing EE. It can improve urban service delivery in areas such as water supply or SL while freeing up fiscal resources for expanding other social and economic development programs.

II. PROJECT DEVELOPMENT OBJECTIVES

A. PDO

17. The development objective of the proposed Project is to promote the efficient use of energy in the Borrower's municipalities by carrying out energy efficiency investments in selected municipal sectors and contribute to strengthening the enabling environment.

B. Project Beneficiaries

18. **The direct project beneficiaries would be the federal and municipal institutions participating in the implementation of the project, as well as the residents of the municipalities where subprojects would be implemented.** The key direct beneficiaries would be participating national institutions: the SENER, the FIDE, the CONUEE, and the CFE, as well

[11] Further details on the support provided to Mexico by the Bank can be found in annex 5.

[12] The diagnostics were prepared from September 2014 to May 2015 with support from the Global Environment Facility (GEF) financing from the Bank's Efficient Lighting and Appliances Project. In municipalities that had a climate action plan (the ICLEI's PACMUN tool or other similar tool), the information was reviewed as part of the data gathering assessment.

[13] Endorsed by the Board of Executive Directors on December 12, 2013.

as the participating subnational entities (municipalities and water and wastewater utilities). Given the scope of the proposed Project, it is not possible to identify all key beneficiaries with any degree of precision at this time. EE benefits would include lower energy use, reduced energy costs, and improved quality of targeted services. Improvements in SL systems would be especially beneficial for women, given the important role that outdoor lighting plays in the safety and security of public spaces. The project would also support communication and citizen engagement actions, including those tailored specifically for women. Finally, energy service providers, private equipment suppliers, and construction firms would benefit from increased demand for their goods and services.

C. PDO Level Results Indicators

19. Progress towards achieving the project development objective (PDO) would be assessed through the following indicators:

(a) Projected lifetime energy savings;
(b) Number of Energy Services Agreements (ESAs) signed; and
(c) Framework to scale up municipal EE in the country.

III. PROJECT DESCRIPTION

A. Project Components

20. The SENER has requested the Bank's support to design and implement a pilot for a national municipal EE program in 32 municipalities in the country.[14] The proposed US$100 million IBRD investment operation would be implemented by the SENER over a five-year period and would comprise two components.

21. **Component 1: Policy development and institutional strengthening** (Total US$7 million, of which US$1 million SENER and US$6 million IBRD). This component would strengthen the enabling environment for EE at the municipal level, and contribute to the identification of potential subprojects that can feed into a pipeline beyond the project's life. The component would finance the following sub-components: (a) capacity building on municipal EE; (b) sector-wide policy support, including a framework to scale-up activities piloted under this operation with a view to transition to a more commercial, sustainable program; and (c) project monitoring, and management activities (see annex 2). All activities under this component would be led and executed by the SENER with substantial technical support from institutions, such as the CONUEE, given its experience working with municipalities on EE policy, capacity building, and certification and management systems.

22. **Component 2: Municipal EE investments** (Total US$148.75 million, of which US$6 million SENER, US$49 million municipalities and water and wastewater utilities (through repayment scheme), and US$93.75 million IBRD). This component would support cost-effective

[14] The SENER worked with the National Federalism and Municipal Development Institute (INAFED for its acronym in Spanish) to select 32 municipalities –one in each state of Mexico– where the project will operate. Municipal EE diagnostics using TRACE tool have been performed as part of the preparation.

EE investments in municipal SL, water and wastewater, and building sectors.[15] Activities to be financed include (a) the preparation of feasibility studies, project designs, and bidding documents for the implementation of identified priority investments (with a bundled approach to the extent possible per technology)[16] and (b) acquisition and installation of items necessary to implement the agreed EE measures. Investments costs would be covered by (a) direct support through the IBRD loan (the share of investment cost that the subnational entity will not have to repay) and (b) repayment by the subnational entity that would be initially supported by the SENER (see annex 3).[17] The first pipeline of subprojects is being prepared; detailed energy audits are under way for six subnational entities, after which the FIDE would prepare feasibility studies and bidding documentation for about four to six subprojects for an estimated investment cost of US$15-20 million (see annex 2). This component would be operated by the FIDE, with support from the CFE and the SENER.

23. The sectoral scope of the investments was decided based on the following criteria: (a) these areas were found to have significant untapped EE potential that can be undertaken directly by the municipality or the water utility; (b) the SENER's sphere of influence lies directly in the energy sector, which in practical terms means the provision of electricity by the CFE; and (c) the use of energy service agreements (ESAs) which allow municipalities to use electricity savings to partially repay EE investments (performed by the FIDE) and which rely on the CFE's electricity bill.

24. The GoM would allocate US$5 million from its GEF System for Transport Allocation of Resources (STAR) to help establish a guarantee fund for the repayments by the municipalities. The funds would not affect the project's arrangements but would enhance its sustainability, by reducing risk of subnational non-payment. They would be processed as additional financing, once they are approved by the GEF Council.

B. Project Financing

25. **The proposed lending instrument would be Investment Project Financing for US$100 million.** Total project costs would be US$156 million, of which US$100 million would be IBRD investment loan funds and US$56 million would be provided as counterpart funding by Mexico, including US$49 million by subnational entities (municipalities and water and wastewater operators that would repay the SENER) and US$7 million by the SENER.

Project Cost and Financing

26. Table 1 details project costs and financing sources.

[15] Drawing from the results of the municipal EE diagnostics conducted during preparation by the SENER.

[16] This means, trying to aggregate in the same bidding processes, goods, installation and works for several municipalities and/or technologies, as a way to achieve economies of scale.

[17] Only the funds corresponding to the loan part of the project (IBRD funds) will not be returned to the FOTEASE, whereas any counterpart funds will be returned.

Table 1. Project Costs and Financing Sources (US$ million)

Project components	Project cost		IBRD		GOM		Subnational entities	
	$US M	**%**	**$US M**	**%**	**$US M**	**%**	**$US M**	**%**
1. Policy development and institutional strengthening	7.00	4%	6.00	86%	1.00	14%	0.00	0%
2. Municipal energy efficiency investments	148.75	95%	93.75	63%	6.00	4%	49.00	33%
3. Front-end fee	0.25	1%	0.25	100%	0.00	0.00	0.00	0.00
Total costs	**156.00**	**100%**	**100.00**	**64%**	**7.00**	**5%**	**49.00**	**31%**

C. Lessons Learned and Reflected in the Project Design

27. The project design has benefited from the Bank's experience with similar projects in other countries, and from experiences in Mexico. The following lessons have been incorporated:

(a) EE interventions at the urban level can provide substantial co-benefits, including creation of fiscal space for investments in other sectors, increased service quality and comfort, improvements in health, urban renewal, security, and public awareness;
(b) Technical assistance is essential to create an enabling environment for EE particularly, to raise awareness and strengthen capacity at the local and national levels, and scale up investments;
(c) EE assessments at the municipal level, including technical data collection and analysis on energy consumption in the different sectors, are crucial for understanding the energy saving potential in public facilities, developing sound eligibility criteria, and identifying a robust pipeline of subprojects;
(d) Establishing a clear and robust baseline and measuring energy performance through an effective monitoring and ex-post evaluation are crucial for a replicable operational model;
(e) Introducing market principles early on in a program (for example, co-payment from municipal/water utilities beneficiaries) is needed to transition to a more commercially sustainable system in later years;
(f) Establishing a practical financial mechanism based on repayment through energy savings to help low creditworthy or highly indebted municipalities allows to cover up-front costs and help finance EE investments;
(g) Given the many competing priorities of municipalities, having them prioritize EE investments, requires – at least to start – a minimum level of support, established according to clear and transparent rules and manageable transaction costs;
(h) In Mexico, limiting the risks associated with term limits of municipal administration is needed to create a more enabling environment for EE investments; and
(i) The leadership of federal authorities is very important to establish a comprehensive, coherent and implementable municipal EE program.

IV. IMPLEMENTATION

A. Institutional and Implementation Arrangements

28. **The project would be implemented over a five-year period. Overall coordination and implementation would be the responsibility of the SENER.** The SENER's General Directorate of Efficiency and Sustainable Energy (*Dirección General de Eficiencia y Sustentabilidad Energética)* would be responsible for project implementation, and would be supported by the Responsible Project Implementing Unit (*Unidad Responsable Ejecutora del Proyecto*, UREP).[18] The SENER would rely on the UREP's in-depth experience implementing Bank-financed projects[19] to handle all procurement and financial management (FM) issues. The UREP would be strengthened to have sufficient capacity in technical issues, safeguards compliance, and monitoring. The SENER would ensure that appropriate implementation arrangements are in place and that all activities being developed by other stakeholders – mainly the FIDE – are done in accordance with project design and Bank policies. The project would channel the IBRD loan and counterpart funds through the FOTEASE.[20] The SENER would also lead the implementation of activities under Component 1 and would prepare, launch and supervise the selection processes to develop the corresponding tasks described in section III.A above and in annex 2.

29. **The FIDE would execute – as 'Operator' – the activities considered under Component 2**, **for which it would enter into an agreement with the SENER (the Operator Collaboration Agreement).** The FIDE's capacity has been proven through the implementation of the Bank-financed Efficient Lighting and Appliances Project and its own projects. The entity has more than 10 years of experience implementing EE projects with municipalities, although it had previously disengaged itself due to the municipalities' lack of financing capacity. The Bank has provided capacity building to the FIDE on its procurement and FM's guidelines during preparation and will organize capacity building during implementation, focusing on preparation of bidding documents and evaluation of economic and financial proposals. The FIDE would also enter into an agreement with the CFE (the CFE Implementation Agreement), through which the CFE would support project execution by validating the SL census, recognizing energy savings, recovering contributions from municipalities and water and wastewater utilities through the electricity bills, and transferring those resources to the FIDE. The FIDE and the CFE's incremental costs would amount to approximately 10.9 percent of each subproject costs (9.7 and 1.2 percent, respectively) and would be partially covered by the loan.

30. **A key element of the operation's design is the introduction of Energy Service Agreement (ESAs), which is an innovative mechanism to finance EE projects in the public sector**. The FIDE and the SENER would enter into an ESA with a subnational entity, where it agrees to continue paying its energy bills (a reduced amount due to the EE measure), plus a

[18] UREP was created to support Bank-based projects. UREP's coordination responsibilities will be detailed in the Project's OM (see annex 3).

[19] The projects currently managed by the SENER through the UREP include the MX Efficient Lighting and Appliances project (Loan – LN – 7996, and its two related grants trust fund – TF – 98062 and TF98465), MX Integrated Energy Services (LN7501 and its related GEF Grant TF91733) and one stand along GEF Grant (TF56781, Large-scale Renewable Energy Development Project).

[20] A chart depicting flow of funds can be found in annex 3. The FOTEASE has been used in previous Bank financed operations since 2009.

contribution to partially repay investment costs to the CFE. Both payments would equal the old electricity bill the entity was paying. The FIDE would then prepare and bid out the project on the subnational entities' behalf. The CFE would continue collecting the energy bill (a reduced amount due to the savings achieved through EE investments) plus the contribution or repayment agreed amount. The CFE would send the subnational entities' contributions (or partial repayment amount) to the FIDE, who would transfer the funds received from the CFE to the FOTEASE which would reinvest them in EE investments. Through this scheme the subnational entity does not incur debt, as it would continue paying what it used to pay, and the implementation would be outsourced to a competent entity (the FIDE). Upon completion of repayment, the subnational entity retains the energy savings.

31. **The project would be demand-driven.** As such, it focuses on preparing subprojects with those municipalities/water and wastewater utilities that meet the eligibility criteria, detailed in annex 3. After the fulfillment of these criteria, the SENER and the FIDE would sign an Activity Initiation Agreement (AIA) with the subnational entity to start subproject preparation (that is, feasibility studies, subproject design, and bidding documents). To be financeable, prepared subprojects would need to demonstrate acceptable levels of economic efficiency and energy savings (see annex 3). Finally, an ESA would be signed between the FIDE, the SENER, and the subnational entity to implement the agreed subproject.

B. Results Monitoring and Evaluation

32. The SENER would bear the overall responsibility for monitoring the project's results. Under Component 1, the SENER would be responsible for monitoring the project's performance. Under Component 2, the FIDE would report to the SENER on the project's performance and the CFE's activities. Under Component 2, monitoring and evaluation (M&E) activities would focus on subprojects' implementation, including financial viability, energy savings, disbursed amounts, defaults, monitoring, reporting and verification (MRV) of energy savings, and reporting on associated GHG reductions. The FIDE would be required to regularly monitor subprojects implementation progress. The SENER, through the UREP, would prepare the project's M&E reports, which include: (a) bi-annual progress reports, based on the framework detailed in annex 1; (b) bi-annual Interim Financial Reports (IFRs); and (c) annual independent financial audits of the project. In addition, a comprehensive evaluation of the project's results will be undertaken during the Mid-term Review.

C. Sustainability

33. **The GoM has demonstrated a consistent commitment to the development of EE initiatives.** The government has developed an overall policy framework that includes the ENE 2014-2018 which incorporates EE as a transformational priority area, the PRONASE that seeks to "promote and support the establishment of institutional arrangements for the design and implementation of EE policies, programs, and projects at the subnational level." The SENER manages the FOTEASE, which has financed EE investments, including Bank projects. The proposed project would benefit from existing institutional arrangements and the channeling of funds through the FOTEASE to guarantee its sustainability.

34. **The proposed project would develop a sustainable operational and financial mechanism that can enable the implementation of municipal EE investments beyond the time frame of the operation.** Performing municipal EE diagnostics would help prioritize investments, and defining clear eligibility criteria would help prepare a robust pipeline of subprojects to be financed. Establishing institutional arrangements that include the CFE as a key partner to recognize and validate the energy savings is crucial for making the model operational. Under the ESAs, energy savings resulting from the EE investments would be recognized, enabling municipalities to participate in the program by paying a fixed fee for service (their co-payment) corresponding to their baseline energy consumption and without incurring debt. The repayment would be channeled to a revolving fund to finance more municipal EE investments, contributing to the program's sustainability. The Project would also develop a framework for scale-up that integrates lessons and experience from the project and defines market solutions to roll out the proposed model at the national level beyond the Project's time frame.

V. KEY RISKS

A. Overall Risk Rating and Explanation of Key Risks

35. Overall implementation risk is rated substantial to account for all the risks described above, as well as the municipalities' re-payment risk. Political and governance risk is assessed as moderate due to the local political changes in administration that could negatively affect municipal authorities' commitment to the Project. Macroeconomic risk is assessed as low given the prudent economic policies in the country over the past two decades, which contributed to the progressive attainment of macroeconomic stability. Risks associated with the energy sector are also rated low as Mexico has demonstrated a deep commitment to sustainable development and the implementation of EE programs and strategies.

36. Technical design risk is rated substantial as the proposed project includes an innovative mechanism to ensure sustainability and appropriate involvement of all relevant stakeholders. The FIDE has experience in designing and supervising interventions in public lighting and buildings, a long-standing institutional and working relationship with the CFE, and proven ability to implement Bank-financed operations. The institutional capacity risk is rated moderate as the SENER and the FIDE have proven their ability to implement Bank-financed operations, but subnational entities' capacities vary widely throughout the country. Extensive preparatory work has been carried out to ensure good coordination between all the participating institutions, including preparatory work with the National Water Commission (*Comisión Nacional del Agua*, CONAGUA) for the water/wastewater subprojects, which will continue during implementation, and the development of the four inter-institutional agreements (see annex 3).

37. The fiduciary risk is rated substantial because activities to be financed under Component 2 will require coordinating with subnational entities, which have little or no experience with Bank-financed operations and EE interventions. However, the funds are ring-fenced within the FIDE, which partially mitigates this risk. The environmental and social risk is rated low given that subprojects would have limited negative environmental and social impacts as they would be implemented in urban areas and within existing facilities. Stakeholders risk is also rated low as potential savings guarantee a strong ownership and most participating institutions have appropriate capacities to implement the operation or at the very least, these will be created or enhanced through

a project-funded activity. Risk of crime and violence events impeding the implementation of the project is rated moderate, to account for the fact that 6 of the 32 municipalities are among the 10 most violent ones in Mexico.

VI. APPRAISAL SUMMARY

A. Economic and Financial Analyses

38. The Project would support policy development and institutional strengthening (Component 1) and municipal EE investments (Component 2). Given the analytical constraints associated with benefits that cannot be measured in monetary terms and/or where information is not readily available, the economic and financial analysis focused on Component 2, which accounts for 94 percent of the IBRD loan. An economic and financial analysis of EE subprojects (cost-benefit analysis) was done for each subsector in a 'typical' municipality/water utility, based on results of the municipal energy audits and/or similar projects performed in Mexico.

39. The economic analysis uses cost estimates for investment and operation and maintenance (O&M)[21] based on similar projects. Costs are adjusted to reflect economic values, excluding taxes and subsidies. Benefits are estimated based on savings to users. The main economic benefit from EE investments is the economic value of the saved energy, including the associated reductions in carbon emissions, as well as savings in O&M expenditures in the case of public lighting. The main economic costs are the capital investments and project incremental costs. Based on the analysis performed, all subprojects are economically viable.

40. The main financial benefit of the EE investments is the reduction in the energy bill of subnational entities. The financial costs of EE investments are the capital investments and incremental costs. Direct support is provided to ensure that subprojects' payback periods are within two mayoral terms or within five years. The analysis shows that all subprojects are viable according to this definition once the proposed direct support is taken into account.

41. Expected direct reductions for each subproject type over its respective project lifetime[22] – measured in tons of carbon dioxide equivalent (tCO_2e) – are 22,190 tCO_2e for SL,[23] 12,939 tCO_2e for municipal buildings (MBs), and 23,258 tCO_2e for water utilities. Total lifetime emission reductions for the project will amount to 463,405tCO_2e.[24] The results of the economic and financial appraisal are presented in table 2.[25] The full financial and economic analysis is in annex 8.

[21] O&M savings apply to the SL sector only, as savings in O&M are difficult to quantify for municipal buildings and water and wastewater sector.
[22] For this analysis, the economic life of the projects is defined as eight years. Further details can be found in the GHG emission reductions assessment, which is part of the project files.
[23] Considering an average sub-project of 17,000 light points.
[24] Calculated based on a portfolio of individual projects that will be implemented over the life of the loan.
[25] All returns shown are net of inflation.

Table 2. Economic and Financial Appraisal Summary

Subproject type	Without direct support		With direct support				Expected lifetime GHG reductions
	EIRR	Project cost (per subproject)	Direct support	Financial NPV	FIRR	Payback period	
Units	*%*	*US$ M*	*%*	*US$ M*	*%*	*yrs.*	*tCO_2e*
Street lighting	8%	13.8	70%	5.2	41%	4.0	26,105
Municipal buildings	57%	1.8	30%	1.7	43%	3.2	12,939
Water utility	64%	3.6	30%	2.1	29%	3.9	23,258

Note: NPV = Net Present Value; EIRR= Economic Internal Rate of Return; FIRR = Financial Internal Rate of Return

B. Technical

42. **The project relies on the utilization of known and proven technologies and methodologies that do not present challenging construction or operational situations**. Subprojects would be implemented in accordance with internationally and accepted technical standards with support from Bank staff and other experts as needed. Technologies, technical parameters, key design features and estimated costs for each component have been proposed by the FIDE, the SENER, and the CONAGUA, among others, and discussed with experienced officials who have participated in similar projects in the past. The SENER has relevant experiences using methodologies and services, such as those described in Component 1, while the FIDE has led the deployment of the technologies, such as those considered in Component 2. Preparation of the technical specifications, evaluation of the bidding processes, contractual negotiations and supervision would be done by the SENER and the FIDE, with project management funding for – as needed, from Component 1 –and supported, as necessary, by the Bank.

43. The SENER has developed capacity necessary to coordinate and supervise the project activities. Through other Bank financed operations it has used tools, such as TRACE, and commissioned technical studies and investments on clean energy. In addition, the FIDE has over the years, procured and installed technologies for SL, water-pumping and other auxiliary equipment for more efficient extraction, transportation, distribution and treatment of water and wastewater, and energy efficient building equipment for MBs, to be funded under Component 2. The FIDE has in-depth knowledge of their specifications, procurement, installation, and O&M. No key technical challenges are foreseen; however, support from experts (from the Bank and elsewhere) would be sought as needed.

C. Financial Management

44. Overall, Project Financial Management (FM) arrangements are adequate and provide a reasonable assurance that the funds would be used for their intended purposes. The main risks identified for this Project are related to the complex flow of funds due to the intervention of various entities during implementation.

45. Component 1 would finance mostly consultancies and capacity building activities which would be paid directly from the FOTEASE to providers of goods and services based on the SENER's instructions. Component 2 would entail transfer of funds from the FOTEASE to the FIDE, which would be in charge of providing EE services to the selected subnational entities. The CFE would retain part of the payment for electricity services made by subnational entities and transfer these funds to the FIDE. Both the FIDE and the CFE have previous satisfactory experience

working with the Bank, and the FM assessment has shown adequate capacity to carry out the FM tasks envisaged under the Project.

46. Moreover, inter-institutional implementation agreements would be signed between the various entities intervening in the Project. These agreements include provisions aimed at ensuring that the funds are managed under sound FM practices acceptable to the Bank. The templates for these agreements have already been reviewed and agreed upon with the Bank. The FM section of the OM includes specific procedures for ensuring that the project's funds are managed under adequate internal control. The annual project audit would provide reasonable assurance that the funds were used for the intended purposes.

D. Procurement

47. Component 1 finances studies, technical assistance, audits and workshops, and project management which would require the support of individual consultants. All consultancies under this component would be procured directly by the SENER, which has experience in with Bank procurement guidelines and procedures and well-trained staff. Procurement for the feasibility studies and investments under Component 2 would be conducted entirely by the FIDE. Although the FIDE also has previous experience in Bank-financed projects, the activities under this component are considered complex and require coordination with the municipal authorities of the selected cities.

E. Social

48. **The project does not trigger any of the social safeguard policies**. First, all subprojects would be carried out in urban municipalities where indigenous peoples are not found with regard to the Bank policy (there are indigenous persons living in cities but not as collective entities with attachments to ancestral territories), and therefore OP 4.10 (Indigenous Peoples policy) is not triggered. Second, subprojects are carried out on already existing infrastructure, such as SL, water and sanitation structures, and existing MBs. As a result, the Project is not expected to require any involuntary land acquisition, and hence, OP4.12 (Involuntary Resettlement) is not triggered.

