See Annex 9 | Economic and Financial Analysis

Document of
The World Bank

Report No: 39196-MX

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED LOAN

IN THE AMOUNT OF US$15.0 MILLION

AND

PROPOSED GRANT FROM THE

GLOBAL ENVIRONMENT FACILITY TRUST FUND

IN THE AMOUNT OF US$15.0 MILLION

TO THE

UNITED MEXICAN STATES

FOR AN

INTEGRATED ENERGY SERVICES PROJECT

December 11, 2007

Sustainable Development Department
Mexico and Colombia Country Management Unit
Latin America and the Caribbean Region

MEXICO-GOVERNMENT FISCAL YEAR
January 1 – December 31

CURRENCY EQUIVALENTS
(Exchange Rate Effective as of December 11, 2007)
Currency Unit = Mexican Peso (MXN)
US$1.00 = 10.804 Mexican Pesos

Weights and Measures
Metric System

ABBREVIATIONS AND ACRONYMS

AFPU	Administrative, Financial and Procurement Unit
BOTT	Build Operate Train and Transfer
CDI	Indigenous People Development Commission
CFE	Federal Electricity Commission
CNA	National Water Commission
COPLADE	State Planning Body
CRE	Energy Regulatory Commission
CRM	Conflict Resolution Mechanism
ESCOs	Electricity Service Companies
EMF	Environmental Management Framework
FAIS	Social Infrastructure Development Fund
FIRCO	Shared Risk Trust Fund for Agricultural Productive Activities
GEF	Global Environmental Facility
GoM	Government of Mexico
GVEP	Global Village Energy Partnership
IESRM	Integrated Energy Services for Rural Communities in Mexico
IIE	Institute of Electrical Research
MOU	Memorandum of Understanding
NAFIN	National Financial Institution
OM	Operations Manual
PAC	Project Advisory Committee
PIBAI	Basic Infrastructure Program for Indigenous People Development
PMC	Project Monitoring Committee
PPMT	Project Planning and Management Team
PPPs	Public Private Partnerships
PROSENER	Energy Sector Program
RET	Renewable Energy Technologies
SAGARPA	Ministry of Agriculture, Livestock and Fisheries
SECs	State Energy Committees
SEDESOL	Ministry of Social Development
SEMARNAT	Ministry of Environment and Natural Resources
SENER	Ministry of Energy
SGS	State Governments
SHCP	Ministry of Finance (Treasury)
SHS	Solar Home Systems
SIL	Specific Investment Loan
SOEs	Statement of Expenditures
SPICs	State Project Implementation Committees
SSE	State Secretariat of Economy
SSF	State Secretariat of Finances
WTP	Willingness to Pay

Vice President:	Pamela Cox
Country Manager/Director:	Axel van Trotsenburg
Sector Director:	Laura Tuck
Sector Manager:	Philippe Benoit
Task Team Leader:	Gabriela Elizondo-Azuela

Integrated Energy Services Project for Small Localities in Rural Mexico

CONTENTS

MEXICO

INTEGRATED ENERGY SERVICES PROJECT

PROJECT APPRAISAL DOCUMENT

LATIN AMERICA AND CARIBBEAN

LCSEG

Date: December 11, 2007 Country Director: Axel van Trotsenburg Sector Manager/Director: Philippe Benoit Project ID: P088996 Lending Instrument: Specific Investment Loan	Team Leader: Gabriela Elizondo Azuela Sectors: Renewable energy (60%); Power (40%) Themes: Rural services and infrastructure (P);Small and medium enterprise support (S) Environmental screening category: Partial Assessment

Global Supplemental ID: P095038 Lending Instrument: Grant Focal Area: C-Climate change Supplement Fully Blended?: Yes	Team Leader: Gabriela Elizondo Azuela Sectors: Renewable energy (100%) Themes: Rural services and infrastructure (P)

Project Financing Data

[X] Loan [ ] Credit [X] Grant [ ] Guarantee [ ] Other:

For Loans/Credits/Others:
Total Bank financing (US$m.): 15
Proposed terms: Fixed Spread Loan (FSL), payable every May 1 and November 1 of each year with a grace period of 5 years. Total repayment terms of 15 years and amortization pattern of level repayments.

Financing Plan (US$m)

Source	Local	Foreign	Total
Borrower/Recipient	60.00	0.00	60.00
International Bank for Reconstruction and Development	15.00	0.00	15.00
Global Environment Facility (GEF)	15.00	0.00	15.00
Private Sector	8.49	0.00	8.49
Total:	98.49	0.00	98.49

Borrower:
Secretaria de Hacienda y Credito Publico, Mexico
Unidad de Crédito Público,
Palacio Nacional, Patio Central, 3er piso, oficina 3010,
Colonia Centro, 06000 México, D.F.
Responsible Agency:
Secretaria de Energia, Mexico
Insurgentes Sur 890, Colonia Del Valle, Delegacion Benito Juarez, 03100, Mexico, D.F.

Estimated disbursements (Bank FY/US$m)									
FY	08	09	10	11	12				
Annual	2.00	3.00	4.00	3.00	3.00				
Cumulative	2.00	5.00	9.00	12.00	15.00				

GEF Estimated disbursements (Bank FY/US$m)									
FY	08	09	10	11	12				
Annual	2.00	3.00	4.00	3.00	3.00				
Cumulative	2.00	5.00	9.00	12.00	15.00				

Project implementation period: Start January 15, 2008 End: June 30, 2012
Expected effectiveness date: April 1, 2008
Expected closing date: December 31, 2012

Does the project depart from the CAS in content or other significant respects? ***Ref. PAD A.3***	[..]Yes [X]No
Does the project require any exceptions from Bank policies? ***Ref. PAD D.7***	[ ]Yes [X] No
Have these been approved by Bank management?	[ ]Yes [ ] No
Is approval for any policy exception sought from the Board?	[ ]Yes [ ] No
Does the project include any critical risks rated "substantial" or "high"? ***Ref. PAD C.5***	[X]Yes [ ] No
Does the project meet the Regional criteria for readiness for implementation? ***Ref. PAD D.7***	[X]Yes [ ] No

Project development objective ***Ref. PAD B.2, Technical Annex 3***
Increase access to efficient and sustainable integrated energy services in predominantly indigenous rural areas of Mexico.

Global Environment objective ***Ref. PAD B.2, Technical Annex 3***
The global environmental objective of the Project is to achieve reduction of greenhouse gas emissions through the use of renewable energy in rural areas for the provision of electricity.

Project description *[one-sentence summary of each component]* ***Ref. PAD B.3.a, Technical Annex 4***
The proposed Project has five main components: (1) strengthening of strategy, policy, and regulatory frameworks, (2) investment in rural electrification sub-projects, (3) technical assistance and capacity building activities necessary to ensure the success and sustainability of the Project at different stages of implementation, (4) technical assistance to increase productive uses of electricity and co-financing --on a pilot basis-- of a limited number of productive or micro-business activities, and (5) Project management.

Which safeguard policies are triggered, if any? ***Ref. PAD D.6, Technical Annex 10***
The Project has been categorized as B.
- Environmental Assessment (OP 4.01)
- Natural Habitats (OP 4.04)
- Cultural Property (OP 4.11)
- Indigenous People (OP 4.10)
- Forests (OP 4.36)

Significant, non-standard conditions, **if any**, for:
Ref. PAD C.7
Loan/credit effectiveness:

- The GEF Grant Agreement has been executed and delivered and all conditions precedent to its effectiveness or to the right of the GoM to make withdrawals under it (other than the effectiveness of this Agreement) have been fulfilled.

- The *Contrato de Mandato* has been entered into by the parties thereto and is in effect.

Covenants applicable to project implementation:

1. (a) GoM, through SHCP and SENER, shall enter into a contract (*Contrato de Mandato*) with NAFIN, satisfactory to the Bank, whereby NAFIN agrees to act as executing agency for the Project and as financial agent of GoM with regard to the Loan.

(b) GoM shall exercise its rights and carry out its obligations under the *Contrato de Mandato* in such a manner as to protect the interests of the Bank and to accomplish the purposes of the Loan, all with the appropriate due diligence and efficiency for the benefit of the Project.

2. SENER shall cause NAFIN (pursuant to the *Contrato de Mandato) to* establish and maintain throughout the implementation of the Project a Federal Implementation Team (FIT), to carry out the implementation of the GoM's rural electrification program. The FIT shall be comprised of a project manager, a technical unit and an administrative unit, all with staffing, functions and qualifications acceptable to the Bank.