F. Environmental

49. **This project has an environmental risk Category B because it is unlikely to result in significant negative impacts.** The project triggered the Environmental Assessment (OP/BP 4.01). The project's adverse impacts are identifiable, mostly temporary, and easily mitigated with known management techniques. Because the sites, types and scale of the subprojects to be financed are not known, an Environmental and Social Management Framework (ESMF) was prepared by the SENER/FIDE and approved by the Bank, and was disclosed in country and on the Bank's external website on September 4, 2015 after consultation with key stakeholders. Consultations were held on August 4, 2015 and participants agreed that the document complied with all national environmental legislation and there were no comments or requests to modify the framework. The ESMF determined that potential subprojects under Component 2 and activities under Component 1 fall into either Category B or Category C. No Category A subprojects will be supported. The ESMF includes an exclusion list for subprojects. Both the SENER and the FIDE have designated personnel responsible for ensuring compliance with the Bank's safeguard policies.

50. **The Physical Cultural Resources policy (OP/BP 4.11) has been triggered** because the project could potentially involve the financing of investments in historical MBs. The ESMF indicates that the national cultural heritage laws should apply when investments take place on historic buildings (Art. 42 and 44 of the Federal Law on Monuments, Archeological, Artistic, and Historic Areas).

G. Other Safeguards Policies Triggered

51. **The policy regarding Projects on International Waterways—OP/BP 7.50—has been triggered and management approved an exception to the Riparian notification on September 28, 2015.** Several of the subprojects being considered for funding may use water from international waterways or their tributaries. In particular, eight municipalities (Tijuana, Monclova, Tuxtla Gutiérrez, Ciudad Juárez, Monterrey, Hermosillo, Centro, and Reynosa) are located near the borders of Mexico, and/or may extract water from international waterways, whether surface or ground water (shared with Guatemala and the United States of America), to meet the water supply needs of the project. The operation will not finance any works and/or activities in municipalities or water and wastewater utilities located in any trans-boundary basin that exceed the original scheme, change its nature, or so alter or expand its scope and extent as to make it appear a new or different scheme. The project team has obtained an exception to the riparian notification requirements according to the policy.

H. World Bank Grievance Redress

52. **Communities and individuals who believe that they are adversely affected by a Bank supported project may submit complaints to existing project-level grievance redress mechanisms or the Bank's Grievance Redress Service (GRS).** The GRS ensures that complaints received are promptly reviewed to address project-related concerns. Project-affected communities and individuals may submit their complaint to the Bank's independent Inspection Panel which determines whether harm occurred, or could occur, because of the Bank's non-compliance with its policies and procedures. Complaints may be submitted at any time after concerns have been brought directly to the Bank's attention and the Bank's management has been given an opportunity to respond. For information on how to submit complaints to the Bank's corporate GRS, please visit http://www.worldbank.org/GRS. For information on how to submit complaints to the World Bank Inspection Panel, please visit www.inspectionpanel.org.

Annex 1: Results Framework and Monitoring

MEXICO: Municipal Energy Efficiency Project

Results Framework

Project Development Objectives

PDO Statement

The development objective of the proposed project is to promote the efficient use of energy in the Borrower's municipalities by carrying out EE investments in selected municipal sectors and contribute to strengthening the enabling environment.

These results are at	Project Level

Project Development Objective Indicators

Indicator Name	Baseline	Cumulative Target Values						
		YR1	YR2	YR3	YR4	YR5	YR6	End Target
Projected lifetime energy savings (MWh) - (Core)	0	408,544	817,088	1,020,714	-	-	-	1,020,714
Number of ESAs signed (Number)	0	9	18	23	-	-	-	23
Framework to scale up municipal EE in the country	No framework	-	-	Finalization of terms of reference for preparation of analysis	-	Presentation of framework and discussions	-	Framework accepted by the SENER

Intermediate Results Indicators

Indicator Name	Baseline	Cumulative Target Values						
		YR1	YR2	YR3	YR4	YR5	YR6	End Target

Projected lifetime GHG emission reductions – (tCO2) (Tons/year)	0	185,479	370,958	463,405	-	-	-	463,405
Default rate of municipalities (%, average rate of non-payment over total outstanding loan balance)	0	0	15	15	10	10	10	10
Sub-projects designed (number)	0	11	22	28	0	0	0	28
Street light interventions (number)	0	3	6	9	0	0	0	9
Water and wastewater interventions (number)	0	4	8	0	0	0	0	8
Municipal building interventions (number)	0	2	4	6	0	0	0	6
Capacity-building, and outreach activities implemented (number)	0	5	10	15	20	25	-	25
Design of energy management systems (EnMS) for street lighting, water and wastewater, and municipal buildings (number)	0	0	0	1	2	3	-	3
Participants in consultation activities during project implementation (number) – (Core)	0	200	400	600	800	1,000	-	1,000
Participants in consultation activities during project implementation – female (Percentage - Subtype: Supplemental) - (Core)	25	25	30	30	35	35	40	40

Indicator Description

Project Development Objective Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Projected lifetime energy savings (MWh)	This indicator projects lifetime energy savings directly attributable to the Project, converted to MWh. The baseline value is expected to be zero. It registers all projected lifetime savings at the time when the subproject is implemented.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER and FIDE
Number of ESAs signed (number)	This means the number of agreements to be signed with municipalities to implement a sub-project.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER and FIDE
Framework to scale up municipal EE in the country	This is a framework, to be accepted by the SENER, under which plans to scale-up EE in the country are made and sought.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER and FIDE

Intermediate Results Indicators

Indicator Name	Description (indicator definition etc.)	Frequency	Data Source / Methodology	Responsibility for Data Collection
Projected lifetime GHG emission reductions – (tCO2)	This indicator measures lifetime GHG emission reductions directly attributable to the project, converted to tCo2. The baseline value is expected to be zero. It registers all projected lifetime emission reductions at the time when the subproject is implemented.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER and FIDE
Default rate of participating municipalities (Percentage)	This indicator measures the aggregate default rate of municipalities and water utilities in which an EE investment is being implemented. The default rate will be estimated by dividing actual repayment by beneficiaries against aggregate repayment obligations established through	Biannual	SENER, FIDE and FOTEASE progress reports	SENER

	ESAs in any given year. The baseline value for this indicator will be zero.			
Sub-projects designed (number)	This indicator measures how many sub-projects were prepared, including those that were not financed by the project. The baseline is expected to be zero.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER and FIDE
Street lighting interventions (number)	This indicator measures how many street lighting interventions are financed by the project. The baseline is expected to be zero.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER and FIDE
Water and wastewater interventions (number)	This indicator measures how many water and wastewater interventions are financed by the project. The baseline is expected to be zero.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER and FIDE
Municipal buildings' interventions (number)	This indicator measures how many public buildings interventions are financed by the project. The baseline is expected to be zero.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER and FIDE
Capacity-building, and outreach activities implemented (number)	This indicator measures how many capacity-building and outreach activities are financed by the project. The baseline should be zero.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER
Design of energy management systems (EnMS) for street lighting, water and wastewater, and municipal buildings	This indicator measures how many EnMS are designed. The baseline should be zero.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER
Participants in consultation activities during project implementation (number)	This indicator measures the level of community engagement in project implementation. It is expected that the baseline value for this indicator will be zero.	Biannual	SENER, FIDE and FOTEASE progress reports	SENER
Participants in consultation activities during project implementation – female (number)	This sub-indicator measures the percentage of women who participated in consultation activities during project implementation.	Biannual	SENER, FIDE and, FOTEASE progress reports	SENER

Annex 2: Detailed Project Description

MEXICO: Municipal Energy Efficiency Project

1. The SENER has requested the Bank's support to design and implement a pilot for a national municipal EE program in 32 municipalities in the country. The proposed operation would seek to reduce energy consumption in municipalities by increasing their capacity to prepare, finance and implement EE investments, and financing EE interventions in selected municipalities. To this end, the SENER, with the support of the National Institute for Federalism and Municipal Development (*Instituto Nacional del Federalismo y el Desarrollo Municipal*, INAFED) selected 32 municipalities – one in each state of Mexico – where the project would pilot the national municipal EE program. As part of project preparation, municipal EE diagnostics and associated data collection have been performed in the 32 municipalities using the TRACE energy diagnostic tool[26] to cover the sectors of (a) street lighting (SL); (b) municipal buildings (MB); (c) water and wastewater; (d) solid waste; and (e) urban transport, including the municipal fleet (see annex 8 for more details).[27]

2. The operation will focus on sectors with cost-effective EE potential (as identified during the municipal EE diagnostics) in the SL, MB, and water and wastewater utilities (OOs) sub-sectors. Other areas such as transport or municipal solid waste are not being selected for financing for the following reasons. First, all three of the selected sub-sectors were found to have significant untapped EE potential that can be undertaken directly by the municipality or where the municipality could have significant influence. Second, the SENER, as the implementing agency, has indicated that its sphere of influence lies most directly in the energy sector, which in practical terms means the provision of electricity by the CFE. Third, one of the novel financing instruments that is being applied in the project is the use of energy service agreements (ESAs) through which municipalities will use electricity savings from the municipalities' electricity bills (through the CFE) to finance the EE investments by the FIDE. This is the case with SL, MB, and OO. (In the case of transport and solid waste management, the energy savings are largely associated with petroleum fuels.) Finally, EE in SL, MB, and OO is the most significant benefit associated with the investments by the FIDE. In the case of municipal transport, for example, energy efficiency is usually a side benefit, with the main motivation for the investments relating to increased mobility, reduced congestion or air pollution, and improved overall image of the city – this has been the case with municipal investments in bus rapid transit in Mexico.

3. The proposed US$100 million IBRD investment operation would be implemented by the SENER over a five-year period and is comprised of two components: (a) policy development and institutional strengthening, and (b) municipal EE investments. These are described in more detail below.

[26] The diagnostics were prepared from September 2014 to May 2015 with support from GEF financing from the Bank's Efficient Lighting and Appliances Project. In municipalities that had a climate action plans (the International Council for Local Environmental Initiative's (ICLEI's) Municipal Climate Action Plan (PACMUN) tool or other similar tool), the information was reviewed as part of the data gathering assessment.

[27] Data for power was also collected, but because this sector remains under federal control, the diagnostics focused on the sectors with larger city control.

4. **Component 1: Policy development and institutional strengthening** (Total US$7 million, of which US$1 million SENER and US$6 million IBRD). This component would strengthen the enabling environment for EE at the municipal level and contribute to the identification of potential subprojects that could feed into a pipeline beyond the project's lifespan. It would support raising awareness and enhancing capacities at the national and subnational levels, as well as developing and adapting tools and systems to facilitate and encourage better integration of energy considerations into subnational planning and management efforts. The component would finance the following sub-components: (a) capacity building on municipal EE; (b) sector-wide policy support, including a framework to scale-up activities piloted under this operation with a view to transition to a more commercial, sustainable program; and (c) project monitoring, evaluation, and management activities.[28] Activities in these categories include, among others, the following:

(a) Capacity building on municipal EE:
   i. ***Municipal EE diagnostic, using the TRACE-based tool,*** to assess energy use and identify energy saving priority areas, focusing on SL, water and wastewater, MBs, transport, solid waste management, and power sub-sectors. This activity can help build a pipeline of priority subprojects in other municipalities beyond the 32 pilot ones to support national scale deployment; and
   ii. ***Capacity-building activities,*** including municipal EE capacity-building programs for municipal energy managers, independent energy auditors, and national entities' staff (including the CONUEE staff) and other key players, to enable the continuous management and deployment of the program.

(b) Sector-wide policy support:
   i. ***Development of a framework for implementation scale-up***, to be accepted by the SENER, which would include relevant procurement methodologies for performance-based contracting and studies to refine the financial and operational mechanism to support a market solution for national-scale deployment;
   ii. ***Development of a framework for EnMS for municipalities*** to facilitate the incorporation of EE into municipal planning consideration. The EnMS would cover three key sectors: SL, water and wastewater, and MBs. It would also include piloting in two municipalities, including technical support; and
   iii. ***Preparation of other relevant outputs*** such as: manuals, analyses, and handbooks on EE measures on the three subsectors; M&E tasks, potentially including the deployment of new technologies to remotely measure electricity use as well as subprojects performance; and development of a geographic information system and data collection to monitor subprojects and activities.

(c) Project monitoring, evaluation and management:
   i. ***Monitoring of energy performance and measurement, verification, and reporting frameworks*** for the three sub-sectors. This task can include the preparation of relevant markets' studies that can help build the case for the development of standards and norms;

[28] See the project's Operational Manual for more details.

ii. ***Impact assessment and evaluation studies***. Activities to be financed would include baseline generation for impact assessment and analysis of project progress, and midterm evaluation analysis and ex-post assessments, including impact evaluation;

iii. ***Communication, dissemination and outreach strategies and activities*** to raise awareness of the GoM's municipal EE program among relevant stakeholders and constituencies. Activities to be financed can include: communication activities with subnational entities; multimedia items for subproject's implementation; media materials for federal institutions; and dissemination of lessons learned, best practices, and relevant experiences; and

iv. ***Project management activities***, including subproject supervision and travels; equipment; safeguards-related processes and documents; and other operational activities defined in the project's Operational Manual (OM).

5. All activities under this component are led and executed by the SENER with substantial technical support from institutions such as the CONUEE, the SENER's technical EE arm, given their experience working with municipalities on EE policy, capacity building, and certification and management systems.

6. **Component 2: Municipal EE investments** (Total US$148.75 million, of which US$6 million SENER, US$49 million municipalities and water and wastewater utilities (through repayment scheme), and US$93.75 million IBRD). This component would support cost-effective EE investments in the municipal SL, water and wastewater pumping, and buildings sectors – drawing on the results of EE assessments conducted during preparation by the SENER (see annex 8). It is expected that these activities would demonstrate the value of municipal EE investments as a means of reducing energy consumption and CO_2, and lowering municipal energy expenditures while maintaining or enhancing quality of service. Investments are expected to have a positive demonstration impact from an operational, economic, financial and environmental standpoint. By developing and testing revolving financing schemes and implementation models, those that are successful would be developed at scale, thereby creating a sustainable framework beyond the project's lifespan. Activities under this component would be operated by the FIDE, with support from the CFE and the SENER.

7. Activities to be financed under Component 2 include, among others: (a) the preparation of feasibility studies, project designs, and bidding documents for the implementation of identified priority investments (with a bundled approach to the extent possible per technology);[29] and (b) the acquisition and installation of items necessary to implement the agreed EE measures.

8. Investments costs would be covered by: (a) direct support through the IBRD loan (the share of investment cost that the subnational entity will not have to repay); and (b) subnational entity repayment initially supported by the SENER.[30] The entities eligible for financing under this

[29] This means trying to aggregate in the same bidding processes, goods, installation and works for several municipalities and/or technologies, as a way to achieve economies of scale.

[30] The funds corresponding to the loan part of the project (IBRD funds) will not be returned to the FOTEASE, whereas any counterpart funds will be returned.

component will be subnational entities such as municipalities (which usually control the SL and MBs[31] subsectors) and water and wastewater operators (responsible for water and wastewater provision at the local level).

9. In addition, the GoM would allocate US$5 million from its GEF System for Transport Allocation of Resources (STAR) to the proposed project to help establish a guarantee fund within the FOTEASE[32] for the repayments by the municipalities. This would help reduce the risk of subnational default repayment, while help to establish a revolving fund with the subnational' co-payments, in order to support a growing portfolio of sub-projects. The funds would be processed as additional financing once they are approved by the GEF Council.

10. The first pipeline of subprojects is being prepared. After the completion of TRACE assessments, eight municipalities have submitted expression of interests to the SENER, focusing on priority areas as per the diagnostic. Detailed energy audits are being prepared with ESMAP support for six municipalities and will be completed by the end of April 2016 (see table A2.1). The FIDE will then prepare the executive subproject design and bidding documentation to be ready by the end of August 2016 for about 4 to 6 subprojects in the three sectors with investment costs estimated to US$15-20 million.

Table A2.1. Pipeline for detailed energy audits

Municipality	Street Lighting	Municipal Buildings	Water Utilities
Cuernavaca			X
Huamantla			X
Leon	X		
Los Cabos		X	
Puebla	X		
Veracruz		X	

11. Specific technologies per subsector, which meet the eligibility criteria of energy savings and economic rate of return (EIRR), would include, but are not limited to the following:

(a) SL:

Eligible equipment: Lighting fixtures and infrastructure, such as poles, arms, and wiring, and management and control systems; and
Technologies: Light-emitting diodes (LEDs)[33] and metal halide.

[31] The project will test, later in its implementation, the inclusion of performance-based contracting (selection of highest NPV proposal) for the buildings sector. This will be done to allocate some project performance risks to the contractors based on the actual energy savings generated from the project. This performance contracting will also seek to pilot the inclusion of innovative parameters to launch bidding processes and evaluate them.
[32] The FOTEASE has financed renewable energy and EE investments, including the implementation of the Bank-financed Efficient Lighting and Appliances Project.
[33] Subprojects may include only lamps or a combination of lamps, posts, hooks, meters and management systems as well as other ancillary equipment.

(b) Water and wastewater:

Eligible equipment: Pumps and motors and other auxiliary equipment for the extraction, transportation, distribution, and treatment of water and wastewater; and

Technologies: Water pumps,[34] variable-speed drivers, capacitor banks, starters, transformers, and aeration systems for wastewater.

(c) MBs:

Eligible equipment, among other: Lighting, air-conditioning, windows, insulation, white roofs, solar water heaters, and photovoltaic (PV) systems; and

Technologies: LEDs, T5 fluorescent bulbs, and other high-efficiency equipment.

[34] Their hydraulic and electric efficiency will be taken into account.

Annex 3: Implementation Arrangements

MEXICO: Municipal Energy Efficiency Project

Project Institutional and Implementation Arrangements

1. **Overall coordination and implementation would be the responsibility of the SENER.** Within the SENER, the General Directorate of Energy Efficiency and Sustainability (*Dirección General de Eficiencia y Sustentabilidad Energética, DGESE)* would be responsible for project implementation, and would be supported by the Responsible Project Implementing Unit (*Unidad Responsable Ejecutora del Proyecto*, UREP).[35] The SENER would rely on the UREP's in-depth Bank implementation experience,[36] and its core team of qualified staff to handle all procurement and financial management (FM) issues. Given the magnitude of the operation, the UREP would be strengthened to have sufficient capacity in technical issues, safeguards compliance, and monitoring, among other specialties. The implementation of Component 1 would be led by the SENER, with support from institutions such as the CONUEE, while Component 2 would be operated by the FIDE, with support from the CFE and oversight from the SENER. The project would channel the IBRD loan and counterpart funds through the FOTEASE,[37] which has been used in previous Bank-financed operations since 2009.[38]

2. **The SENER would ensure that appropriate project implementation arrangements are in place** and that all activities being developed by other stakeholders – mainly the FIDE – are done in accordance with project design and Bank procedures. The SENER's responsibilities are detailed in the project's OM and include, among others, the following:

(a) Project management, implementation, and supervision;
(b) Coordination with subnational entities (municipalities and OOs) and other federal- and state-level entities, as needed;
(c) Developing communication plans and reaching out to stakeholders;
(d) Presenting the project and its activities to the FOTEASE for funding allocation and approval;
(e) Ensuring that the FIDE has access to resources to implement Component 2;
(f) Monitoring of the project's implementation (preparing progress reports and IFRs, managing data collection databases and following up on project indicators, monitoring the operation's financial progress);
(g) Fiduciary responsibilities: Procurement (preparation and launching of bidding processes for project management activities and overseeing those to be conducted by the FIDE), FM (FM reporting, independent financial audits, and so on);

[35] UREP was created to support Bank-based projects.
[36] The projects currently managed by the SENER through the UREP include the MX Efficient Lighting and Appliances project (Loan – LN – 7996, and its two related grants trust fund – TF – 98062 and TF98465), MX Integrated Energy Services (LN7501 and its related GEF Grant TF91733) and one stand along GEF grant (TF56781, Large-scale Renewable Energy Development Project).
[37] The Energy Transition and Sustainable Energy Use Fund (*Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía*, FOTEASE) has financed renewable energy and energy efficiency investments, including the implementation of the Bank financed Efficient Lighting and Appliances Project.
[38] A chart depicting flow of funds can be found in figure A3.1 in the current annex.

(h) Supervising and ensuring safeguards' compliance; and
(i) Preparing monitoring and reporting outputs and information necessary to track progress based on the indicators included in annex 1 and elsewhere.

3. **In addition to overall project coordination, the SENER would lead the implementation of activities under Component 1**. This means that the SENER would prepare, carry out the selection processes to develop the corresponding tasks (described in Section III.A and annex 2), and supervise their implementation.[39] The General Directorate of Energy Efficiency and Sustainability would be responsible for the technical work in close collaboration with the CONUEE, such as preparing all documentation for the hiring of services, overseeing consultancies, and coordinating with municipal authorities. The UREP would also support the administrative processes, including the procurement of needed consultancies. The component would be supported by the loan and counterpart funding from the SENER.

4. **The activities under Component 1 would be implemented as follows**:

(a) The Treasury of the Federation (*Tesorería de la Federación*, TESOFE), through the SENER, transfers the resources allocated to the FOTEASE, according to the federal budget;
(b) The SENER proposes the planned activities to the FOTEASE's Technical Operational Committee for its approval;
(c) After the FOTEASE's approval, the SENER prepares all documentation for the hiring of services and procurement of needed consultancies; and
(d) The SENER, through the FOTEASE hires and pay for any services or consultancies under Component 1.

5. **The FIDE would execute – as 'Operator' – the activities considered under Component 2, for which it would enter into an agreement with the SENER (the FIDE Collaboration Agreement)**. The FIDE's capacity has been proven through the implementation of the Bank-financed Efficient Lighting and Appliances Project (P106424 and P120654) and its own projects. The entity has more than 10 years of experience implementing EE projects with municipalities but had disengaged itself due to the municipalities' lack of financing capacity. The Bank has provided capacity building to the FIDE on Bank procurement and FM's guidelines during preparation and would organize workshops during implementation, focusing on preparation of bidding documents and evaluation of economic and financial proposals.

6. **The FIDE's responsibilities** are detailed in the project's OM and include, among others, the following:

(a) Perform and in the cases where outsourced assess the technical and economic feasibility of subprojects;
(b) Support the SENER and coordinate the Activity Initiation Agreement (AIA) and the Energy Service Agreement (ESA) with the beneficiaries and the CFE;
(c) Prepare, conduct and supervise the bidding processes relevant to the implementation of Component 2 and in accordance with the Bank's guidelines;

[39] For further details on these project activities, see Project Description Section III.A of the main text or annex 2.

(d) Make payments for services and goods, in accordance with the contract;
(e) Coordinate and manage all information concerning project progress at the subnational level and report it to the SENER/UREP and provide updated information on project progress;
(f) Monitor the implementation of the project at the subnational level in every aspect, including physical, technical, legal, economic, financial, and environmental and social;
(g) Communicate to the SENER/UREP any breach on the compliance of relevant inter-institutional agreements;
(h) Reimburse to the FOTEASE resources paid back by participating subnational entities; and
(i) Transfer resources to the CFE for the incremental costs incurred by the company.

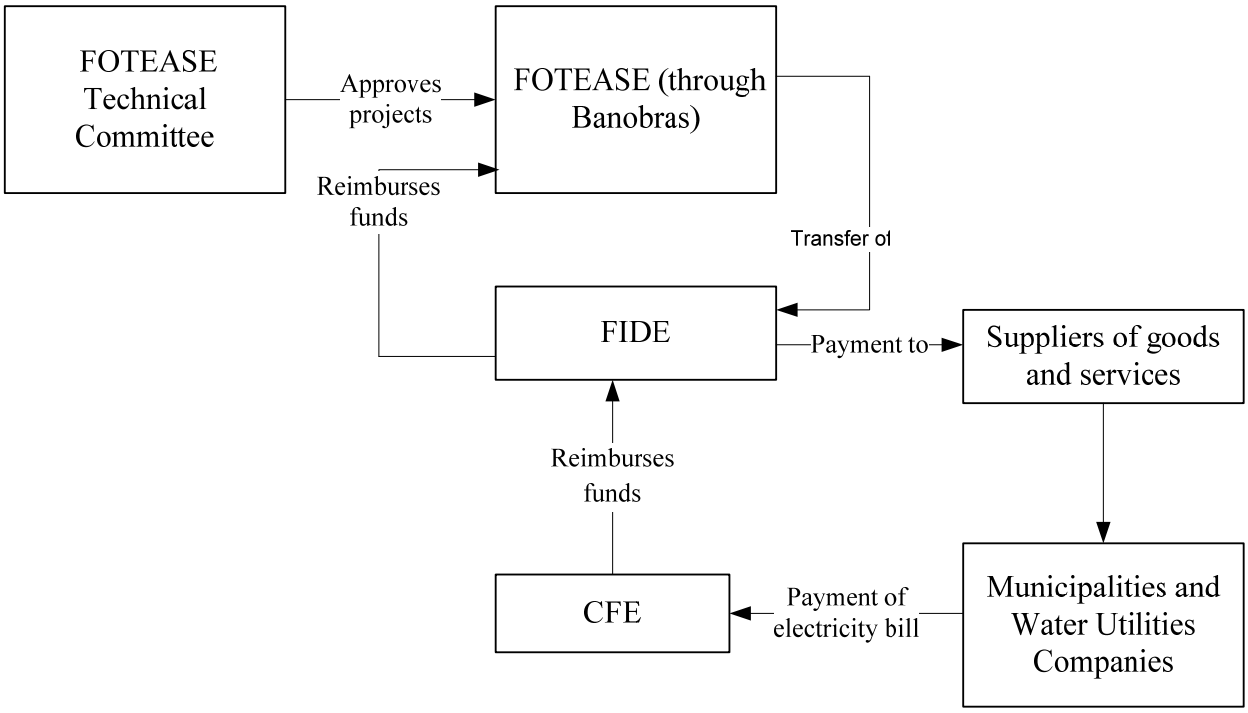
7. **The CFE would support project execution by recognizing and validating the SL census (which is prepared before the implementation of interventions in such sector) and the energy savings**. The utility would also help recover the contributions from municipalities and OO through the electricity bills and transfer those resources to the FIDE. This Fund would then transfer the funds received from the CFE to the FOTEASE which would reinvest them in EE investments. The incremental costs of the FIDE and the CFE would amount to 10.93 percent of investments total costs (9.7 percent of the investment in the case of the FIDE and 1.20 in the case of the CFE, or 2.25 percent of the beneficiary's repayment obligation) plus a fixed fee of $25 MXN per light point for the CFE for the carrying out of SL census. The FIDE's incremental costs would be partially covered by the Loan. Further details on these incremental costs can be found on table A3.1.

8. **The proposed mechanism for the implementation of Component 2 seeks to leverage Bank financing and maximize sustainability of project results.** Detailed implementation arrangements for Component 2 can be seen in figure A3.1, and would be articulated around four inter-institutional agreements, all of which have been drafted and agreed upon with the Bank:

(a) A collaboration agreement between the SENER and the FIDE for the execution of Component 2 activities: the Operator Collaboration Agreement;
(b) An implementation agreement between the FIDE and the CFE to define the parties obligations, including the CFE's activities during subprojects' preparation and implementation: the CFE Implementation Agreement;
(c) An Activity Initiation Agreement (AIA) among the SENER, the FIDE, and participating municipalities and OO, to start subprojects' evaluation and preparation; and
(d) An ESA among the SENER, the FIDE and the participating municipalities and OO to execute agreed subprojects. Detail on the ESA[40] is provided below.

[40] ESAs were successfully tested and executed in Armenia and Former Yugoslav Republic of Macedonia (Armenia Energy Efficiency Project P116680 under implementation) and are being replicated in a number of similar EE investments projects in Europe and Central Asia Region.

Figure A3.1. Operational and Financial Mechanism for Financing EE Investments



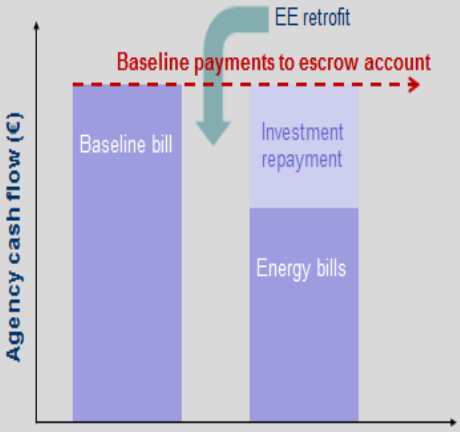
9. **A key element of the operation's design is the introduction of ESAs, which is an innovative mechanism to finance EE projects in the public sector**. The FIDE and the SENER would enter into an ESA with a subnational entity, where it agrees to continue paying its energy bills (a reduced amount due to the EE measure), plus a contribution to partially repay investment costs to the CFE. Both payments would equal the old electricity bill the entity was paying. The FIDE then prepares and bids out the project on the subnational entities' behalf. The CFE would continue collecting the energy bill (a reduced amount due to the savings achieved through EE investments) plus the contribution or repayment agreed amount. The CFE would send the subnational entities' contributions (or partial repayment amount) to the FIDE, who would transfer the funds received from the CFE to the FOTEASE which would reinvest them in EE investments. Through this scheme the subnational entity does not incur in debt, as it will continue paying what it used to pay, and the implementation would be outsourced to a competent entity (the FIDE). Upon completion of repayment, the subnational entity retains the energy savings.

10. A big advantage of the proposed mechanism is that it would not place an undue burden on the subnational entity (municipality and/or OO), as it would continue paying the usual amount for its electricity bill and the implementation would be outsourced to a competent entity (the FIDE). In addition, ESAs are typically viewed as a long-term contract obligation, similar to utility payments, and thus, the subnational entity would not incur debt. The ESA can be made with flexible contract duration in the event the energy savings are a bit higher or lower than expected. The box illustrates the ESA concept in further detail.

Box 1. Energy Service Agreements

Under an ESA, the EE financier (the FIDE) offers a full package of services to identify, finance, implement, and monitor EE projects for public clients. In other countries, the financier then subcontracts actual design and implementation to local Energy Service Companies (ESCOs). The client is required to continue to make its baseline energy bill payments into an account in the CFE, which are then used to pay its reduced bills and repay the investment and associated fees, until the contract period ends.

The figure on the right illustrates the basic idea of a client's cash flows under the ESA, with payments equal to its baseline energy bill. Such a scheme requires the agency to pay only what it is paying today without taking on associated investment risks. In some cases, the contract duration is fixed; in other cases, the contract can be terminated after an agreed level of payment has been made, which can encourage the client to save more energy.



For public sector clients, ESAs are generally not registered as debt, since they are generally viewed as long-term contractual commitments. Such a scheme provides major advantages to the client because it is relatively simple to carry out, does not require debt financing, and poses little risk. However, the public clients must show demonstrated energy bill payment discipline, have sufficient baseline data and have met basic internal levels of comfort (for example, heating/cooling).

11. **The Project is demand-driven**. As such, it focuses on preparing subprojects with those municipalities and OOs that: (a) expressed interest in participating in the project – on a first come, first serve basis; and (b) complied with the project's eligibility criteria (see paragraph 12 and 13 below for details). The SENER would launch annual calls for proposals to municipalities and OOs, asking to submit one proposed subproject per expression of interest per year. To ensure transparency and fairness in the selection of subprojects, all eligibility and selection criteria detailed below (including for the allocation of the direct support) would be clearly spelled out in the call for proposals and relevant communication materials handed out to the subnational entities.

12. Eligibility criteria to participate in the project is described in the project's OM and include:

(a) completed municipal EE diagnostic analysis using the TRACE-based tool with sufficient data input and identified EE potential in SL, MBs, or water and wastewater;
(b) demonstrated financial discipline and no current account deficits or agreed repayment schemes with the CFE and/or the FIDE; and
(c) a letter of intent from the mayor, at least two years left in the mandate of the municipal administration, and a commitment to secure state or municipal approval (if applicable).

13. After demonstrating the fulfillment of these criteria, the SENER and the FIDE would sign AIAs with municipalities and OOs to start preparation of subprojects. Once the subproject is screened to ensure its eligibility, ESAs would be prepared and signed, and the FIDE would perform the feasibility analysis, including a detailed energy audit and subproject design for the SL and MBs sectors. For the water and wastewater sector, the FIDE would hire a consultant to perform the detailed energy audit and executive subproject for the investment and would review the work. On that basis, the FIDE would propose subprojects to maximize its value to the municipality (for

example, the highest NPV),[41] discuss subproject parameters with the municipality, and negotiate final subproject parameters, to be agreed upon with the beneficiaries on the ESA. The FIDE would then prepare bidding documents.

14. To be financeable, prepared subprojects would need to demonstrate acceptable levels of economic efficiency and energy savings, as defined here:

(a) At least 20 percent energy savings;
(b) Economic internal rate of return (EIRR) of at least 7 percent (calculated excluding any direct support); and
(c) Minimum subproject cost of US$1 million; and maximum cost of US$15 million for SL, US$4 million for OOs, and US$2 million for MBs.

15. **To reduce the risk of local political changes in administration affecting the municipal authorities' commitment to the repayment of the ESA, a non-reimbursable direct support would be provided to subnational entities**. One of the main barriers to implement EE investments in Mexican municipalities is the political risk of changes in municipal administration every three years. To overcome this, direct support would help reduce payback periods, and provide an incentive to invest in more advanced (and thus, costly) technology to carry out more integrated infrastructure works. The direct support would be established at a level needed to guarantee that payback does not go beyond two municipal administration periods, more specifically within five years, to reduce political risk. The amount of direct support would vary by subproject and the criteria would be re-assessed by the SENER and the Bank during the project's Mid-term Review, based on implementation results and with a view to reduce them, to transition to a more commercial, sustainable program. The following criteria are based on the results of economic and financial analysis of typical subprojects and of investments supported by the FIDE and would apply to the selection of all subprojects, unless otherwise agreed by the Bank:

(a) All subprojects would receive a minimum 30 percent direct support, regardless of their financial viability and in order to address high transaction costs and perceived high risks for all parties; and

(b) The non-reimbursable support could exceed 30 percent if needed to bring the payback period to less than 6 years or two municipal terms:
- Up to 40 percent of total investment for subprojects of up to US$2 million;
- Up to 70 percent for investments over US$2 million.

16. **Baseline, energy savings, and co-payment schedule would be established and agreed upon in the ESA, after which the FIDE would launch the biddings**. The value of the baseline would determine the level of energy savings used to repay the share of the investment cost to be borne by the municipality or OO. This baseline would be established based on historical consumption of the municipality or OO and could be fixed throughout the subproject's lifetime. In addition, for energy savings to materialize, they have to be recognized by the CFE, particularly in the case of SL where a large share of light points does not have metering available. Consumption for non-metered lighting would be measured based on the CFE-validated inventory (census),

[41] Later during implementation, performance-based contracting can be tested for the buildings sector, where the bidder will be given greater flexibility to design a proposal resulting in the highest NPV.

which establishes consumption parameters per equipment. Such aspects would be duly included in the ESA.

17. **Co-payment of municipalities would be used as a revolving fund**. As previously mentioned, the municipal co-payment amounts corresponding to energy savings (net of the FIDE's and the CFE's incremental costs) would be transferred back to the FOTEASE to be reinvested in municipal EE activities, with the aim of creating a 'revolving fund' for such investments. The resources to be transferred to the FOTEASE would be earmarked for energy efficiency interventions, help achieve sustainability and leverage project's impacts, to help create a successful model that could be replicated on a national scale.

18. **The operational and financial mechanism proposed by the project has a strong potential to motivate municipalities and OOs to participate**. The ESA presents two main advantages to municipalities or water and wastewater operators as they would: (a) improve infrastructure and service delivery, in a business as usual scenario, with no additional energy costs and procurement/construction processes; and (b) not have to incur debt. The direct support is an additional bonus, translating into a shorter repayment period and a quicker availability of savings in the municipal or water and wastewater operator's budget, because the legislation allows municipalities and OOs to keep the savings. In addition the repayment scheme allows the SENER to leverage its investment and fund additional EE projects.

19. The 'incremental costs' for the FIDE and the CFE amount to approximately 10.93 percent of subproject cost (9.70 percent for the FIDE and approximately 1.23 percent of the investment cost for the CFE and would be partially covered by the loan. Table A3.1 summarizes estimated costs per activity performed by the FIDE and the CFE.

Table A3.1: Expected FIDE's and CFE's Incremental Costs for the Project[42]

	Stages of subproject	Activity	Amount	% (of subproject costs)	Source of financing
FIDE	Preparation	Feasibility analysis/executive subproject	2.05 USD M	2.00%	IBRD loan
	Evaluation	Bill analysis and census	1.08 USD M	1.05	IBRD loan
		Analysis of energy balance			
		Analysis of alternatives for energy savings			
		Definition of energy indices			
		Verification of estimates of consumption and savings potential			
		Finalization of technical analysis			
		Technical specifications and bidding documents			
	Monitoring, verification and reporting	Measurement of energy results	1.81 USD M	1.76	IBRD loan
		Analysis of changes in the baseline			
		Reports/recommendations			
	Technical monitoring of implementation	Technical verification of installation of equipment	1.90 USD M	1.85	IBRD loan
		Works and authorization of payment			
	Administration fees	Selection process	3.11 USD M	3.04	Counterpart (SENER)
		Procurement process			
		Service fees (lighting, water, and so on.)			
		IT development			
		Formalization of contract			
		Monitoring of payment			
		Supervision visit			
FIDE Total			9.95 USD M	9.70	
CFE	Public lighting census update		0.21 USD M	MXN 25.00 + VAT	IBRD loan
	Public lighting billing		1.02 USD M	2.25 of beneficiary's repayment obligation	Counterpart (SENER)
	Billing receipts and statements				
	Administration fees				
	CFE Total		1.23 USD M	1.20	

20. **The implementation of planned activities under Component 2 would follow the following sequence** (see the Financial Management section for further details):

(a) TESOFE, through the SENER, transfers the resources allocated to the FOTEASE, according to the federal budget;

[42] Assuming a 100 percent success rate.

(b) The SENER proposes to the FOTEASE's Technical Operational Committee, for its approval, the transfer of resources to the FIDE to analyze and finance potential interventions;
(c) After its approval, the FOTEASE transfers the approved resources to the FIDE for the implementation of Component 2;
(d) The FIDE prepares all documentation for the procurement of services and goods, and their installation, as considered under Component 2, starting with detailed energy audits and baseline studies and continuing, if appropriate, to interventions;
(e) The FIDE collects the resources generated by energy savings from participating subnational entities (and through the CFE's electricity billing), reimburse the CFE for its costs incurred during project implementation, and reimburse remaining resources to the FOTEASE (after collecting the agreed incremental costs); and
(f) In case of no payment or insufficient payment from subnational entities, the municipality, the CFE and the FIDE discuss options- including adjustment to terms of the ESA.

Financial Management

21. **Project FM risk is Moderate**. The FM tasks of this project would be carried out mainly by two entities: the SENER as overall project coordinator, and the FIDE which would implement the project's activities under Component 2 and would provide financial information regarding project implementation to the SENER. Overall, project FM arrangements are adequate to provide assurance that the project's funds would be used for the intended purposes. Main pending actions include the signature of implementation agreements among the projects implementing entities (the templates for these agreements have already been reviewed and approved by the Bank).

22. **The FM arrangements agreed under this project would be similar to those used in a number of other projects financed by the Bank for which the SENER has been the coordinating agency**. These arrangements have proven to function properly and mainly consist of the following: (a) using the FOTEASE (a public trust fund controlled by the SENER and managed by BANOBRAS) as financing mechanism; (b) coordinating FM functions through an administrative unit, which is part of the SENER's organizational structure (the UREP) and is adequately staffed for undertaking the tasks under this project; (c) the participation of the FIDE as co-implementing agency; and (d) the designation of the National Development Bank (*Nacional Financiera*, NAFIN) as financial agent, which entails managing project disbursements and supporting the SENER in the procurement processes.

23. **The project also has a number of additional actors with different roles**, including: (a) the CFE who would retain part of the payment for electricity services made by project beneficiaries and transfer these funds to the FIDE (further details of this process are provided in the flow of funds section), and (b) various municipalities and OOs companies, which would be the project's beneficiaries. The FM risk is mitigated through various measures divided in three main layers of control:

(a) **Country-level mitigating measures.** The overall strong country public FM arrangements would be applied to this project because they would be integrated into the national budget which operates under a comprehensive and well-established legal framework. The Bank would reimburse eligible expenditures incurred by the FOTEASE and the FIDE recorded under earmarked budgetary lines, and NAFIN would be the project's financial agent providing operational support and oversight.

(b) **Entities-level mitigating measures.** In general terms the entities participating within the federal government in Mexico operate under an adequate internal control environment with sound financial and operational systems and well-defined procedures. The Bank has performed a capacity assessment to the SENER and the FIDE, and both institutions have shown adequate FM capacity. As noted earlier, they have long-standing experience working with the Bank.

(c) **Program-specific controls.** As a relevant mitigating measure, inter-institutional implementation agreements are in the process of being signed among the various entities intervening in the project, aimed at documenting the project's implementation arrangements and ensuring that the funds would be managed under sound FM practices acceptable to the Bank. Similarly, the FM Manual includes specific procedures for ensuring that the project's funds are managed under sound FM practices.

24. The Bank would provide capacity building and would conduct periodic supervision visits in addition to requiring semi-annual unaudited financial reports and an annual audit to the project's financial statement, which would be conducted under terms of reference and by an external auditor acceptable to the Bank.

25. Given the diversity of institutions with different roles participating in the project, provided below is an explanation of the FM functions, which would be carried out by each of these entities:

(a) **SENER.** The overall project coordinator is the SENER. Within the SENER the unit known as the UREP would be in charge of managing all FM processes. This entails, among others, managing the project's designated account, coordinating supervision missions, overseeing budgeting formulation, controlling the allocation of resources, following up on budget execution, transferring funds, assuring adequate and timely financing of eligible expenses, preparing the project's accounting records and issuing financial reports required by the Bank, and coordinating the project's external audit.

(b) **FOTEASE.** All project funds would be channeled through the FOTEASE, which is a federal government TF. BANOBRAS is the fiduciary agent of this TF and operates only by the instructions of the SENER through a Technical Operational Committee created specifically for managing the TF and its responsibilities include evaluating and approving the projects to be financed.

(c) **FIDE.** This entity would implement activities under Component 2. The FIDE also has previous experience implementing Bank projects in which it has demonstrated adequate FM capacity.

(d) **CFE.** This entity is only involved in Component 2. It would collect electricity payments from municipalities and OOs companies. Based on the parameters and guidelines determined by the FIDE, the CFE would calculate the amount of energy savings derived from the project, which would be retained and transferred to the FIDE, and validate the SL census to recognize the energy savings.

(e) **NAFIN.** This is a federal government development bank and, would represent the *Secretaría de Hacienda y Crédito Pública* (Ministry of Finance) as the project's financial agent of the Borrower with regard to the loan, In that capacity, NAFIN would be responsible for financial administration, including managing loan disbursement processes and provide other implementation support and oversight to the SENER, based on its many years of experience with Bank-supported projects.

26. **Financial reporting**. The SENER, through the UREP, would prepare consolidated semi-annual unaudited project IFRs, which would be presented 60 days after the end of each semester, and the annual audited project financial statements, which would be audited under terms of reference acceptable to the Bank, by an independent audit firm selected by the Ministry of Public Administration (*Secretaria de la Función Pública*, SFP) in accordance with the audit terms of reference and memorandum of understanding agreed between the Bank and the SFP. The FIDE would provide financial information to the SENER regarding the implementation of Component 2.

27. **Internal control and internal audit.** The internal auditing function is carried out by the SENER's Internal Control Unit (*Órgano Interno de Control*, OIC), which reports to the SFP and must follow the Public Audit Standards and Guidelines issued by the latter. The SFP also approves the annual work programs of the Internal Control Unit, oversees their operation, and receives their audit reports. Good systems are in place for timely follow-up to internal audit observations and implementation of recommendations.

28. **Flow of funds.** The general flow of funds arrangements are described in the following figure and table, and explained below.[43]

[43] Solid lines are used to explain the flow of funds while dotted lines are used to explain the flow of information. Numbers are used to describe the flow of funds regarding the expenditure cycle and letters are used for the flow of funds concerning the reimbursement of eligible expenditures pre-financed by the Government.