3. SENER shall cause NAFIN (pursuant to *Contrato de Mandato*) to establish and maintain throughout the implementation of the Project a Project Advisory and Monitoring Committee (PAMC) comprised of relevant project related representatives as deemed necessary by SENER.

4. GoM through SENER shall cause the Selected States to establish and maintain throughout the implementation of the Project the State Implementation Teams (SITs) to assist SENER in the implementation of the Project at the state level.

A. STRATEGIC CONTEXT AND RATIONALE

1. Country and Sector Issues

1. Mexico has already achieved electrification coverage of 96.6 percent. However, there remain an estimated 3.5 million people without electricity living predominantly in rural areas of the Southern States (Oaxaca, Chiapas, Guerrero and Veracruz).

2. Electrifying the remaining households is challenging, since the majority of them are found in small, remote, isolated communities. Further, the unelectrified population is expected to increase by 20 percent through population growth over the next decade. About 60 percent of the people with no electricity are indigenous. Typically, these communities also lack other basic services and infrastructure such as roads, water, telecommunications, education and health. Seventy percent of the un-electrified population in extreme poverty is concentrated in the Southern States.[1].

3. In 2000, the Government of Mexico (GoM) expressed its commitment to increase the national electrification coverage and established the goal to implement a national rural electrification program based on renewable energy (Energy Sector Program, PROSENER 2001-2006). During that period however, no national rural electrification program was set in place to provide economically efficient and sustainable solutions, mainly due to a number of institutional, programmatic and fiscal constraints.

4. The new government administration at the Ministry of Energy (2007-2012) has expressed its interest in implementing such a program, which will be part of the sector strategic platform for the energy sector starting in 2007. On December 1, 2006, President Felipe Calderon launched the "Program of 100 Priority Actions" listing rural electrification as priority number 37:

> " 37. Electrification to remote communities: The government will implement a program to electrify remote communities with technologies based on renewable energy, using local natural resources in a sustainable way"

5. President Felipe Calderon has also emphasized the commitment of the new administration to target the 100 Municipalities with the highest degree of poverty (i.e., lowest human development index), the majority of which are located in the same Southern States of Mexico.

6. One of the main constraints to the implementation of a national rural electrification program is the nature and performance of decentralization policies introduced in 1996. These policies effectively transferred the administration of federal resources for social infrastructure development (known as *Ramo 33*) from the central

[1] The high level of poverty in the Southern States is confirmed by both the Marginality Index (based on access to basic infrastructure services, housing conditions, level of education and wage earnings) measured and reported by the National Population Commission (CONAPO) and the Human Development Index (based on per capita GDP, education and life expectancy) reported by the United Nations Development Program (UNDP). For both indices, the Southern States have the lowest ranking among all States.

government to the States and Municipalities. As a consequence, the programmatic and executing functions for rural electrification development were shifted from the Federal Electricity Commission (CFE) to the Municipalities.

7. Unfortunately, the decentralization of the financial and programmatic control to the States and Municipalities has not been accompanied by a parallel build-up of local capacity to identify electrification needs/uses and to plan cost-effective solutions accordingly. Various studies based on a recent national municipal survey have concluded that the expenditure efficiency associated with the social fund *Ramo 33* at the Municipality level is extremely low.[2]

8. To some extent the transfer of responsibilities slowed down the implementation of basic services and infrastructure, especially in remote rural localities. Since 2001, the government has reacted with the implementation of broad social programs that seek to improve the expenditure efficiency of municipal resources through Federal-State-Municipal co-financing agreements to advance both social development and basic infrastructure.

9. However, although two of these programs (Microregions and PIBAI) included rural electrification as one of their many components, they were traditionally more focused on grid extensions and did not balance or integrate appropriately the key economic, technical and social aspects that must accompany the planning and implementation of sustainable rural electrification initiatives. Indeed, the national average cost per connection in rural communities over the period 2001-2005 has been in the order of US$2,400 per household. In the State of Oaxaca, CFE has reported average costs per connection as high as US$4,200.

10. Another important constraint is the lack of understanding regarding the performance of renewable energy in rural distributed applications, which has resulted in a generalized resistance to the use of these types of solutions.