Figure A3.2: Description of Flow of Funds Arrangements

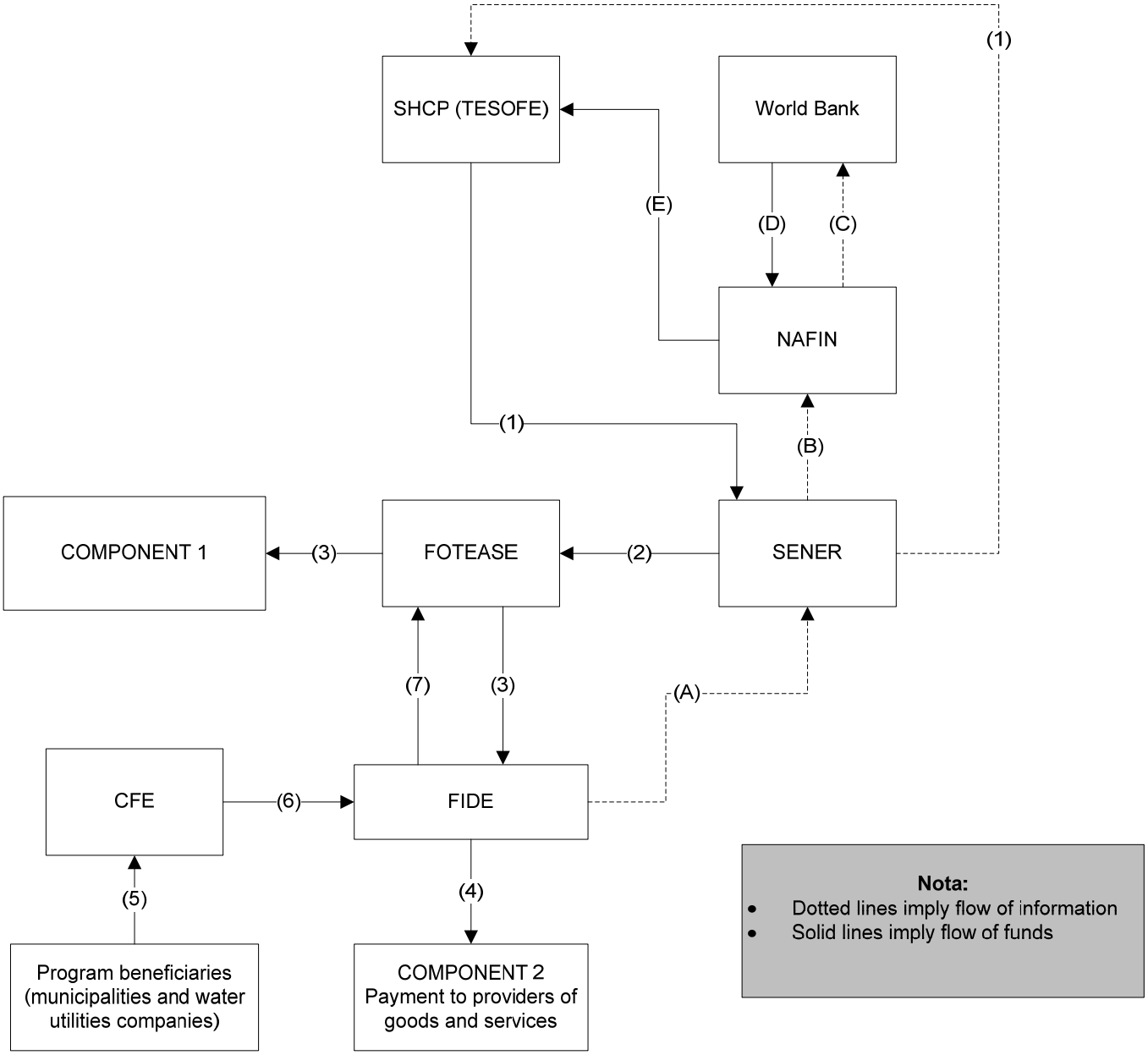


Table A3.2: Description of Flow of Funds Arrangements

Expenditure Cycle (numbers)	Reimbursement of funds (letters)
1. Based on the budget approved annually by the Congress. The SENER receives from the TESOFE the funds approved for this program. 2. The SENER transfers the funds received to the FOTEASE. 3. Within the FOTEASE, a Technical Committee evaluates and if applicable approves the expenditures to be financed under the program. Based on the approval of the Technical Committee, the FOTEASE, by the SENER's instruction, pays directly for expenditures incurred under Component 1 and transfers funds to the FIDE for expenditures under Component 2. 4. The FIDE in its capacity as the co-implementing agency of Component 2 carries out all procurement processes and pays the providers of goods and services. 5. The FIDE determines the energy savings derived from the implementation of the project activities (in the case of SL, this is based on the CFE-validated census); however, the subnational entities (that is, Municipalities and water utilities companies) continue paying their regular electricity bill to the CFE (that is, without considering any energy savings at all). This would be the part of the copayment by the subnational entities, and would be paid through the CFE's electricity bill. This amount would be paid back to the SENER (FOTEASE) through steps 6 and 7 below. 6. CFE retains the energy savings and transfers them to the FIDE. 7. The FIDE transfers the funds received from the CFE to the FOTEASE which would be reinvested in EE.	A. After payments have been incurred, the FIDE would present periodic financial reports showing physical and financial execution under Component 2 to the SENER. B. The UREP in the SENER would prepare financial records and reports showing the complete project financial execution and disbursement requests (including expenditures under Components 1 and 2, which would be submitted to NAFIN). C. NAFIN in its capacity of financial agent would submit to the Bank the project's financial reports and disbursement requests. D. The Bank would reimburse eligible expenditures to NAFIN. E. NAFIN would reimburse the funds to the TESOFE.

29. **Disbursement arrangements**. The loan disbursement arrangements[44] are summarized in this table:

Table A3.3: Summary of Loan Disbursement Arrangements

Disbursement method	Reimbursement of eligible expenditures (pre-financed by the government's budget) into a project account in U.S. dollars designated by NAFIN.
Supporting documentation	Statement of Expenses (SOEs).[45]
Retroactive expenditures	The project may finance eligible expenditures that comply with the following conditions: • Not exceeding 5 percent of the loan amount; • Made by the borrower one year before the date of the Loan Agreement; • The retroactive expenditures will be subject to the same systems, controls and eligibility filters described above in this annex. Those expenditures will also be subject to the regular project external audit (see below).

Procurement Arrangements

A. General

30. Procurement for the proposed project would be carried out in accordance with the Bank's "Guidelines: Procurement of Goods, Works, and Non-Consulting Services under IBRD Loans and IDA Credits & Grants by World Bank Borrowers" dated January 2011, and revised in July 2014; and 'Guidelines: Selection and Employment of Consultants under IBRD Loans and IDA Credits & Grants by World Bank Borrowers dated January 2011, and revised in July 2014, and the provisions stipulated in the Legal Agreement. The various items under different expenditure categories are described in general below. For each contract to be financed by the loan, the different procurement methods or consultant selection methods, the need for pre-qualification, estimated costs, prior review requirements, and time frame are agreed between the borrower and the Bank in the Procurement Plan. The Procurement Plan would be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

31. **Procurement of works**: The Project would finance civil works related to the installation of the EE goods in the selected municipalities; minor works might also be required to improve EE in public buildings; and harmonized Standard Bidding Documents (SBD) agreed with the Bank would be used for International Competitive Bidding (ICB) and National Competitive Bidding

[44] For details, please see the Disbursement Guidelines for Projects (May 2006) for World Bank Clients.

[45] All SOE supporting documentation will be available for review by the external auditors and the Bank staff at all times during the project implementation, until at least the later of: (a) one year after the Bank has received the audited financial statements covering the period during which the last withdrawal from the loan account was made and (b) two years after the closing date. The borrower and the project implementing entity shall enable the Bank's representatives to examine such records.

(NCB). Contracts for small works to cost less than US$500,000 could be procured by comparing price quotations.

32. **Procurement of goods:** Under Component 2, goods procured under this project would include energy-efficient technologies for municipal SL, lighting fixtures, meters and management and control systems for SL, water pumps, motors and other auxiliary equipment for the extraction, transportation, distribution, and treatment of water and wastewater; and lighting, air conditioning, energy-efficient windows, insulation, photovoltaic (PV) panels, solar water heaters and equipment for MBs. The procurement would be done using harmonized SBD agreed with the Bank for all ICB and NCB. Contracts for small purchases in individual contracts to cost less than US$100,000 would be carried out through shopping.

33. **Procurement of non-consulting services**: During project preparation some activities for capacity building and dissemination were identified as non-consulting services under Component 1. The procurement would be done using harmonized SBD agreed with the Bank for all ICB and NCB. Contracts for small purchases in individual contracts to cost less than $100,000 would be carried out through shopping.

34. **Selection of Consultants**: The Project would require consulting services to provide technical assistance to the SENER to implement the project under Component 1 and 2. Component 1 would also finance Project Implementing Unit (PIU) staff; Component 2 would require consultant services for feasibility studies and bidding documents for identified investments.

- Firms. Most contracts for firms are expected to be procured using the Quality- and Cost-Based Selection Method (QCBS). Consultant assignments of specific types as agreed previously with the Bank in the Procurement Plan may be procured with the use of the following selection methods: (a) Quality Based Selection (QBS); (b) Selection under a Fixed Budget (SFB), especially for works supervision contracts; (c) Least Cost Selection (LCS); (d) Selection Based on Consultants' Qualifications (CQS), for contracts estimated to cost below US$300,000 equivalent; and, exceptionally (e) Single Source Selection (SSS), under the circumstances explained in paragraph 3.9 of the Consultant Guidelines. The harmonized request for proposal (RFP) must be used.

- Short lists of consultants for services estimated to cost less than US$1 million equivalent per contract may be composed entirely of national consultants in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

- Individuals. Individual consultants would be hired to provide technical advisory and project support services and selected in accordance with Section V of the Consultant Guidelines.

35. **Project incremental costs:** The project would finance implementation team's project incremental expenses, including logistics services for capacity building; travel expenses of approved personnel commissioned under project activities; internet connectivity; communications expenses; office consumables; printing and reproduction services; publication of procurement

notices; publicity and marketing efforts; and could include the rent of office space for the implementing team.

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

36. Procurement activities would be carried out by the SENER for Component 1 and the FIDE would be responsible of procurement under Component 2. The SENER has previous experience in Bank-financed projects and would retain its procurement capacity with adequate procurement staff within the UREP. The FIDE's responsibilities are detailed above (paragraph 6 of the Project Institutional and Implementation Arrangements in this annex). The FIDE would conduct its responsibilities with its own resources; the cost of these activities would be considered as project incremental costs. Whenever the FIDE needs to hire an external consultant to meet its responsibilities paragraph 34 of this section would apply. The implementation agreement between the FIDE and the CFE would be financed with resources of the counterpart. The FIDE has a well-trained procurement staff within its Administrative Unit with previous experience in ICB. An assessment of the capacity of the implementing agency to implement procurement actions for the project has been carried out by procurement accredited staff (PAS) on April 2014. The assessment reviewed the organizational structure for implementing the project and the interaction among the project's staff that are responsible for procurement. The key issues and risks concerning procurement for implementation of the project have been identified and include the multiplicity of executing agencies involved in the project. The corrective measures that have been agreed are as follows:

Table A3.4: Corrective Measures for Appropriate Procurement Implementation

Activity	Responsible Entity	When
Procurement consultant	FIDE and SENER	Throughout project implementation
Operational manual	SENER	Before negotiations
Procurement plan	FIDE and SENER	Before negotiations

37. The overall project risk for procurement is high. This rating will be reviewed during the first year of the project's implementation.

C. Procurement Plan

38. As this is a demand driven project the Procurement Plan includes the identified investments for the six municipalities that are preparing detailed energy audits (Puebla, León, Cuernavaca, Huamantla, Los Cabos, and Veracruz). The plan would be updated as required when the cities that meet the eligibility criteria as defined in the OM join the project and identified investments are agreed upon. The borrower, at appraisal, developed a Procurement Plan for project implementation which provides the basis for the procurement methods. This plan has been agreed between the borrower and the project team on January 9, 2016 and is available in the project's database and on

the Bank's external website. It is also available in the *Sistema de Ejecución de Planes de Adquisiciones* (SEPA) and in any other system required by the Bank.

D. Frequency of Procurement Supervision

39. In addition to the prior review supervision to be carried out from Bank offices, the capacity assessment of the implementing agency has recommended two supervision missions per year to carry out post review of procurement actions.

Environmental and Social

40. **The project does not trigger any social safeguard policies**. All subprojects would be in urban municipalities where indigenous peoples are not found with regard to the Bank policy (there are indigenous persons living in cities but not as collective entities with attachments to ancestral territories) and therefore OP 4.10 (Indigenous Peoples policy) is not triggered. In addition, subprojects would be carried out on already existing infrastructure such as SL, water and sanitation structures, and existing MBs. As a result, the project is not expected to require any involuntary land acquisition and hence OP 4.12 (Involuntary Resettlement) is not being triggered.

41. **This project has an environmental risk Category B because it is unlikely to result in significant negative impacts.** The project triggered the Environmental Assessment (OP/BP 4.01). The project's adverse impacts are identifiable, mostly temporary and easily mitigated with known management techniques. Because the sites, types, and scale of the subprojects to be financed are not known, an ESMF was prepared by the SENER/FIDE and approved by the Bank, and was disclosed in country and on the Bank's external website on September 4, 2015 after holding consultation with key stakeholders on August 3, 2015. During consultation, participants agreed that the document complied with all national environmental legislation and they were no comments or requests to modify the framework. Both the SENER and the FIDE have designated personnel responsible for ensuring compliance with the Bank's safeguard policies.

42. **The ESMF defines the legal, environmental, social, and cultural resources protection requirements that may apply to the activities in Component 1 and to the subprojects in Component 2**, and compliance actions, if any, that would be mandatory for project funding. The ESMF includes an exclusion list for subprojects and no Category A subprojects would be supported. Potential subprojects under Component 2 and activities under Component 1 would fall into either B or C categories. The types of subprojects to be financed under Component 2 are public lighting, EE in water supply and wastewater processes and EE measures in public buildings, such as efficient lighting and air conditioners.

43. **All subprojects subject to screening by the SENER and the ESMF supports the screening process**. The ESMF will be applied by proponents when they submit their subprojects for evaluation and possible funding to the SENER. The ESMF will also provide guidance for preparing subproject-specific and simplified Environmental and Social Impact Assessments and Management Plans which will include mechanisms to attend and resolve claims and grievances. The team's environmental and social specialists will supervise the proper application of the project's ESMF.

44. **The Physical Cultural Resources policy (OP/BP 4.11) has been triggered** because the project could potentially involve the financing of investments in historical MBs. The ESMF indicates that the national cultural heritage laws should apply when investments apply to historical buildings (Art. 42 and 44 of the Federal Law on Monuments, Archeological, Artistic, and Historic Areas).

Other Safeguard Policies Triggered

45. **The policy regarding Projects on International Waterways—OP/BP 7.50—has been triggered.** Several of the subprojects being considered for funding may use water from international waterways or their tributaries. In particular, eight municipalities (Tijuana, Monclova, Tuxtla Gutiérrez, Ciudad Juárez, Monterrey, Hermosillo, Centro, and Reynosa) are located near the borders of Mexico and may extract water from international waterways, whether surface or ground water (shared with Guatemala and the United States of America) to meet the water supply needs of the project. Given the project's framework approach, some of the Project investments could involve water utilities in these municipalities.

46. **However, management approved an exception to the Riparian notification on September 28, 2015.** The operation would not finance any works and/or activities in municipalities or water and wastewater utilities located in any trans-boundary basin that exceed the original scheme, change its nature, or so alter or expand its scope and extent as to make it appear a new or different scheme. As such, the project team has assessed and concluded that, while OP 7.50 is triggered, the exception included in paragraph 7(a) of OP 7.50 to the riparian notification requirements under the policy will apply. The team has obtained an exception to the notification requirement.

Monitoring and Evaluation

47. Monitoring and evaluation (M&E), supervision, and reporting tasks are essential to analyze progress, provide necessary corrective measures during implementation, and assess the operation's impact. In the case of the proposed project, the SENER (through the General Directorate of Energy Efficiency and Sustainability and with support from the UREP) would bear the overall responsibility for monitoring the project's results.

48. Under Component 1, the SENER would be responsible for monitoring the project's performance, and under Component 2, the FIDE would report to the SENER on the project's performance and the CFE's activities. Under Component 2, M&E activities would focus on subprojects' implementation, including financial viability, energy savings, disbursed amounts, defaults, monitoring, reporting and verification (MRV) of energy savings, and GHG accounting. The FIDE would be required to regularly review subprojects to monitor implementation progress. Component 2 can also finance, as necessary, the carrying out of monitoring and reporting activities and the creation of systems to monitor subprojects.

49. The SENER, through the UREP, would prepare the project's M&E reports, which include: (a) bi-annual progress reports, based on the framework detailed in annex 1; (b) bi-annual IFRs;

and (c) annual independent financial audits of the project. In addition, a comprehensive evaluation of the project's results will be undertaken during Mid-term Review.

Annex 4: Implementation Support Plan

MEXICO: Municipal Energy Efficiency Project

Strategy and Approach for Implementation Support

1. The Implementation Support Plan (ISP) describes the support Mexico requires to implement key mitigation measures identified in the Project Appraisal Document. The ISP will seek to ensure that major risks are addressed and the Project can be implemented in a swift and expedient manner. Project design already takes these issues into account and provides mitigation options to be backed by the Bank. The ISP will be implemented by the Bank team involved in the operation and taking into account country-level risks, legal framework, and local context. The ISP is indicative and flexible and will be revisited during project implementation based on progress made on the ground.

Overall Project Implementation

2. The Bank strategy to support implementation will rely on continuous monitoring and constant interaction with and advice for the SENER and the FIDE. Even though these institutions count with proven, capable, and experienced staff, hands-on and constant collaboration and advice will be necessary to overcome any challenges associated with project implementation.

3. Satisfactory implementation from the start will require the preparation of critical tasks in the following areas:

(a) Legal

The Bank team will work closely with the SENER and the FIDE to help expedite:

- the effectiveness due diligence; and
- the signature of all inter-institutional agreements among the SENER, the FIDE, the CFE, and the municipalities or water operators.

(b) Procurement

- A Procurement Plan for the first 18 months and a procurement chapter for the OM have been prepared with full support of the Bank team;
- Provide capacity building to the SENER and the FIDE as needed;
- Review procurement documents and deliver timely feedback to the SENER and the FIDE; and
- Monitor procurement progress against the Procurement Plan.

(c) Financial management

- Provide capacity building to the SENER and the FIDE as needed;
- Closely supervise the project's FM; and
- Review any audits or FM reports on time.

(d) Safeguards

- Support the development of specific studies and terms of reference needed at subproject level, under a framework approach;

- Provide capacity building to the environmental and social teams and to municipalities and other subnational authorities and stakeholders (as needed); and
- Closely supervise the implementation of safeguards documents, taking into account experiences and lessons learned from previous operations.

4. Particular key issues to be addressed also include the following:

(a) Implementation capacity:

The participation of several national and subnational entities, under differentiated implementation arrangements, may slow down the implementation of the operation. The Bank team will also convene, present and discuss the operation with stakeholders and provide capacity building, as needed.

(b) Implementation arrangements:

Insufficient counterpart funds. New players could also lack adequate counterpart funding to ensure equipment O&M after the project. Even though energy savings will free up sufficient resources to fund such tasks, municipalities could use available resources for other purposes. Mitigation options include helping municipalities identify new funding sources, and establishing in any legal agreement the obligation to perform such tasks or also requiring such service is provided by the FIDE or a contractor.

(c) Stakeholder involvement:

Dissemination of information for relevant stakeholders. Improved dissemination and incorporation of new stakeholders during implementation will be sought. The Bank team will make sure it can recollect and take into account their opinions, considering the varying conditions across each province.

Municipalities may lack interest, capacities, or experience. The Bank team will support participating subnational entities. The Bank team will help address each entity's particularities by supporting the preparation of specific guidelines or manuals and ensuring the SENER and the FIDE work closely with them.

Implementation Support Plan

5. The Bank team will undertake field visits on a regular basis and have discussions with the SENER, the FIDE, the participating subnational entities, and other stakeholders. During project implementation, it will also maintain a constant presence in the field with at least two supervision missions per year (and even more during the first year of implementation). The Bank team will also support the strengthening of the capacities of the SENER and the FIDE and will develop capacity building activities for subnational entities.

6. The Bank team will also undertake regular and comprehensive fiduciary reviews, including thorough reviews of FM reports and findings of procurement reviews and audits. As needed, the Bank team will work together with the SENER and the FIDE to maintain a viable delivery model, allocate adequate human resources – in quantity and quality – for and throughout the implementation period, and continuously provide valuable guidance through local staff.

7. Implementation support will be carried out at the following levels:

(a) Technical. Technical staff will be located in Washington. Additional technical experts will also be used as needed, including for the development of technical specifications;
(b) Fiduciary. Bank staff will provide advice and support to the SENER and the FIDE. As usual, staff will be readily available in Mexico City and Washington D.C.;
(c) Governance and capacity building. Support will be coordinated from Washington D.C.; and
(d) Safeguards. The Bank will support relevant stakeholders with senior staff based in Washington, D.C, and Mexico City, as well as local experts and consultants.