11. Further constraints include (i) the lack of a legal framework addressing specific provisions for the development of renewable energy, (ii) the existence of high and inefficient consumer subsidies (not targeted to the poor) that affect the competitiveness of renewable energy, (iii) the complexity of inducing service provision --especially private-- in rural areas, and (iv) the lack of a strategic framework streamlining the expertise and efforts of key government agencies while continuing to strengthen Municipal and local capacities.

12. To bridge the electrification gap and promote a more efficient use of available public resources, the GoM has requested assistance from the Bank to prepare and implement a project to (a) guide and streamline national rural electrification efforts, complementing other programs already advancing from the grid extension front, (b)

[2] See Hernandez, Fausto 2004. *Analisis de Aportaciones Federales para Infraestructura* for an in-depth analysis of Ramo 33. See also Diaz Cayeros, Silva Castaneda 2004. *Decentralizacion a Escala Municipal en Mexico: la Inversion en Infraestructura Social*, CEPAL, UN. Both reports are included in the Project Files.

increase access to efficient and sustainable integrated energy services, (c) improve the quality of life and promote the economic development of remote rural communities, (d) develop a sustainable market for the provision of least-cost integrated energy solutions, and (e) leverage municipal government funds with co-financing from non-government stakeholders.

2. Rationale for Bank Involvement

13. The proposed Bank and GEF-assisted Project is consistent with the government agenda and the National Development Plan (PND 2007-2012) as it will contribute to reducing poverty, developing basic infrastructure, strengthening institutional capacities and improving environmental protection. The proposed operation supports the strategies and specific actions on rural electrification established by the Ministry of Energy (SENER). Most importantly, rural electrification has been listed by President Calderon and his team as one of the top priorities for immediate action starting in 2007.

14. The Project will introduce an approach that adopts international best practice in rural electrification. The Bank will deepen its ongoing support to poverty reduction in Mexico and leverage its comparative advantage of extensive experience in rural electrification and renewable energy.

15. The proposed Project, which is focused on off-grid solutions, is complementary to the rural electrification strategy included in the Basic Infrastructure Program for Indigenous People Development (PIBAI) being led by the Indigenous People Development Commission (CDI). In rural electrification, the PIBAI is only focused on grid extensions. A cooperation agreement has been signed between CDI and SENER which establishes the commitment to coordinate programmatic scope, objectives and actions.[3]

16. The proposed operation is also complementary to the objectives and scope of the Micro Regions Program being implemented by the Ministry of Social Development (SEDESOL), which focuses on improving social and economic development in the Municipalities that exhibit the highest degree of poverty. In this case, SEDESOL has also signed a cooperation agreement with SENER to support the operation with their expertise and through co-financing.

17. The Project will implement a strategy to guide and streamline on-grid and off-grid national electrification initiatives and promote fiscal efficiency, strengthening at the same time the capacity of States and Municipalities to plan, program and provide integrated energy services to rural communities living in remote isolated regions.

[3] For instance, the universe of non-electrified communities to be reached with either grid extensions or off-grid solutions in the Southern States has already been defined and agreed with CDI.

3. Higher Level Objectives to Which the Project Contributes

18. The proposed Bank and GEF-assisted Project is consistent with the Country Partnership Strategy (CPS) which proposes to support the GoM in its four pillars: (i) reduce poverty and inequality, (ii) increase competitiveness, (iii) strengthen institutions, and (iv) promote environmental sustainability. The CPS acknowledges the incidence of extreme poverty in rural areas and the wide development gap that exists between the South and the rest of Mexico. In particular, the CPS emphasizes the need to improve access to basic infrastructure, and includes rural electrification as part of the proposed country program for 2006.

19. The Project is consistent with GEF Operational Program Number 6, "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs". In the Project, IBRD and GoM funds will provide minimum capital cost and output-based subsidies to catalyze investments in rural electrification. GEF support will target only those components that specifically support the introduction of renewable energy based electrification projects: (i) development of policy and regulatory incentives, (ii) development of regulatory measures, standards and manuals to ensure minimum quality levels in technical installations and service delivery, (iii) market transformation through the provision of minimum capital cost and output based subsidies, (iv) technical assistance and capacity building activities, and (v) technical assistance to increase productive uses of electricity and economic development in rural communities.