Table A4.1. Implementation Support Plan

Time	Focus	Skills Needed	Resource Estimate (annual)
First 18 months	Legal	Legal counsel	8 staff weeks (SWs) per specialist
	Procurement	Procurement specialist	6 SWs per specialist
	FM	FM specialist	
	Safeguards	Social and environmental specialists	
	Implementation capacity	Task team leader and rest of the team	12 SWs per specialist
	Implementation arrangements	Task team leader, legal counsel and rest of the team	
	Stakeholder involvement	Task team leader, social specialist and rest of the team	3 SWs per specialist
18-84 months	Technical	Power engineer	6 SWs per specialist
	Fiduciary	FM and procurement specialists	24 SWs per specialist
	Safeguards	Social and environmental specialists	12 SWs per specialist

Table A4.2. Skills Mix Required

Skills Needed	Number of Staff Weeks per year	Number of Trips per year	Comments
Procurement specialist	6	–	Based in Mexico City
FM specialist	6	–	Based in Mexico City
Social specialist	15	–	Based in Washington
Environmental specialist	12	2	Support from local consultants
Legal counsel	8	1	Based in Washington
Power engineer	6	2	Non-local; for the first 2 years only
Task team leader and rest of the team	39	–	TTL based in Washington

Annex 5: World Bank's Energy and Climate Change Engagement with Mexico

MEXICO: Municipal Energy Efficiency Project

1. **The Bank has experience in the development of analytical tools and drawn lessons from operational work in EE at the national and municipal levels in Mexico.** The MEDEC study identified a number of urban EE measures, and contributed to developing several Bank-financed operations addressing EE, such as the Low Carbon Development Policy Loan and the Efficient Lighting and Appliances Project. The Bank is also collaborating with Mexico's participation in the Partnership for Market Readiness (PMR) that is developing Nationally Appropriate Mitigation Action Plans (NAMAs) on urban EE and refrigerator efficiency. The Bank also supported the implementation of ESMAP's TRACE in the municipalities of León and Puebla, and supported the SENER in expanding the EE assessments into 30 additional municipalities in Mexico with GEF support from the Efficient Lighting and Appliances Project. The Bank's involvement in end-use EE and low-carbon development, coupled with its support in energy use diagnostics at the municipal level, has led the SENER to seek the Bank's assistance to design and implement a national municipal EE program that supports its long term energy strategy.

2. Table A5.1 summarizes the Bank's energy and climate change engagement with Mexico in the last few years.

Table A5.1. Overview of GEEDRs Energy and Climate Change Engagement in Mexico.

Foundations (Before 1999)	Early Support (1999–2006)	Strengthening (2007–2009)	Continuing (2010–)
Financial Services			
• Solid Waste Management Pilot Project (P007628, FY86) • Urban Transport Project (P007615, FY87) • High Efficiency Lighting Pilot Project (P007492, FY94)	• Renewable Energy for Agriculture Project (P060718, FY00) • Methane Gas Capture and Use at a Landfill - Demonstration Project (P063463, FY01) • Introduction of Climate-friendly Measures in Transport (P059161, FY03) • Mexico: Waste Management and Carbon Offset Project (P088546, FY05) • La Venta III – Large-Scale Renewable Energy Development Project (P077717, FY06)	• Hybrid Solar Thermal Power Plant (P066426, FY07) • Mexico Wind Umbrella – La Venta II (P080104, FY07) • Mexico Integrated Energy Services (P088996, FY08)	• **Municipal Energy Efficiency Project (P149872, FY16)** • Mexico Efficient Lighting and Appliances (P106424, FY10) • MEDEC Low Carbon DPL (P121800, FY11) • Urban Transport Transformation Program (P107159, FY10) • Sustainable Energy Technology Development for Climate Change (P145618, FY15)
Foundations (Before 1999)	**Early Support (1999–2006)**	**Strengthening (2007–2009)**	**Continuing (2010–)**
Knowledge Services			

	• Latin America and Caribbean Region Landfill Gas Initiative (P104757, FY06) • Evaluation of Energy Efficiency Initiatives (P099734, FY06) • Economic Assessment of Policy Interventions in the Water Sector (P096999, FY06)	• Mexico: Electricity Subsidy Study (P101346, FY08) • Carbon Finance Assistance Program for Mexico (P104731, FY09) • Mexico Low-carbon Development for Mexico (MEDEC) (P108304, FY09) • Massive Urban Transport-Federal Program (P110474, FY09)	• Mexico Renewable Energy Assistance Program (P117870, FY11) • Global Gas Flaring Reduction Partnership (FY10-on) • PMR – Market Instruments for Climate Change Mitigation in Mexico (P129553, FY13-on) • Carbon Capture, Utilization and Storage Development in Mexico (P131200, FY13) • Implementing TRACE Model in Pilot Cities in Latin America (P133060, FY14) • Greening Mexico's Electricity Generation by Internalizing Externalities • Energy Policy Notes • Programmatic Approach in Energy: Supporting a Low-Carbon Economy (P150562, FY15)
Convening and Coordination Services			
	• Consolidation & Strengthening of the Mexican Office for Greenhouse Gas Mitigation (P060412, FY99)	• Preparation of the Clean Technology Fund Investment Plan (FY09)	• Energy-efficiency and Access Forum (FY11) • International Renewable Energy Forum (FY14) • Energy Efficiency in Cities Conference (FY14)

Annex 6: Energy Consumption in the Public Sector in Mexico
MEXICO: Municipal Energy Efficiency Project

I. Introduction

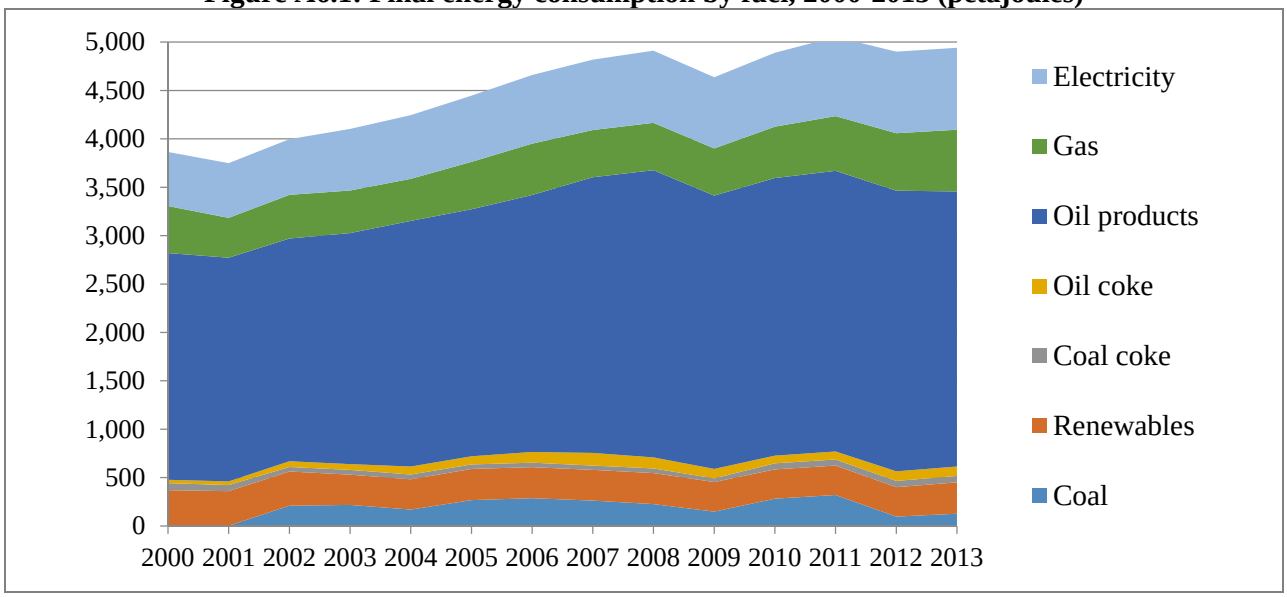
1. Mexican energy production and consumption trends have been shifting in recent years. Currently, the country faces a high risk of becoming a net energy importer. To address this challenge, Mexico has passed energy reform legislation (2013-2014) intended to increase productivity, competition, and overall efficiency, in particular in the power and hydrocarbon sub-sectors. The reform is opening up energy markets to private sector participation, including foreign investors, especially for the exploration and production of hydrocarbons and electricity generation, with the aim of modifying the energy production trends and enhancing energy security. The reform also seeks to support the reduction of energy consumption through conservation and EE. The SENER believes EE is a transformational priority area that can help reduce the country's vulnerability by decreasing energy demand, thereby helping lower GHG emissions.

2. Important untapped opportunities exist at all levels for reducing energy consumption and improving efficiency and service delivery. The information and graphs below make the case for working with municipalities in reducing energy consumption. EE is among the most cost-effective ways to manage energy consumption, decrease energy expenditures and help achieve GHG emissions reduction goals in urban areas in Mexico.

II. Overall Energy Consumption in Mexico

3. From 2000 to 2011 Mexico's energy consumption growth – 2 percent annually – was larger than GDP growth – 1.8 percent. By 2013, energy consumption had increased roughly 28 percent (compared to 2000 levels), as shown in figure A6.1.

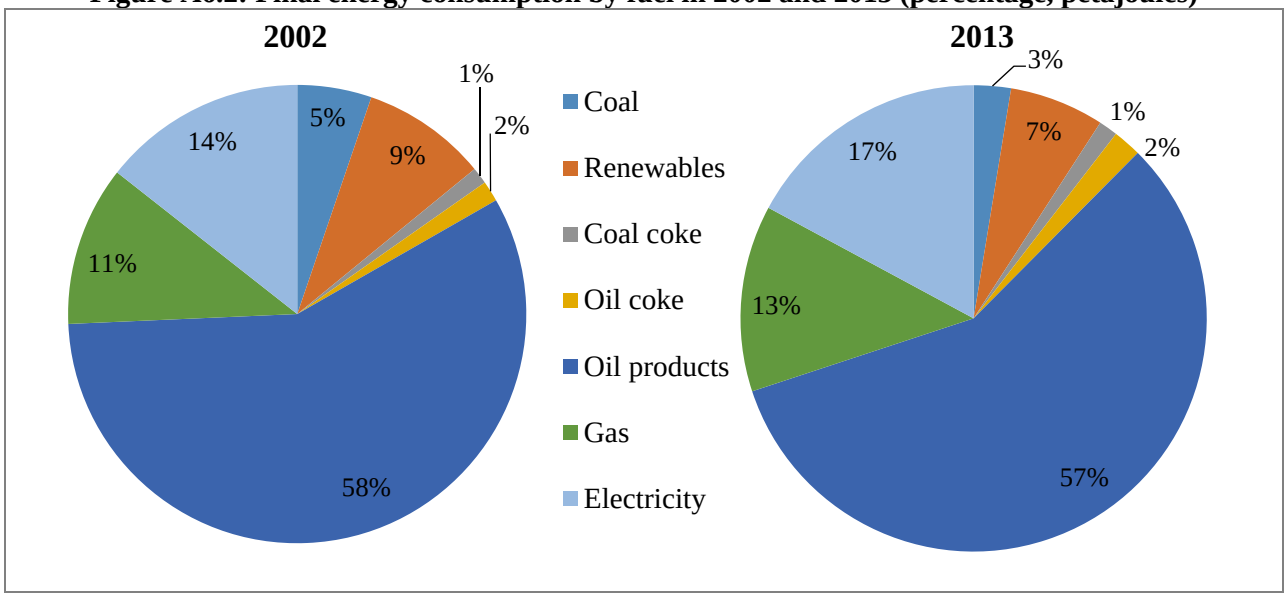
Figure A6.1: Final energy consumption by fuel, 2000-2013 (petajoules)



Source: National Energy Balance, Energy Information System, SENER

4. Even though consumption by fuel has remained quite stable, electricity use has increased at a faster pace and together with natural gas, is the only fuel whose overall consumption share has increased (Figure A6.2).

Figure A6.2: Final energy consumption by fuel in 2002 and 2013 (percentage, petajoules)

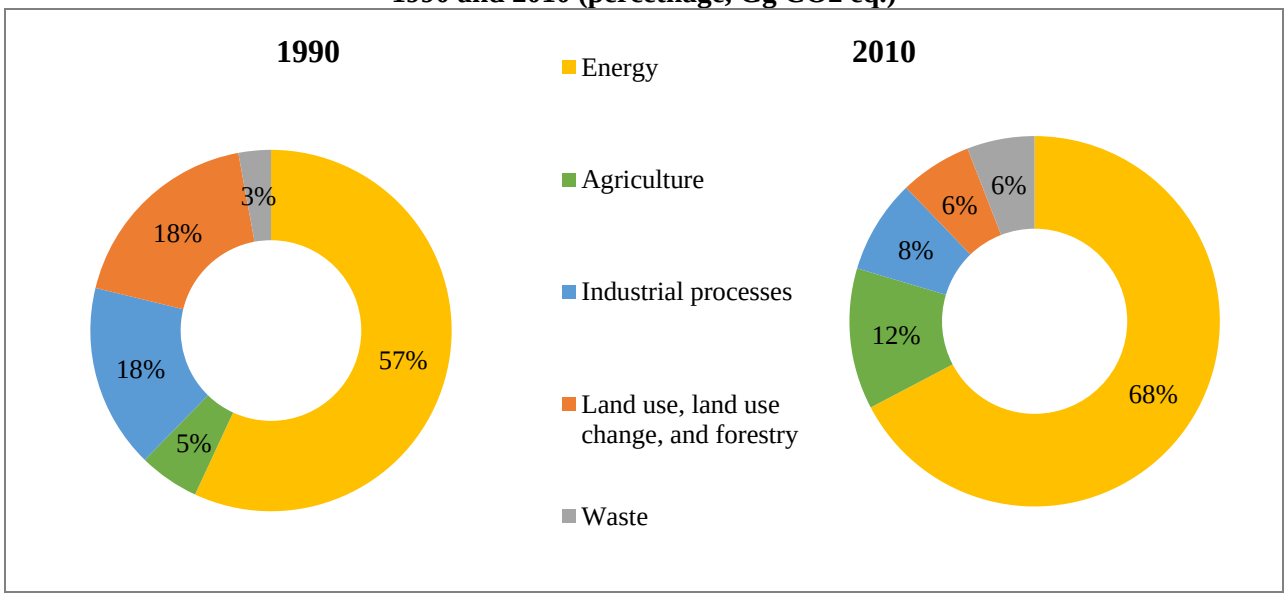


Source: National Energy Balance, Energy Information System, SENER

III. GHG Emissions in Mexico

5. According to Mexico's National Inventory of Greenhouse Gases Emissions, 1990-2010, in 2010, Mexico's emissions (in units of cO_2eq.) amounted to 748,252 Gg, which represents a 33.4 percent increase from 1990 levels, and an annual average growth rate of 1.5 percent (in the same period, the GDP grew at an annual rate of 2.5 percent). As shown in figure A6.3, total share by sector is: energy, 67.3 percent (503,817.6 Gg); agriculture, 12.3 percent (92,184.4 Gg); industrial processes, 8.2 percent (61,226.9 Gg); land use, land use change and forestry, 6.3 percent (46,892.4 Gg), and waste, 5.9 percent (44,130.8 Gg).

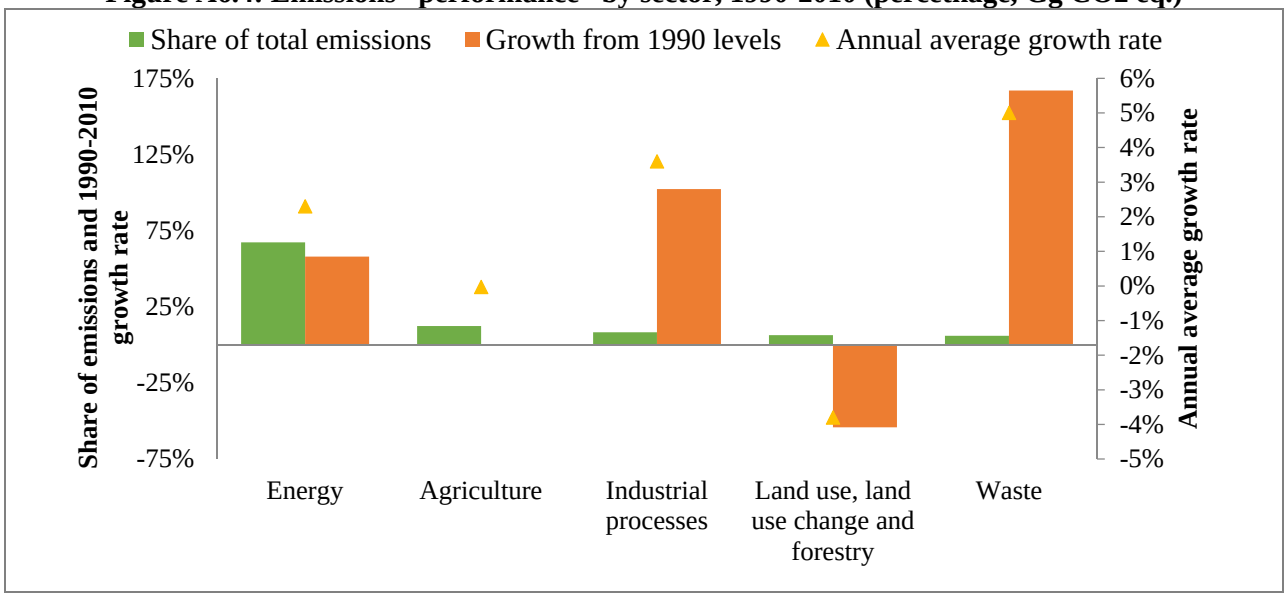
Figure A6.3: Total contribution to the country's emissions by sector, 1990 and 2010 (percetnage, Gg CO2 eq.)



Source: Fifth National Communication to the United Nations Framework Convention on Climate Change

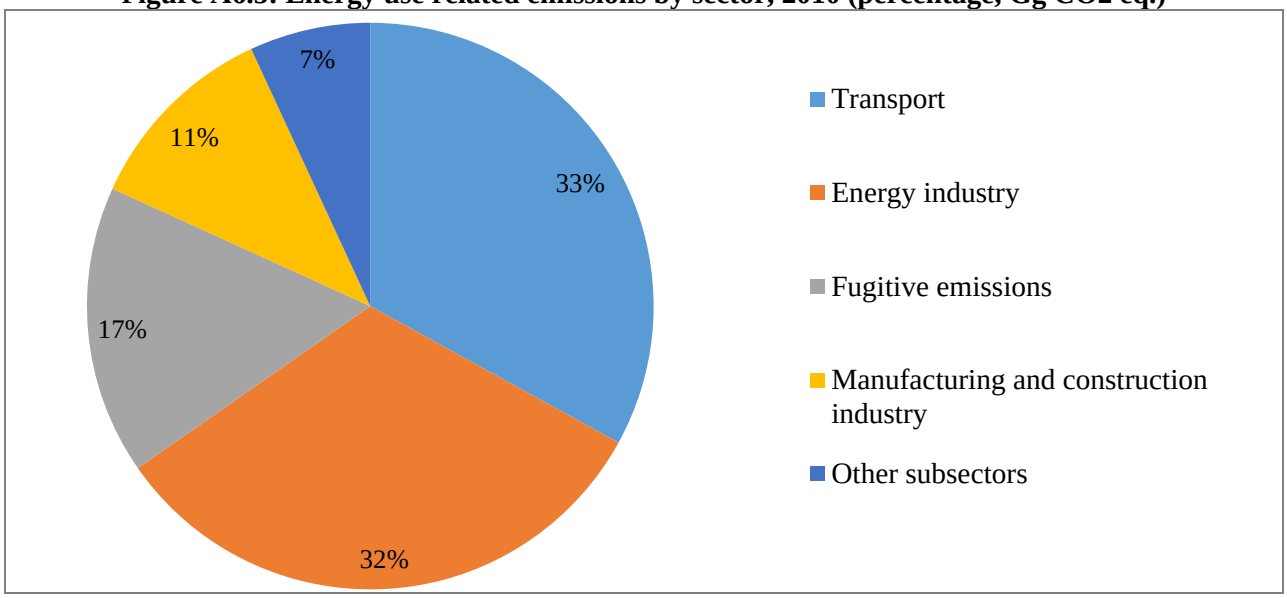
6. In addition, in the last few decades, energy use related emissions have continued to grow at a fast pace (see figure A6.4).

Figure A6.4: Emissions "performance" by sector, 1990-2010 (percetnage, Gg CO2 eq.)



7. In the energy use category, emissions' breakdown by sector is: transport, 33.0 percent; energy industry, 32.3 percent; fugitive emissions, 16.5 percent; manufacturing and construction industry, 11.3 percent; and other subsectors (residential, commercial, agriculture, and livestock), 6.9 percent.

Figure A6.5: Energy use related emissions by sector, 2010 (percentage, Gg CO2 eq.)



Source: Fifth National Communication to the United Nations Framework Convention on Climate Change

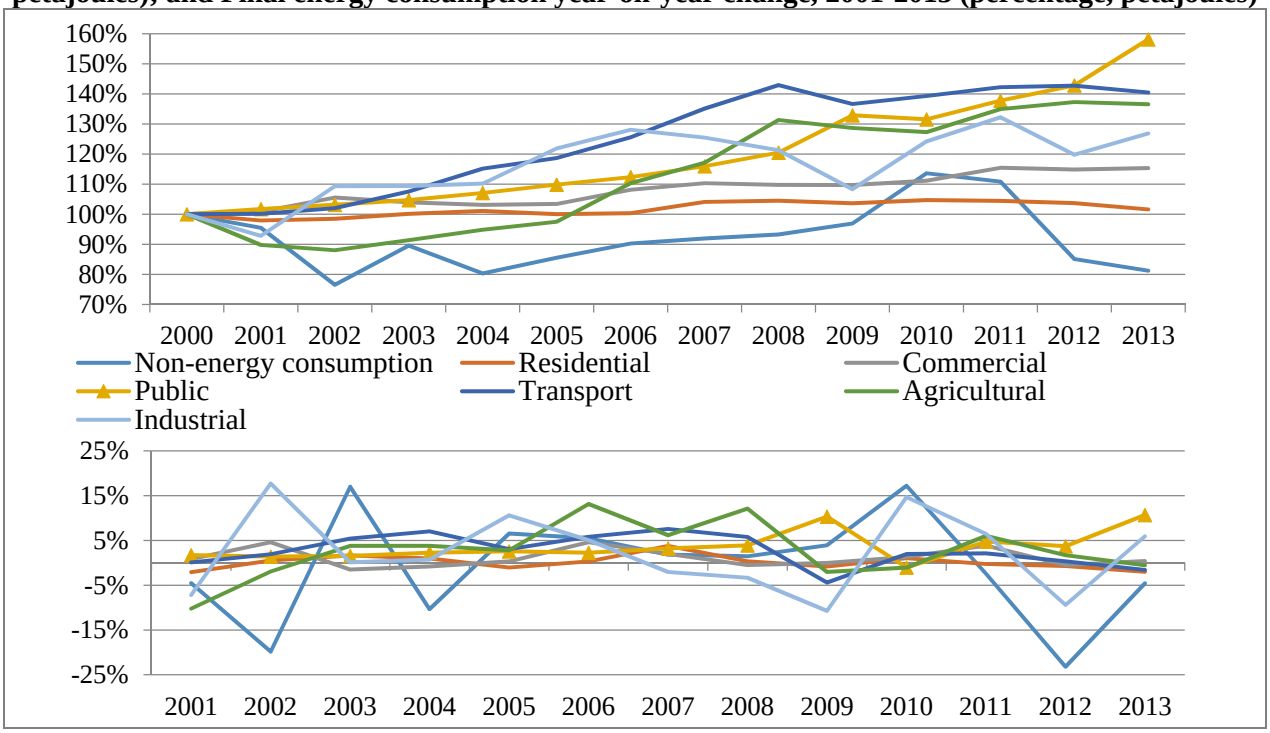
8. In conclusion, tackling GHG emissions in Mexico's energy sector is vital if the country intends to mitigate climate change. This has been acknowledged as the country's Special Climate Change Program (which aims to achieve emission reductions of 83.2 million tCO_2e by 2018). The energy sector is expected to be the main driver in mitigating climate change. Under this plan, the energy sector (including institutions such as the SENER, the CFE, the State-owned Oil Company,

PEMEX, and the CONUEE) will be responsible for achieving emission reductions of at least 51 million tCO_2e, that is, 61.3 percent of the country's overall mitigation goal.