20. Mexico has ratified important multilateral environmental agreements (Vienna Convention 1985; Montreal Protocol 1987; United Nations Framework Convention on Climate Change 1993). It ratified the Kyoto Protocol on September 7, 2000 and established the Ministry of Environment (SEMARNAT) (*Secretaria de Medio Ambiente y Recursos Naturales*) as the designated national authority (DNA) responsible for the implementation of the Clean Development Mechanism (CDM). SEMARNAT is a sophisticated agency, with an agenda that includes all relevant global environmental topics and strategies directly linked to all key sectors including energy, transport and water, among others.

B. PROJECT DESCRIPTION

1. Lending Instrument

21. The proposed Project is a fully blended operation that includes both a GEF grant and an IBRD loan. The lending instrument is a Sector Investment Loan (SIL) implemented over a five year period. Given the nature of the components and the complexities of the fiscal and budgetary processes in Mexico, this was considered the most appropriate approach to support the development objectives of the proposed operation.

2. Project Development Objectives and Key Indicators

22. The main development objective of the proposed Project is the following:

Increase access to efficient and sustainable integrated energy services in predominantly indigenous rural areas of Mexico. To achieve this, the proposed Project will: (i) contribute to the financing of subprojects to supply electricity services to about 50,000 currently unserved rural households,[4] businesses and public facilities such as schools and health clinics, using renewable source-based integrated energy services, (ii) develop a sustainable market for the provision of least-cost integrated energy solutions in rural areas, and (iii) demonstrate the key elements of a strategy for electricity provision in rural areas that attracts investment from private and public sector electricity providers, as well as national, regional and local governments.

23. To ensure the success of the main development objective, the activities included in the program will also:

Promote the development of social and productive activities to increase the use of electricity. The Project will implement a pilot program to: (i) promote a more intensive use of electricity for subsistence and productive activities (ii) increase the number of community projects and investments with high developmental impact (e.g., leverage and maximize the productive impact of remittances) and, (iii) promote public private partnerships aimed at community development. The program will seek to promote only those micro-businesses that have a chance of financial viability and potential for strong multiplier effects.

24. The key performance indicators will be: (i) the number of new electricity connections, (ii) improved efficiency of public expenditures (i.e., resources saved due to co-financing with private sector and users, and introduction of least-cost considerations), (iii) the number of new productive uses of electricity established in rural areas, and (iv) the number of community and economic development projects facilitated by the use of electricity.

3. Project Global Environmental Objective and Key Indicators

25. The global environmental objective of the Project is to achieve reduction of greenhouse gas emissions through the use of renewable energy in rural areas for the provision of electricity. The key global performance indicator is avoided carbon emissions (CO2e). Total estimated carbon emission reductions from facilities installed during Project implementation are estimated at 4.98 million metric tones of carbon dioxide equivalent (CO2e), over the lifetime of the systems. The long-term national impact of this Project is expected to be larger due to replication effects.

[4] This is about 6% of the total number of households without electricity service in Mexico, which reached 811,846 at the end of 2005 (INEGI, 2006).

4. Project Components

26. The proposed Project will be developed primarily in the Southern States: Oaxaca, Guerrero, Veracruz and Chiapas[5] and will focus on communities or aggregates of communities in the range of 50 to 500 households. The initiative will target 50,000 households in the period May 2007-2012.

27. The proposed Project has five main components: (1) strengthening of strategy, policy, and regulatory frameworks, (2) investment in rural electrification sub-projects, (3) technical assistance and capacity building activities necessary to ensure the success and sustainability of the Project at different stages of implementation, (4) technical assistance to increase productive uses of electricity and co-financing --on a pilot basis-- of a limited number of productive or micro-business activities, and (5) Project management. Each of these components is described below (and in more detail in Annex 4).

28. ***Component 1.*** *Strengthening of strategy, policy, and regulatory frameworks (Estimated Cost US$ 4.1 Million).* This component includes (a) the review and design of strategy, policy and/or regulatory measures for electricity tariff and subsidy schemes as well as ownership and property rights associated with off-grid rural electrification projects, (b) the design of incentives to foster the development of renewable off-grid electricity services, (c) the development of technical specifications, standards and manuals to ensure minimum quality levels in technical installations and service delivery practices, (d) the development of methodological guidelines and tools for public consultation activities, and (e) the design of a conflict resolution mechanism to ensure transparency and reduce risks.

29. ***Component 2.*** *Investment in Rural Electrification Sub-Projects (Estimated Cost US$ 68.4 Million).* This component will provide capital cost subsidies for a certain fraction of the investment cost of rural electrification sub-projects, as well as targeted output-based subsidies focused on service quality and market development. The sub-projects will be implemented by qualified electricity service providers. Two different service delivery models will apply depending on the type of sub-project as described in Annex 4. The main off-grid technological options considered under the program are described below in Section D2 ("Technical"). In addition, the Project will include the installation of a limited number of efficient wood stoves in rural households.[6]

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[5] With the possibility to include Puebla, the other State with a high number of non-electrified dispersed isolated communities or other States with Municipalities that exhibit a high degree of poverty or a low human development index.

[6] The substitution of lighting materials/fuels -- such as candles, batteries, diesel and petroleum-- for photovoltaic or other renewable energy alternatives does not necessarily eliminate the burning of fuel wood or other solid fuels for cooking and heating, which result in high levels of indoor pollution (i.e., exposure to fine particulates from biomass smoke increases the risk of a range of serious diseases in both children and adults). The Project therefore emphasizes the provision of integrated energy services including the provision of efficient wood stoves.

30. ***Component 3.*** *Capacity Building to State, Municipal and Community Stakeholders (Estimated Cost US$ 12.6 Million).* This component aims to assist the various stakeholders that will work together under the proposed Project. Under this component the Project will strengthen the capacity of Federal, State, Municipal and Community stakeholders to identify, plan, prioritize, implement, supervise and monitor, sustainable off-grid rural electrification sub-projects in cooperation with electricity service providers, the private sector, decentralized government institutions such as the CFE and when appropriate, NGOs and academia. The component is focused on all those stakeholders that will be ultimately responsible for execution, implementation and for ensuring sustainability. The component will include the activities and actions necessary to strengthen the different stages of the project cycle as described in Annexes 4 and 6.

31. ***Component 4.*** *Co-Financing and Technical Assistance to Increase Productive Uses of Electricity (Estimated Cost US$ 6.0 Million).* The objective of this component is two-fold: (a) promote a more intensive use of electricity while contributing to increase the number of social and productive activities (i.e., foster local economic development) and, (b) support community entrepreneurs through technical assistance and co-financing to increase the number of community projects and investments with high developmental impact. To the extent possible, the project will seek to leverage and maximize the productive impact of remittances. The component includes technical assistance and capacity building activities focused on: (i) access to micro-financing and development of business plans, (ii) development of social or community projects with high impact on health and education, and (iii) development and financing of productive and economic activities.

32. ***Component 5.*** *Project Management (Estimated Cost US$ 7.5 Million).* This component will support the overall management of the proposed Project including all Federal and State level institutions in charge of project execution and implementation. It is expected that the actual administration of the GEF and IBRD resources will be carried out by *Nacional Financiera* (NAFIN).

TABLE 1. ESTIMATED PROJECT COSTS BY COMPONENT						
COMPONENT		US$ Million				
		GOM	IBRD	GEF	Private	Total
1	**Policy, Regulation and Strategy**					
	Tariff and Subsidy Schemes/ policy legal and regulatory frame	0.250	0.200	0.400		0.850
	Ownership Rights and Schemes	0.250	0.200	0.400		0.850
	Conflict Resolution Mechanism	0.050	0.100			0.150
	Incentives to Promote RETs		0.200	0.050		0.250
	Technical Specifications, Manuals and Standards	0.525	0.475	0.500		1.500
	Methodological Guidelines, Tools Social Consultation	0.500				0.500
2	**Rural Electrification Sub-Projects (Investment/ OBA Subsidies)**					
	See Annex 5 for Details	49.220	6.890	5.765	6.540	68.415
3	**Technical Assistance**					
	Computer hardware and software/modeling tools planning stage		0.010			0.010
	Measurement, data collection on renewable energy resources	0.200	0.400	1.000		1.600
	Capacity building to PPMT and SPICs	1.000	0.300	0.700		2.000
	Communication strategy / information campaign	0.500		0.500		1.000
	Pre-feasibility, Feasibility, Engineering of Selected Subprojects	0.250	0.500	0.500		1.250
	Bidding packages, service delivery models	0.100	0.200	0.300		0.600
	Permanent training to community extension agents	0.500	0.300	0.500	0.200	1.500
	Impact Evaluation (surveys / analysis)	0.450	0.300	0.500		1.250
	Monitoring Activities (technical / social / environmental)	1.000	0.500	0.750		2.250
	Technical, Social and Environmental Oversight State Level	0.315	0.300	0.385		1.000
4	**Technical Assistance Social/productive Uses of Electricity**					
	Capacity building social and productive activities / micro-businesses	0.250		1.250		1.500
	Financing of social activities (consumptive with development effect)	1.000				1.000
	Investments in Micro-Businesses (entrepreneurial activities)		1.750		1.750	3.500
5	**Project Management 4 States 5 year Period**					
	Federal Level: Management, Procurement, Financial, Technical	0.500	0.875	0.850		2.225
	State Level: Management, Procurement, Financial, Technical	1.250	1.500	0.200		2.950
	Legal, Fiduciary Management including Fee for Administration of Project Account	1.890		0.450		2.340
TOTAL		**60.000**	**15.000**	**15.000**	**8.490**	**98.490**