IV. Energy Consumption in the Public Sector Mexico

9. With regard to energy consumption, the public sector still represents a small share of overall consumption. However, energy use in this sector has been increasing on average at an annual rate of 3.64 percent since the year 2000.[46] Public sector energy consumption has grown more than in any other sector in the past 15 years as shown in figures A6.6 and A6.7.

Figures A6.6 and A6.7: Final energy consumption growth by sector, 2000-2013 (percentage, petajoules); and Final energy consumption year-on-year change, 2001-2013 (percentage, petajoules)



Source: National Power Sector, Energy Information System, SENER

[46] Except for a brief moment during the 2009-2010 economic crisis.

10. Mexican municipalities' highest expenses after salaries are for SL, and water supply and treatment. Public sector services tariffs are on average some of the highest, in particular SL and water tariffs.[47] According to the *Sistema de Información Energética* (National Energy Information System, SIE), in 2014 SL amounted to 58 percent of total municipal public sector electricity consumption, while water-pumping and related activities represented the remaining 42 percent of the total public sector services sales.[48] Since 2002, these subsectors have seen considerable growth; SL sales have increased by 32 percent, and the use of electricity for water services has increased by 78 percent.

Table 1. Tariff by Sector

Tariff	US cents/kWh
Agriculture	3.4
Residential	8.2
Industrial	9.0
Public Sector Services	15.5
Commercial	18.6
Average	**9.5**

Table 2. Public Sector Service Tariffs

Public Service Tariffs	US cents/kWh
Street Lighting (D.F., Monterrey, Guadalajara)	21
Street Lighting (rest of the country)	17
Water/Wastewater utility	12

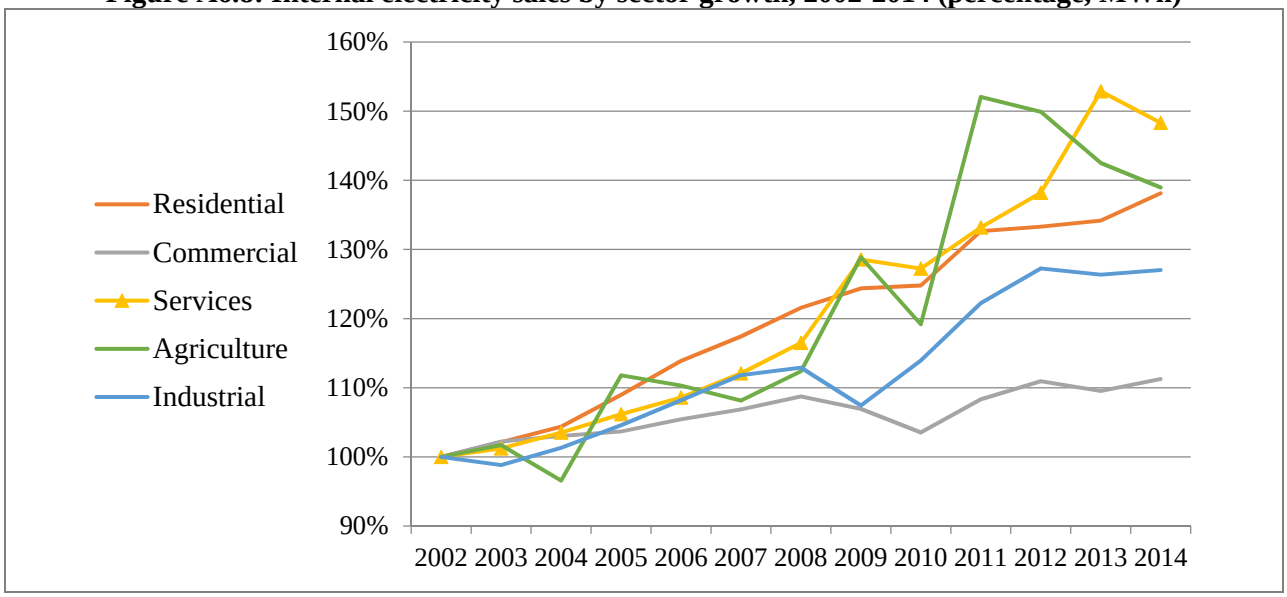
Source: SENER. 2015. SIE, Dirección General de Planeación e Información Energéticas

11. Although representing a small share of total internal electricity sales, electricity consumption in the public sector has been growing at an accelerated pace (over 48 percent since 2000) as shown in figure A6.8.

[47] Even if special tariffs for SL and water supply and treatment exist, some operators have switched to medium voltage tariffs to reduce costs.

[48] Public sector services sales exclude those for MBs, because the SIE does not disaggregate energy consumption data for buildings. Tariffs applicable to the public buildings subsector may include different low and medium voltage tariffs (such as tariffs 2 or 3 – low voltage- and OM or HM-medium voltage).

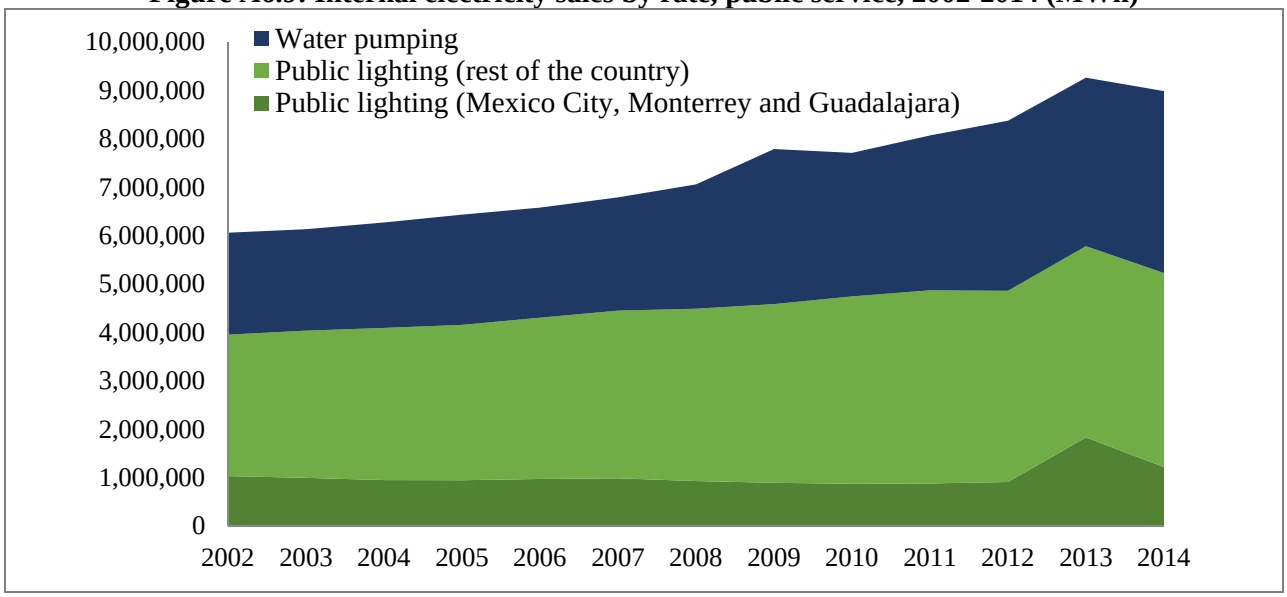
Figure A6.8: Internal electricity sales by sector growth, 2002-2014 (percentage, MWh)



Source: National Power Sector, Energy Information System, SENER

12. In addition, electricity consumption at the local level has grown almost 50 percent since 2002 (figure A6.9); in 2014 water pumping represented 42 percent of all the services sectors sales, while public lighting accounted for the remaining 58 percent (14 percent in the cities three largest cities and 45 percent in the rest of the country).

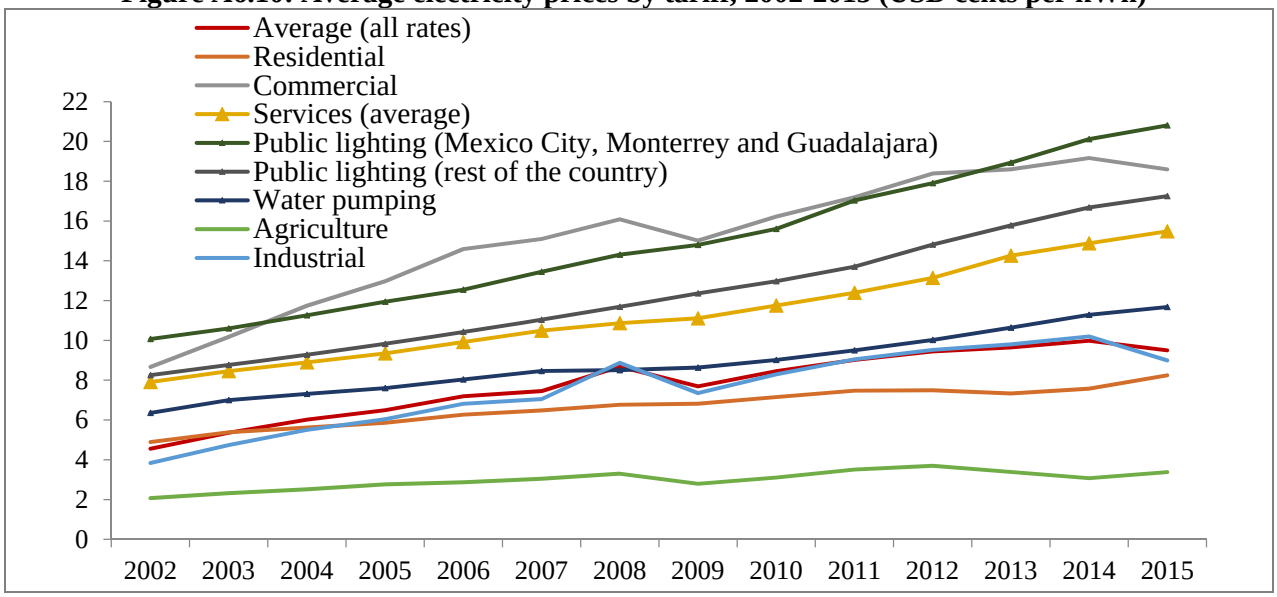
Figure A6.9: Internal electricity sales by rate, public service, 2002-2014 (MWh)



Source: National Power Sector, Energy Information System, SENER

13. Even though public sector service's rates have not increased as others, they include some of the highest tariffs in the country (for example, public lighting and water tariff), as shown in figure A6.10 below.

Figure A6.10: Average electricity prices by tariff, 2002-2015 (USD cents per kWh)



Source: National Power Sector, Energy Information System, SENER

14. In conclusion, even if the public sector's energy consumption is small, and local urban services energy use is still reduced, it has grown at an accelerated pace in the last few years. As cities in Mexico continue to experience significant demographic and economic growth – which will translate into increased energy consumption – municipalities will face increased pressure to provide expanded high-quality and affordable public sector services. As some of the highest rates lie within the public sector services, investing in EE will not only reduce energy expenditures but also liberate budgetary resources which can be used to provide or enhance overall public sector services in Mexican municipalities.

Annex 7: Economic and Financial Analyses

MEXICO: Municipal Energy Efficiency Project

1. The proposed operation is expected to result in sizeable economic and financial benefits at both the city and country levels, including global environmental benefits. The project will support policy development and institutional strengthening (Component 1) and municipal EE investments (Component 2). Given the analytical constraints associated with benefits that cannot be measured in monetary terms and/or where information is not readily available – such as capacity-building activities in Component 1 – the economic analysis focuses on Component 2, which accounts for 94 percent of the IBRD loan.

2. Initial estimates indicate that many cities in the region have high EE potential due to outdated and high energy-consuming equipment. Economic benefits from this project include saved energy, including the associated reductions in carbon emissions, and savings due to a reduction in expenditures on O&M. Other economic benefits that are not monetized in this analysis include better capacity to design/implement EE programs or the collateral benefit of improved access to municipal services. For example, in the case of SL, the analysis does not take into account improved street safety as well as benefits that may accrue as a result of the additional civil works that will be undertaken on the public SL infrastructure (for example, improvement in distribution cables). Also, because energy consumption is an important cost for local governments and competes for resources with other economic and social development programs, reducing energy expenditures will create fiscal space to allow municipalities to redirect investments towards the expansion of social services or to meet critical infrastructure investment priorities.

3. The economic and financial analysis of EE sub-projects (cost-benefit analysis) was done for each subsector (public lighting, MB, and water/sanitation) in a 'typical' municipality/water utility, based on the results of energy audits and/or similar projects performed in Mexico. The economic analysis uses cost estimates for investment and O&M[49] based on similar projects in Mexico and Latin America. Costs are adjusted to reflect economic values, excluding taxes and direct support. Benefits are estimated based on savings to users. Detailed results are presented below.

4. The following assumptions apply to all three sub-sectors. Detailed assumptions for each sub-sector are provided within the respective sections.

- The foreign exchange rate is $18.28 MXN per U.S. dollar;
- All costs and revenues, as well as the discount rate, are net of inflation;
- The social cost of carbon is US$30 per tCO_2e reduced by the project.[50] The cost of carbon is included in the economic analysis but is not taken into account in the financial analysis, given that the monetization of emission reductions from this project is not currently envisioned;

[49] Savings in O&M are difficult to quantify for the public building and the water-pumping sectors; thus, these savings are not included in the analysis.

[50] Based on 2014 World Bank guidance note: http://globalpractices.worldbank.org/climate/_layouts/15/WopiFrame2.aspx?sourcedoc=/climate/Documents/carbon%20pricing%20guidance%20note%20-%207%2015%202015.docx&action=default.

- The financial analysis is inclusive of taxes and direct support; the economic analysis is exclusive of taxes or direct support;
- Economic cost of electricity is assumed to be US$0.18 perkWh;[51]
- Price of electricity used in the financial analysis is based on average prices over the 2014 calendar year for each sector;[52]
- The discount rate is assumed to be 6 percent. Although the actual cost of capital for the municipalities will essentially be zero given that municipalities will receive a no-interest loan, 6 percent is used to represent the economic opportunity cost of capital in Mexico;[53] and
- Project incremental costs – charged by the CFE and the FIDE to reimburse their expenses for project preparation – are estimated to be roughly 11 percent of capital expenditures per subproject for this analysis.[54] Ultimately, the amounts charged by both entities will reflect actual costs incurred by each entity.

5. The finding of the analysis is that all projects are economically viable. With regard to assessing financial viability, the project seeks to ensure that the subprojects' payback periods are within two mayoral terms, more specifically within five years. This relatively short payback period is achieved through the application of direct support. The analysis shows that all subprojects are viable according to this definition once the proposed direct support is taken into account.

a) Public Street Lighting

6. The financial and economic analyses for the public SL EE project is based on the following additional key assumptions:

- Mexican city with 20,000 light points and a baseline of 80 percent high pressure sodium and, 20 percent metal halide. This is similar to the situation of the city of Veracruz;[55]
- The tariff used is the Tarifa 5, which applies specifically to public SL;[56]
- Project assumes retrofit of all SL points from the existing technology to LEDs within a two-year period;
- Subproject cost include the cost of LED technology (US$490 per point), installation costs (US$25 per point), additional cost for civil works[57] (US$160 per point), and subproject preparation costs;

[51] Based on information that public SL tariff (US$17.73 on average over the2014 calendar year) reflects 97 percent of the actual cost of energy, according to the study by Yale University: http://nexus.som.yale.edu/walmex/sites/nexus.som.yale.edu.walmex/files/imce_imagepool/world%20bank-tariff-subsidy9780821378847.pdf.

[52] When tariffs are distinguished by region, the Central region is used. See the CFE's website for historical tariff data: http://app.cfe.gob.mx/Aplicaciones/CCFE/Tarifas/Tarifas/tarifas_negocio.asp

[53] Based on the 10 year Mexican bond yield as of June 2015: http://www.tradingeconomics.com/mexico/government-bond-yield.

[54] Incremental costs are 9.7 percent for the FIDE and 1.2 percent for the CFE (of overall investments).

[55] According to data provided by the CFE in fall 2014.

[56] For more information, see: http://app.cfe.gob.mx/Aplicaciones/CCFE/Tarifas/Tarifas/tarifas_negocio.asp?Tarifa=5&Anio=2015&mes=7

[57] Assumption based on discussions with local entities involved in public street lighting retrofit projects. Civil works includes various measures to ensure the new lighting points will meet the national technical standards, and can include installation of new lighting poles, replacement / improvement of distribution cables, etc.

- Project revenues are based on savings for electricity bills and savings on O&M costs; and
- Project returns are analyzed over eight years.

Main findings- base case

7. A summary of the financial and economic analysis can be found in table A7.1.

Table A7.1: Public SL: Summary of results from financial & economic analyses

Project analysis	**Unit**	**Financial analysis (w/o direct support)**	**Financial analysis (w/ direct support)**	**Economic analysis (no taxes, no direct support)**
Key assumptions				
Total luminaires replaced in project	number	20,000	20,000	20,000
Years to implement project	number	2	2	2
Period of analysis	years	8	8	8
Cost per point in year 1 (technology + infrastructure)	US$	635	190	547
% support to be provided on CAPEX	%	0%	70%	0%
Cost of electricity at year 1	US$/year/MWh	173	173	154
Real annual increase in electricity prices	%	1%	1%	1%
% electricity saving to LED with project	%	44%	44%	44%
% O&M saving to LED with project	%	88%	88%	88%
Project fees (as percentage of CAPEX)	%	10%	10%	10%
Include smart system?	flag	N	N	N
Social cost of CO2e	US$/tCO2e	30	30	30
Estimate project results				
Total project investment over 8 years (Including fees, excluding support)	US$	13,774,617	13,774,617	9,009,847
Total financial savings (electricity + O&M) over 8 years	US$	11,898,249	11,898,249	11,531,729
Total GHG reductions over 8 years	tCO2e	26,105	26,105	26,105
Total electricity savings over 8 years	GWh	58	58	58
Cost of support over 8 years	US$	-	8,789,825	-
Payback period (non-discounted)	years	> 8	4	7
NPV over 8 years	US$	(3,090,810)	5,207,877	1,105,033
IRR (Internal rate of return)	%	-4%	41%	8%
Discount rate	%	4%	4%	6%

8. The total electricity savings from the subproject are estimated at 44 percent, equivalent to savings of 58 GWh over the eighth year life of the project; the estimated savings for O&M is 88 percent.[58] The GHG reductions associated with the energy saving are equal to approximately 26,105 tCO2e over the eight-year period (for a 20,000 light points sub-project).

[58] O&M savings are realized as a result of reduced expenditures for (a) equipment replacement due to the longer average life of LEDs compared to the current technology, and (b) labor costs associated with equipment replacement. Note that the baseline does not include other costs that may be included in the total O&M costs for a public SL system (for example, regular maintenance of poles, cables, and so on). If these costs were included in the baseline, the total

9. The results of the economic analysis show that the subproject has an expected economic internal rate of return (EIRR) of 8 percent with a payback period of seven years. The EIRR is just above the hurdle rate of 6 percent and equal to the subproject's minimum selection rate,[59] primarily due to (a) the high upfront capital cost of LED technology, and (b) the assumption that additional civil works will be needed to improve the condition of urban infrastructure to ensure proper performance of the LEDs. However, the analysis does not monetize any potential collateral benefits associated with the civil works because they are difficult to quantify. The expected economic cost of the investment is US$13.8 million; the expected economic savings are US$11.9 million (these include savings on energy and O&M expenditures).

10. The results of the financial analysis without any direct support show an expected internal rate of return (IRR) of -four percent and an NPV of US$-3.1 million. The expected negative financial return for this project without any direct support is a result of the reasons stated above, namely the high capital cost of LEDs and, more importantly, the need for additional civil works to prepare the project. The total investment is US$13.8 million and the expected subproject savings on energy and O&M expenditures are US$11.9 million.

11. In the light of the low expected financial returns for the project, direct support is needed to incentivize municipal action and achieve a payback period before the end of two mayoral terms (that is, within five years). A maximum direct support of 70 percent is proposed to achieve this goal by reducing the upfront capital expenditure costs associated with LED technology. The cost of this direct support is approximately US$8.8 million. Including the direct support, the subproject's IRR is 41 percent and the NPV is US$5.2 million over eight years.

Sensitivity analysis

12. A sensitivity analysis was conducted to understand the impact of a worst-case scenario and best-case scenario, taking into account 15 percent +/- changes in three key variables: electricity tariffs, LED prices, and energy savings. The findings are shown in table A7.2.

percentage savings will be lower (as the denominator for calculating the percentage savings will increase), although the nominal savings amount will remain the same.

[59] See selection criteria in annex 3.

Table A7.2: Public SL: Summary of Sensitivity Analyses

Project analysis	Unit	Scenario 1: Worst case (higher LED costs, lower elec. prices & savings)	Scenario 2: Best case (lower LED costs, higher elec. prices & savings)
Key assumptions			
Total luminaires replaced in project	number	20,000	20,000
Years to implement project	number	2	2
Period of analysis	years	8	8
Cost per point in year 1 (technology + infrastructure)	US$	219	162
% support to be provided on CAPEX	%	70%	70%
Cost of electricity at year 1	US$/year/MWh	147	199
Real annual increase in electricity prices	%	1%	1%
% electricity saving to LED with project	%	35%	52%
% O&M saving to LED with project	%	88%	88%
Project fees (as % of CAPEX)	%	10%	10%
Include smart system?	flag	N	N
Social cost of carbon dioxide (CO2e)	US$/tCO2e	30	30
Estimate project results			
Total project investment over 8 years (Including fees, excluding support)	US$	13,774,617	13,774,617
Total financial savings (electricity + O&M) over 8 years	US$	8,610,503	15,820,569
Total GHG reductions over 8 years	tCO2e	21,068	31,143
Total electricity savings over 8 years	GWh	46	69
Cost of support over 8 years	US$	8,789,825	8,789,825
Payback period (non-discounted)	years	5	3
NPV over 8 years (million MXN)	US$	2,478,118	8,473,742
IRR	%	22%	69%
Discount rate	%	4%	4%

13. In the 'worst-case' scenario there will be a 15 percent increase in LED prices, a 15 percent decrease in electricity prices at year 1 and in the annual rate of price increases, and a 15 percent decrease in total energy savings. Based on these assumptions, the financial analysis including the 70 percent direct support forecasts a payback period of five years, an IRR of 22 percent and an NPV of US$2.5 million.

14. In the 'best-case' scenario there will be a 15 percent decrease in LED costs, a 15 percent increase in electricity prices at year 1 and in the annual rate of price increases, and a 15 percent increase in savings. This results in a payback period of three years, an IRR of 69 percent, and an NPV of US$8.5 million.

b) Municipal Buildings

15. The financial and economic analysis for the public MB EE and solar PV subproject is based on the following key assumptions:

- The subproject is based on three theoretical 10,000 m2, six-story, MB in Guadalajara, Mexico that use 10,200,000 kWh of electricity per year before the start of the project;

- The tariff used is the H-M tariff, which applies for medium voltage buildings with demand of 100 kW or more;[60]
- The analysis assumes a total investment of US$1.89 million per city, which is equivalent to approximately three buildings of this size. In practice, the buildings financed within a city will likely vary in size; therefore, the actual number of buildings financed in each city will vary as well;
- Subproject assumes retrofit of building lighting and air-conditioning systems, painting of rooftops with reflective paint, and installation of rooftop solar PV (120 kWp);
- Investment costs take into account the capital expenditures and subproject preparation and implementation costs;
- Subproject savings are based on energy savings from (a) reduced energy consumption from EE investments, and (b) partial displacement of grid electricity by solar PV;
- Investment costs and data savings are based on a combination of information from the IFCs EDGE tool,[61] actual projects carried out by Elektra – a Mexican department store, and information provided by the FIDE; and
- Subproject returns are analyzed over eight years. Given that multiple technologies are installed in the project, an eight-year period was selected as a reasonable average lifecycle because it is in line with the duration used for SL and water, allowing for easier comparison of investments across the three sectors.

Main findings - Base Case

16. A summary of the financial and economic analysis can be found in table A7.3.

[60]The H-M tariff comprises a capacity charge (based on average demand) in a charge per kWh consumed. For more information, see:
http://app.cfe.gob.mx/Aplicaciones/CCFE/Tarifas/Tarifas/tarifas_negocio.asp?Tarifa=HM&Anio=2015&mes=7
[61] See: http://www.edgebuildings.com/.

Table A7.3: MB: Summary of results from financial and economic analyses

Key assumptions	unit	Financial anlysis (w/o support)	Financial analysis (w/ support)	Economic analysis (no taxes, no support)
Buildings' size	m2	10,000	10,000	10,000
Current energy use by three buildings	kWh / year	10,200,000	10,200,000	10,200,000
Price of electricity - Tarifa H-M - average price, including taxes	US$ / kWh	0.13	0.13	0.15
Social cost of carbon	US$ / tCO2e	25	25	25
Direct support	%	0%	30%	30%
Period of analysis	years	8.0	8.0	8.0
Discount rate (net of inflation)	%	6%	6%	6%
Summary of results				
Total project investment	US$	1,877,445	1,877,445	1,618,487
Total project revenues (savings)	US$	3,569,891	3,569,891	4,838,764
Cost of support	US$	-	80,744	-
Energy savings	%	20%	20%	20%
Energy savings	MWh	28,499	28,499	28,499
Emission reductions	tCO2e	12,939	12,939	12,939
NPV	US$	1,193,017	1,678,731	2,218,400
IRR	%	24%	43%	55%
Payback period	years	4.4	3.2	3.0

17. The total electricity savings from the project (that is, three buildings) are estimated at 20 percent, equivalent to savings of 28.5 GWh over the life of the project. The GHG reductions associated with the energy saving are equal to approximately 12,939 tCO2e over the eight-year period as a result of savings from EE and the generation of electricity using solar PV.

18. The results of the economic analysis show that the project has an expected net EIRR of 55 percent with a payback period of three years. The total economic cost of the investment for three buildings is estimated at US$1.88 million, and expected economic savings are US$3.6 million, including the social cost of carbon (US$0.4 million).

19. The results of the financial analysis without any direct support show an expected net internal rate of return (IRR) of 24 percent, a NPV of US$1.2 million, and a payback period of 4.4 years. The expected total project investment for three buildings is US$1.88 million and the expected savings on energy are US$3.6 million.

20. Although the financial returns for the subproject are positive, a direct support of 30 percent of capital expenditures is proposed to reduce the payback period. Assuming a 30 percent direct support, the project has an expected net IRR of 43 percent, an NPV of US$1.7 million, and a payback period of 3.2 years. The subproject costs are US$1.88 million and expected savings on energy are US$3.6 million.

Sensitivity Analysis

21. A sensitivity analysis was conducted to understand the impact of a worst-case scenario and best-case scenario, taking into account 15 percent +/- changes in three key variables: investment cost, energy savings, and electricity prices. The findings are shown in table A7.4.

Table A7.4: MBs: Summary of Sensitivity Analyses

Key assumptions	unit	Scenario 1: Worst Case	Scenario 2: Best Case
Buildings' size	m2	10,000	10,000
Current energy use by three buildings	kWh / year	10,200,000	10,200,000
Price of electricity - Tarifa H-M - average price, including taxes	US$ / kWh	0.13	0.13
Social cost of carbon	US$ / tCO2e	25	25
Direct support	%	30%	30%
Period of analysis	Years	8.0	8.0
Discount rate (net of inflation)	%	6%	6%
Summary of results			
Total project investment	US$	2,159,062	1,595,829
Total project revenues (savings)	US$	3,050,559	4,094,645
Cost of support	US$	92,856	68,632
Energy savings	%	17%	23%
Energy savings	MWh	24,653	32,346
Emission reductoins	tCO2e	9,900	13,390
NPV	US$	1,045,414	2,316,336
IRR	%	25%	73%
Payback period	years	4.3	2.4

22. In the 'worst-case' scenario there will be a 15 percent increase in investment costs, a 15 percent decreases in total energy savings, and a 15 percent decrease in electricity prices at year 1 and the annual increase in electricity prices. Based on these assumptions, the financial analysis including the 30 percent direct support forecasts a payback period of 4.3 years, an IRR of 25 percent, and an NPV of US$1.05 million.

23. In the 'best-case' scenario there will be a 15 percent decrease in investment costs, a 15 percent increase in savings, and a 15 percent increase in electricity prices. This results in a payback period of 2.4 years, an IRR of 73 percent, and an NPV of US$2.3 million.

c) Water Utility

24. The financial and economic analyses for the public water and sanitation EE subproject are based on the following key assumptions:

- The subproject is based on a theoretical water utility producing 67.85 million m^3 per year that consumes 39.25 GWh of electricity per year;
- The tariff used for this analysis is Tarifa 6, which applies to all public OOs;[62]
- Subproject investments include: water pump and motor replacement, installation of variable-frequency drives, and regular maintenance of electro-magnetic equipment;

[62] See: http://app.cfe.gob.mx/Aplicaciones/CCFE/Tarifas/Tarifas/tarifas_negocio.asp?Tarifa=6&Anio=2015&mes=7.

- Additional investments are assumed for 'auxiliary services,' which could include a variety of interventions that may be needed to prepare the project (for example, electrical protections, couplings, valves, and fittings for new pumping equipment). These investments in auxiliary services will be necessary pre-conditions for the project and no financial or economic returns from these investments are accounted for in this analysis;
- The total investment size is assumed to be US$3.6 million before subproject incremental costs, and this is divided among the aforementioned interventions; and
- Subproject returns are analyzed over eight years, because this was determined to be a reasonable average lifecycle for the water pump and motor, which represents the largest portion of the investment costs.

Main findings- Base Case

25. A summary of the financial and economic analysis can be found in table A7.5:

Table A7.5: Water and Sanitation EE: financial and economic analysis

Key assumptions	**unit**	**Financial anlysis (w/o support)**	**Financial analysis (w/ support)**	**Economic analysis (no taxes, no support)**
Volume of water produced / treated	m3 / year	67,850,000	67,850,000	67,850,000
Electricity consumption	kWh/year	39,250,000	39,250,000	39,250,000
Price of electricity	US$/kWh	0.10	0.10	0.15
Real annual increase on price of electricity	%	1%	1%	1%
Social cost of carbon	US$ / tCO2e	25	25	25
Support for investment costs	%	0%	30%	30%
Period of analysis	years	8	8	8
Discount rate (net of inflation)	%	6%	6%	6%
Summary of results	**unit**			
Gross project cost	US$	3,637,763	2,640,993	2,729,540
Cost of direct support	US$	-	974,836	-
Total project revenues (savings)	US$	5,540,000	5,540,000	8,760,000
Energy savings	%	21%	21%	21%
Energy savings	GWh	51	51	51
Emission reductions	tCO2e	23,258	23,258	23,258
NPV	US$	1,160,000	2,120,000	4,200,000
IRR	%	14%	29%	63%
Payback period	years	5.4	3.9	2.8

26. The total electricity savings from the project are estimated at 21 percent, equivalent to savings of 51 GWh over the eight-year life of the project. The GHG reductions associated with the energy savings are equal to approximately 23,258 tCO2e.

27. The results of the economic analysis show that the project has an expected net EIRR of 63 percent with a payback period of 2.8 years. The economic costs - capital expenditures and subproject preparation and implementation incremental costs – are US$2.7 million, and the economic savings are US$8.76 million, including savings on energy expenditures, which include the social cost of carbon (US$0.7 million).

28. The results of the financial analysis without any direct support show an expected net IRR of 14 percent, an NPV of US$1.16 million over eight years, and a payback period of 5.4 years. This takes into account capital expenditures and project preparation fees of US$3.6 million and expected savings on energy expenditures of US$5.54 million.

29. While the financial returns and payback period are relatively attractive, a direct support is needed to bring the payback period to less than five years. A 30 percent direct support on capital expenditures is proposed to achieve this goal. The cost of the direct support is approximately US$0.97 million. Including the direct support, the subproject's IRR is 29 percent, and the NPV is US$2.12 million over eight years.

Sensitivity analysis

30. A sensitivity analysis was conducted to understand the impact of a worst-case scenario and best-case scenario, taking into account 15 percent +/- changes in three key variables: investment cost, energy savings, and electricity prices. The findings are shown in table A7.6.

Table A7.6: Water and Sanitation: Summary of Sensitivity Analysis

Key assumptions	unit	Scenario 1: Worst Case	Scenario 1: Best Case
Volume of water produced / treated	m3 / year	67,850,000	67,850,000
Electricity consumption	kWh/year	39,250,000	39,250,000
Price of electricity	US$/kWh	0.09	0.12
Real annual increase on price of electricity	%	1%	1%
Social cost of carbon	US$ / tCO2e	25	25
Support for investment costs	%	30%	30%
Period of analysis	years	8	8
Discount rate (net of inflation)	%	6%	6%
Summary of results	**unit**		
Gross project cost	US$	3,796,427	1,683,633
Cost of support	US$	1,401,327	621,458
Total project revenues (savings)	US$	3,980,000	7,370,000
Energy savings	%	18%	24%
Energy savings	GWh	44	59
Emission reductions	tCO2e	19,770	26,750
NPV	US$	(300,000)	4,570,000
IRR	%	1%	113%
Payback period	years	7.9	1.9

31. In the 'worst-case' scenario there will be a 15 percent increase in investment costs, a 15 percent decreases in total energy savings, and a 15 percent decrease in electricity prices in year 1 and the annual increase in electricity prices. Based on these assumptions, the financial analysis including the 30 percent direct support forecasts a payback period of 7.9 years, an IRR of 1 percent, and an NPV of US$-0.3 million over eight years.

32. In the 'best-case' scenario there will be a 15 percent decrease in investment costs, a 15 percent increase in savings, and a 15 percent increase in electricity prices in year 1 and the annual increase in electricity prices. This results in a payback period of 1.9 years, an IRR of 113 percent, and an NPV of US$4.57 million over eight years.

Annex 8: Energy Use in Pilot Mexican Municipalities

MEXICO: Municipal Energy Efficiency Project

Background and Context

1. Building on the positive experience of the Bank-supported city TRACE[63] energy diagnostics conducted in the cities of Puebla, Puebla and León, Guanajuato in 2013, in the summer of 2014, Mexico's Energy Ministry (SENER) announced energy diagnostics in 30 additional cities,[64] each from a different Mexican state to ensure broad coverage. The diagnostics kicked off Mexico's national program to scale up EE in Mexican cities – with the support of the Bank.[65] For each municipality, the TRACE energy diagnostic and associated data collection covered the sectors of: (a) SL; (b) MBs; (c) water and wastewater; (d) solid waste; and (e) urban transport, including the municipal fleet.[66] The diagnostics were prepared from September 2014 to May 2015.

2. These 30 cities form the initial target population for the PRESEM's EE investments in the three selected sectors: SL; MBs and water and wastewater. These 32 municipalities generally represent capitals – or large cities – of their respective states. On average, the population of these municipalities is 730,000 habitants with an average GDP per capita of MXN 231,174 (US$14,706 per capita) and an average electricity consumption of 2,230 kWh per capita. They pay on average $107,692,000 MXN (US$699,200) per year for their electricity bills (for public lighting and MBs), representing on average roughly 5 percent of the overall budget of each municipality. On average, these cities spend roughly 65 percent of their municipal budgets on operational costs, leaving 35 percent for investment capacity. On average, more than one third (35 percent) of the operational costs cover staff costs. The figure below presents budget shares of 25 municipalities.

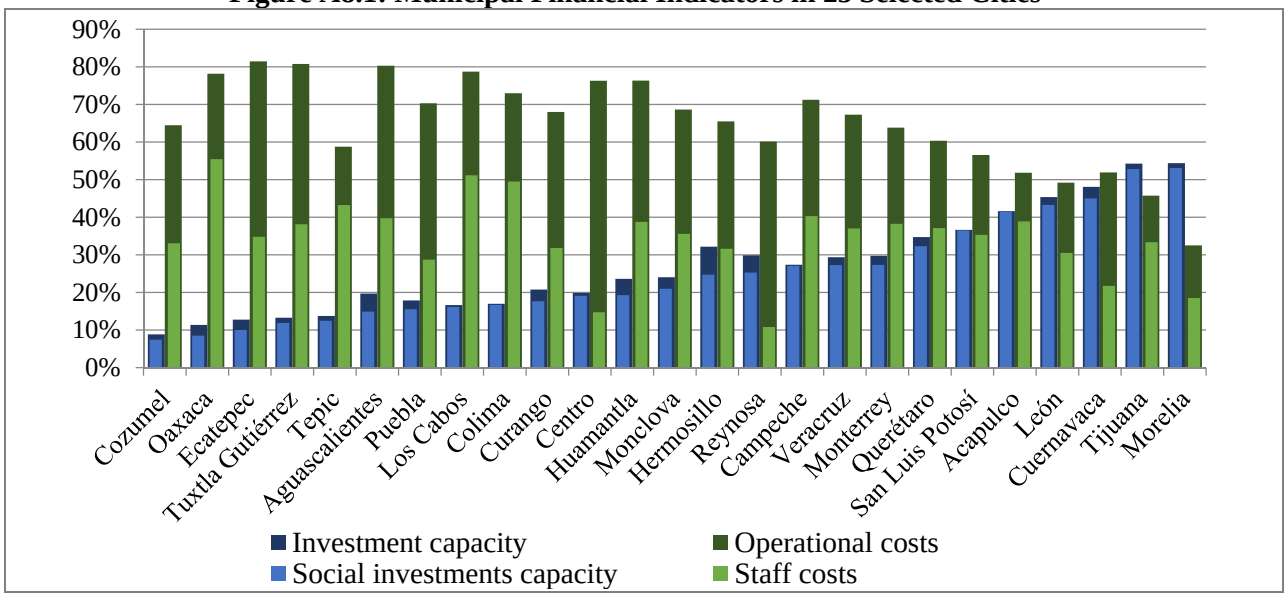
[63] TRACE is a decision support tool, developed by ESMAP, for conducting rapid assessment of energy use in cities, that identifies and prioritizes sectors, and suggests specific EE interventions in the following sectors: public lighting; public transport; public buildings; water and wastewater; solid waste; power and heat.

[64] The cities were selected by the SENER with support from the Institute of National Support to Federalism and Municipal Development (INAFED) as part of a pilot on where to start the national municipal EE program.

[65] The SENER funded the work through GEF funds it had available from the Efficient Lighting and Appliances Project (P106424) and managed the team of consultants (10 consultants in addition to a coordinator). The Bank provided technical support for the diagnostics. In addition to deployment the Bank's TRACE tool, the Bank helped expand the data collection to begin gathering more information to help begin gathering the foundation to inform the investment projects.

[66] Data for power was also collected, but as this sector remains under federal control, the diagnostics focused on the sectors with larger city control.

Figure A8.1: Municipal Financial Indicators in 25 Selected Cities[67]



Source: Municipal Financial Indicators, the INAFED

3. For a variety of reasons, the relative ease of collecting data and the quality of the data varied by municipality, as well as by sector. In general, the sector that was the most straightforward to cover reliably was SL; whereas the ones that were the most complicated were the public transport (not usually a sector within the municipalities' jurisdiction) and MBs (management and data are not consolidated within most municipalities).[68]

4. The PRESEM's target sectors (that is, public lighting, MBs and water and waste water) figured prominently in each of the municipalites's priorities coming out of the TRACE diagnostics (table A8.1).

[67] Financial indicators were calculated as follows:
Investment capacity = (investments / total expenditures)
Social investments capacity = (public works and social actions expenditures / total expenditures)
Operational costs = (administrative costs / total expenditures)
Staff costs = (expenditures on personnel / total expenditures)

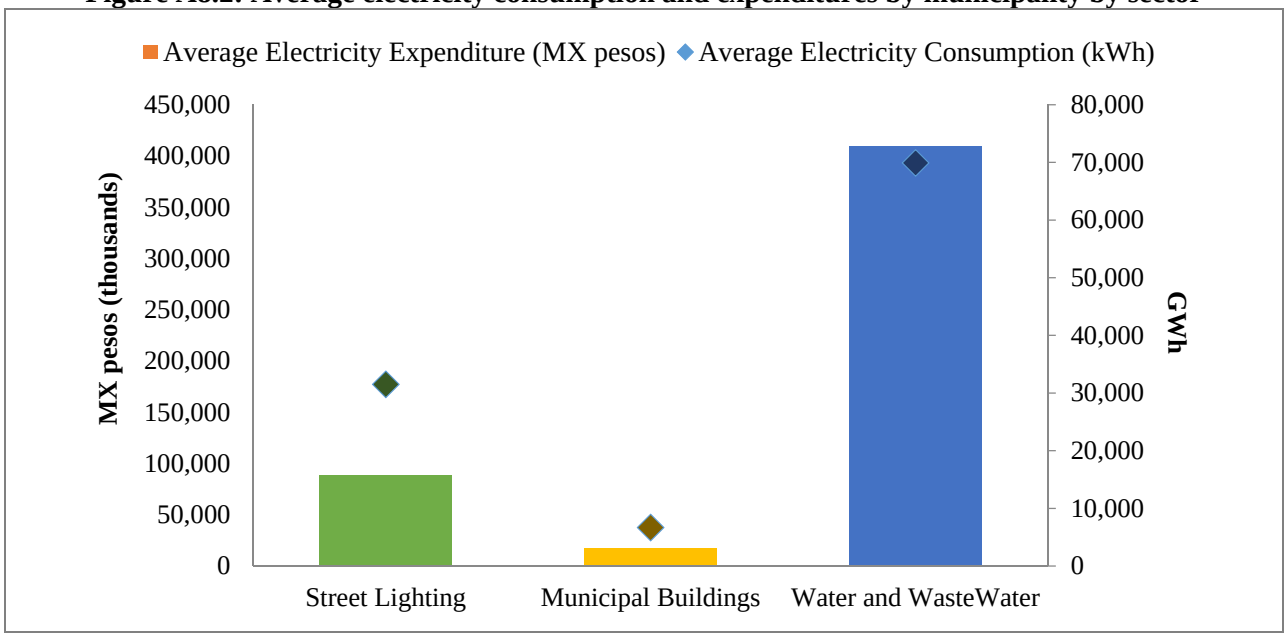
[68] The information and insights from this rapid diagnostics will be deepened through detailed energy audits for interventions/municipalities selected for the PRESEM's investments.

Table A8.1: Priority Sectors Identified with TRACE Diagnostic in each Municipality

Municipality	Priority 1	Priority 2	Priority 3
Acapulco	Public lighting	Water and waste water	
Aguascalientes	Public lighting	Waste	Municipal buildings
Campeche	Public lighting	Water and waste water	Municipal buildings
Centro Villahermosa	Public lighting	Waste	Municipal buildings
Ciudad Juárez	Public lighting	Municipal buildings	Waste
Colima	Public lighting	Municipal buildings	
Cozumel	Public lighting	Municipal buildings	
Cuernavaca	Water and waste water	Public lighting	Municipal buildings
Culiacán	Waste	Public lighting	Municipal buildings
Durango	Public lighting	Waste	Municipal buildings
Ecatepec	Water and waste water	Public lighting	Municipal buildings
Fresnillo	Public lighting	Waste	Municipal buildings
Guadalajara	Public lighting	Waste	Municipal buildings
Hermosillo	Water and waste water	Public lighting	Waste
Huamantla	Water and waste water	Public lighting	Municipal buildings
León	Public lighting	Waste	Municipal buildings
Los Cabos	Municipal buildings	Waste	Water and waste water
Mérida	Public lighting	Waste	Municipal buildings
Miguel Hidalgo	Municipal buildings	Waste	Public lighting
Monclova	Public lighting	Municipal buildings	Waste
Monterrey	Public lighting	Waste	Municipal buildings
Morelia	Water and waste water	Waste	Public lighting Municipal buildings
Oaxaca	Water and waste water	Public lighting	Municipal authority
Pachuca	Public lighting	Waste	Municipal buildings
Puebla	Public lighting	Municipal buildings	Waste Municipal authority
Querétaro	Water and waste water	Public lighting	Municipal buildings
Reynosa	Public lighting	Waste	Municipal buildings
San Luis Potosí	Public lighting	Municipal buildings	Waste
Tepic	Water and waste water	Public lighting	Waste
Tijuana	Public transport	Municipal buildings	Public lighting
Tuxtla Gutiérrez	Water and waste water	Public lighting	Municipal authority
Veracruz	Public lighting	Water and waste water	Municipal buildings

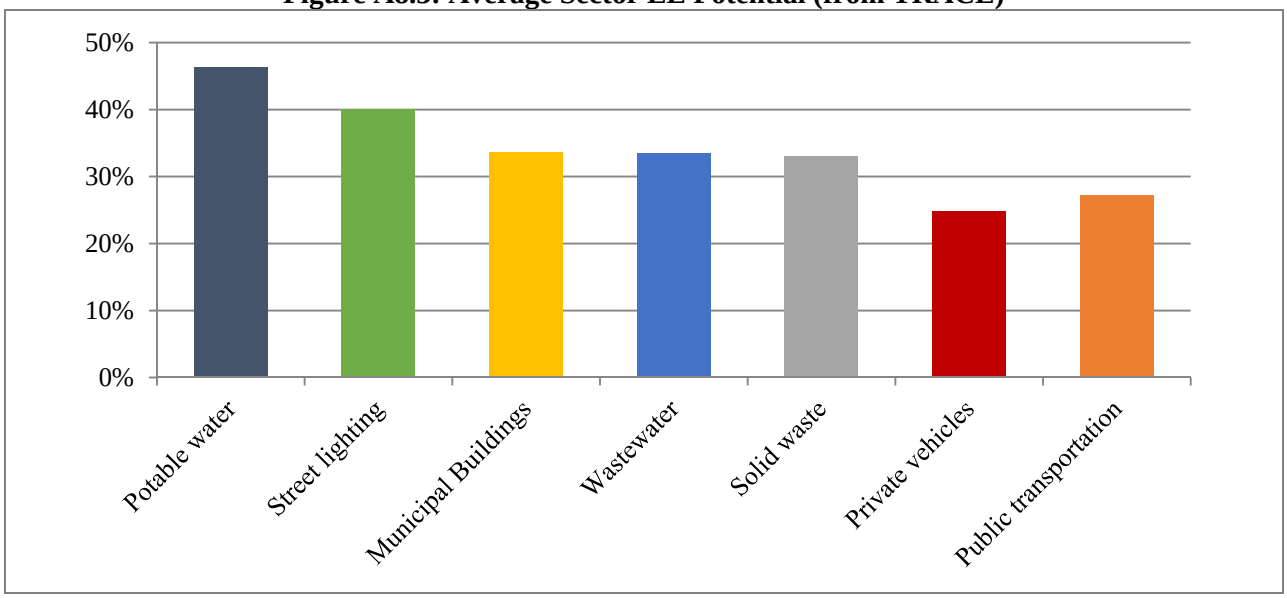
5. Figure A8.2 shows the average electricity consumed by the three target sectors by municipality, along with the average electricity expenditures for each of these three sectors (and how much they represent relative to each municipality's overall budget).

Figure A8.2: Average electricity consumption and expenditures by municipality by sector



6. With regard to EE potential, TRACE calculates each city's EE potential relative to the performance of better-performing cities in the TRACE data-base. The average indicative EE potential by municipality for each of the target sectors is shown in figure A8.3.

Figure A8.3: Average Sector EE Potential (from TRACE)

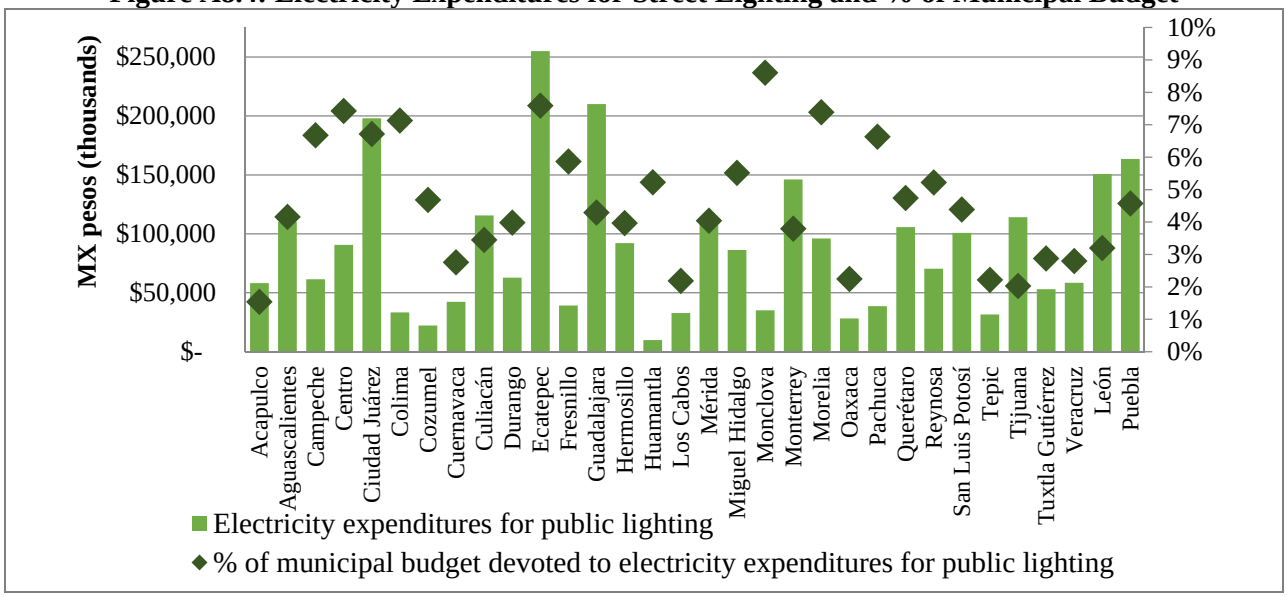


Street Lighting

7. On average, 89 percent of municipal streets are lit. The Mexican municipalities targeted by the PRESEM have an average of 42,700 light points providing lighting for the safety and security of their population, with a failure rate, on average of 11 percent. The majority of the municipalities have some – but not all – of their SL system metered. On average 42 percent of light points are metered in the 15 municipalities with meters. Billing of electricity consumption is based on inventory surveys conducted by the CFE.

8. As shown in figures A8.4, electricity expenditures for SL take up about 4 percent of each municipality's budget.[69] According to experts in SL and in the literature, this is the second highest expenditure category for municipalities after staff costs. The data collected on O&M costs associated with SL is patchy, but is significant.

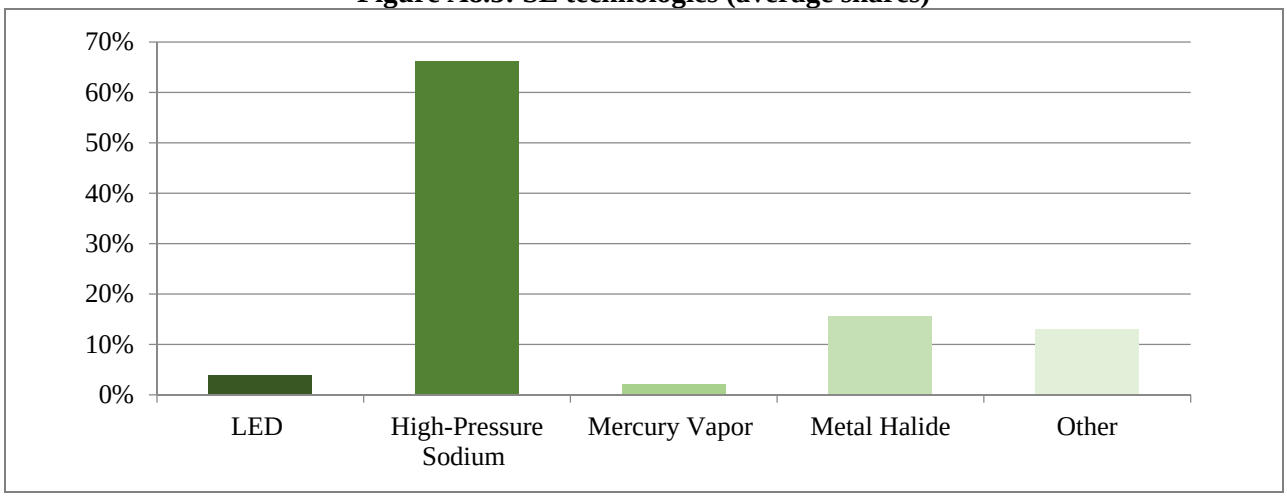
Figure A8.4: Electricity Expenditures for Street Lighting and % of Municipal Budget



9. The most common technology for SL in Mexican municipalities is high pressure sodium, representing on average 66 percent of a city's light points (figure A8.5). More efficient LED streetlights take up a small share of the total, at 3.8 percent, while metal halide accounts for 15.6 percent. Replacing high-pressure sodium (HPS) lamps with LED or metal halide can generate roughly 40-50 percent savings over the lifetime of an LED bulb.

[69] On average, Mexican municipalities spend MXN 88,322,000 (US$5,622,000) in electricity expenditures for SL.

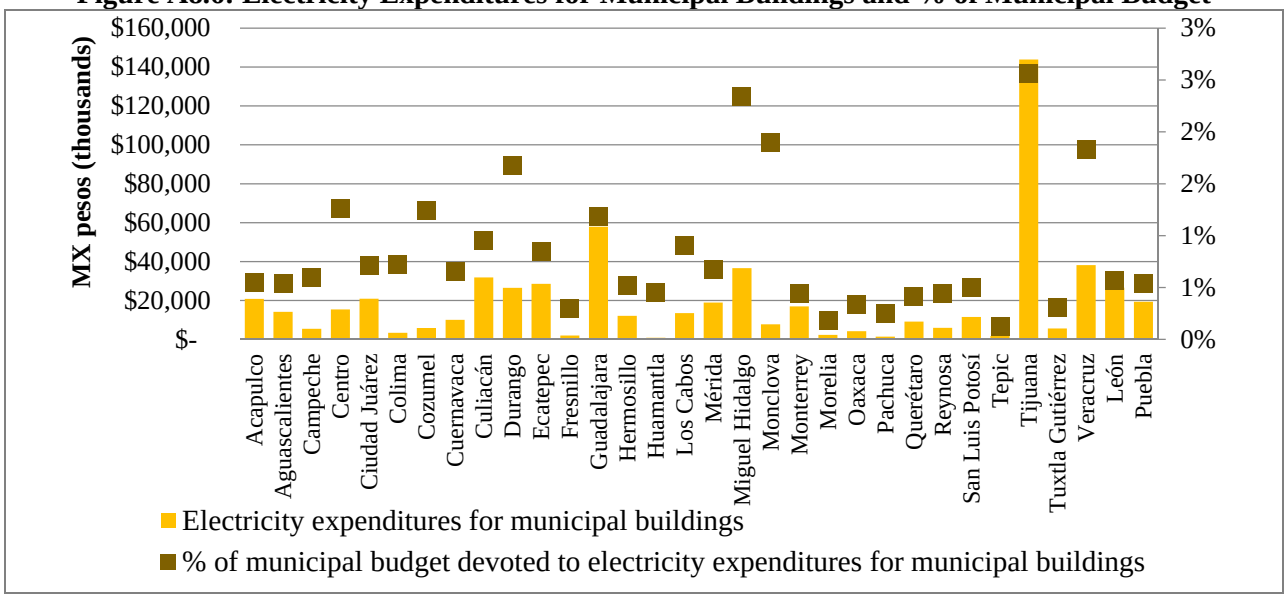
Figure A8.5: SL technologies (average shares)



Municipal Buildings

10. As has been the case in other TRACE diagnostics, the MBs data have been challenging to collect[70] and as such need to be interpreted cautiously. The number of MBs varied significantly by municipality, but on average, each city in the sample has about 46 MBs representing an average of 96,000 m^2, consuming 82 kWh per m^2.[71] The electricity consumption by these buildings costs, on average, $19,370,000 MXN (US$1,233,000) per municipality (see figure A8.6).

Figure A8.6: Electricity Expenditures for Municipal Buildings and % of Municipal Budget



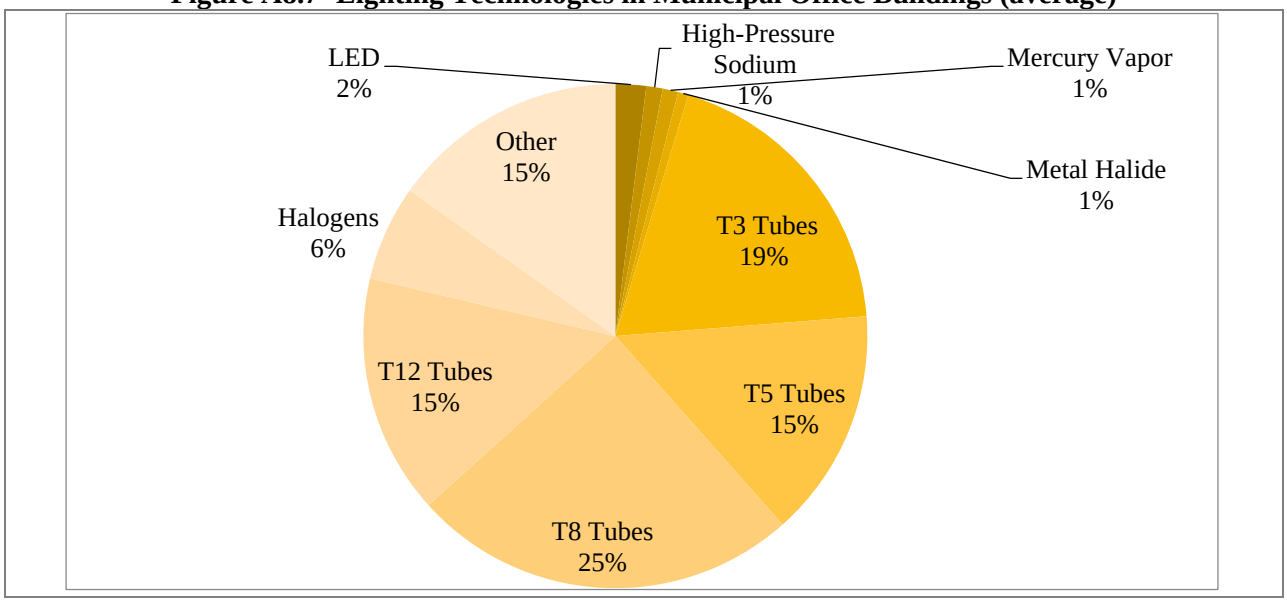
11. According to data collected through the TRACE diagnostics, the majority of the municipalities have buildings with cooling systems, although the use of air conditioners varies

[70] In fact proxies are often needed. In the case of Mexico, the consultants typically did walk-throughs in a representative set of MBs and then extrapolated the data.

[71] A small percentage of MBs are reported to consume a small amount of diesel – diesel generators, as well as electricity.

according to the different climates in different parts of the country. Out of the information collected, wall-unit air conditioners are the most common type of technology in municipal office buildings (72 percent). Windows in municipal offices are overwhelmingly (75 percent) single pane. With regard to indoor lighting technologies, there are various technologies in use in MBs (figure A8.7). The most common types are T3 (19 percent) and T8 (25 percent) tubes.

Figure A8.7- Lighting Technologies in Municipal Office Buildings (average)



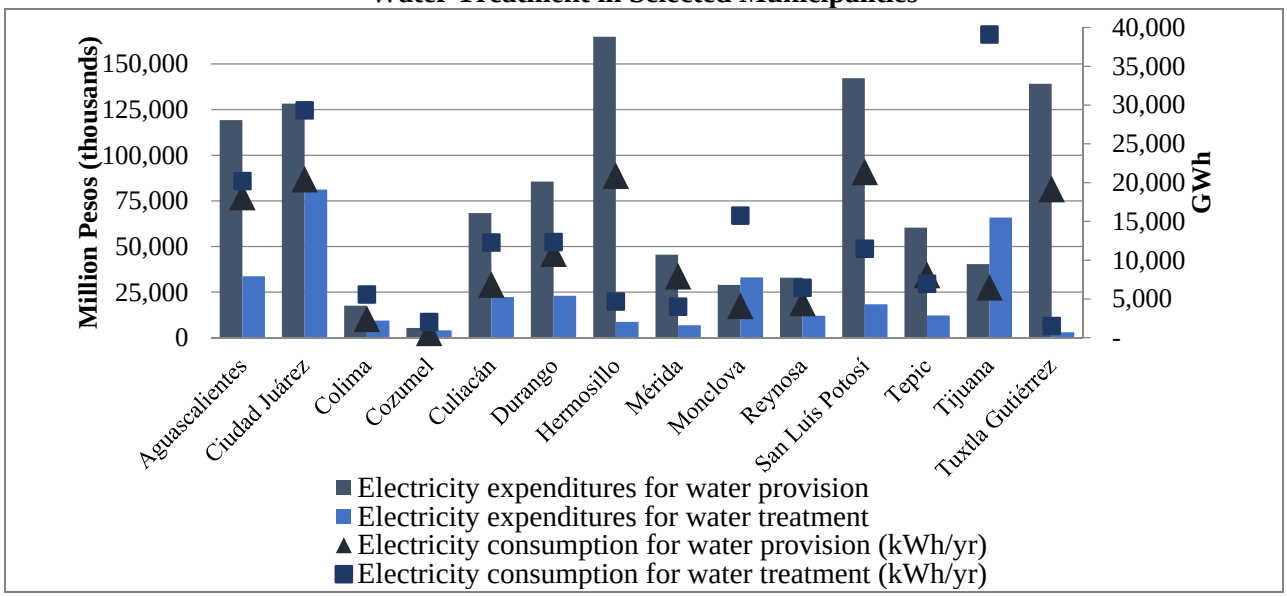
12. While detailed energy audits will provide a better picture, there is potential to improve the EE – as well as comfort levels – in many MBs. This was also suggested by the 24 (out of 32) municipalities that concluded that buildings were among their top three priorities for energy efficiency improvements.

Water and wastewater

13. Public utilities (*Organismos operadores*) are responsible for the supply of water and the treatment of wastewater in the 32 Mexican municipalities. On average, the water consumption in Mexican municipalities was 189 m3 per capita. This is a sector that consumes significant amounts of electricity; each OO consumes on average 69,916,000 kWh and pays $118 MXN million in electricity expenses (figure A8.8).

Figure A8.8: Electricity Consumption and Expenditures for Water Provision and

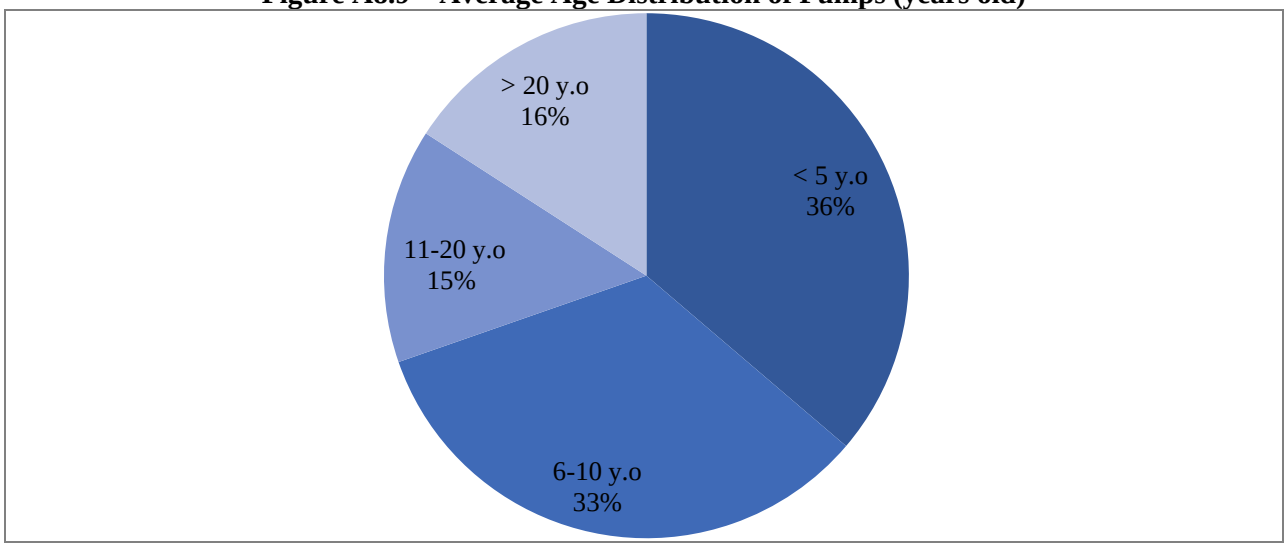
Water Treatment in Selected Municipalities



14. Moreover, better water treatment requires greater amounts of energy (on average, selected Mexican municipalities treated 60 percent of the water). Poor infrastructure creates energy and water losses. The diagnostics conducted in the 32 Mexican cities indicate that, on an average, the technical and commercial losses in OOs amount to 51 percent.

15. Water pumping consumes a significant amount of energy and typically offer EE potential. While data collected on pumps was not complete, figure A8.9 offers an estimate (from 23 cities) of the age distribution of water pumps.

Figure A8.9 – Average Age Distribution of Pumps (years old)



16. The conditions and potential of different public utilities (*organismos operadores)* in Mexico vary significantly. The information from the diagnostics has been corroborated with

priority OOs for improvements identified by the *Asociación Nacional de Empresas de Agua y Saneamiento* (ANEAS) and the CONAGUA to help identify OOs with high EE improvement potential.

MAP – Major River Basins in Mexico

Source: World Bank Cartography, Map No. IBRD 41533