5. Lessons Learned and Reflected in the Project Design

33. The Project builds on the Bank's extensive experience in rural electrification.[7] Recent rural electrification projects by the World Bank and others were examined, including projects for Argentina, Bolivia, Chile, Ecuador, Philippines, Mexico (FIRCO Project), and Nicaragua. Some of the key lessons learned that have been incorporated in the Project include:

Implementation of a robust program that functions within an institutional network well coordinated across the Federal, State and Municipal levels. One of the challenges of decentralized service planning and provision is how to establish effective linkages with the nationwide sector planning and strategies. The Project is designed to facilitate continuous interaction between the local and central government levels to ensure that the local development experiences feed into the sectoral policies and that successful models can be replicated and scaled up at the national level.

Continuous capacity building. It has been acknowledged that lack of local capacity is one of the main risks for programs involving a transfer of responsibilities for infrastructure provision to local levels. Efficient and sustainable provision of infrastructure, with adequate quality, is often a task beyond the local capacity, and, without appropriate technical assistance, it may lead to: (i) delays in implementation; (ii) distortions in sub-project selections (avoiding more complex projects); (iii) higher costs; and/or (iv) quality and sustainability problems. The Project emphasizes the continuous capacity building of Federal, State and Municipal parties involved in program implementation and the communities.

Enhancing sustainability associated with off-grid electrification projects. The main lessons learned from past projects of the Bank and other agencies include three aspects. The first is the need to adhere to least-cost principles in designing power supply systems. The second is the need to ensure that subsidies are transparent, non-distortionary, and where possible, linked to specific outputs. Subsidies must also be targeted to the poor --the need to reach the poorest of the poor must be balanced with the goals of sustainability, subsidy minimization, and the need to demonstrate viable solutions. The third is the need to build local capacities to manage, operate and maintain the off-grid systems and provide market development services. This is often a long and costly process but without it, the systems are bound to fail.

[7] This experience is documented in several reports including: (a) Meeting the Challenges of Rural Electrification in Developing Nations: The Experience of Successful Programs, ESMAP Report (2005), and (b) Cabraal A., Cosgrove-Davis M, Schaeffer (1996), Best Practices for Photovoltaic Household Electrification Programs, Lessons from Experiences in Selected Countries, The World Bank.

Ensuring a robust base load to sustain capital intensive projects. In particular, the Project design places special emphasis on identifying productive loads to improve the financial sustainability of larger renewable energy-based off-grid projects (e.g., micro-hydro, mini-grids).

34. The performance and lessons learned from previous electrification programs and projects in Mexico were also analyzed in depth. The design of the Project integrated the lessons and recommendations from recent studies financed by the Global Village Energy Partnership (GVEP) which analyzed specific cases in Mexico focused on off-grid solutions and the links between renewable energy and productive uses (see Annex I for a detailed description; reports are included in the project files).

35. One notable lesson is that the d*esign of output based subsidy schemes and the terms and conditions specified in bidding documents* should consider the lessons learned so far in Bank projects that have already introduced novel, medium term service contracts for solar and wind home systems (e.g., Bolivia),[8] (a) careful tender and subsidy design must be taken into account, (b) room for creativity in OBA design leads to efficiency gains when a good consultation process is conducted and a number of key elements are fine tuned during the process, (c) transparency and reliability of bidding process is ensured, (d) disbursement schedules must balance government control with the real limitations of providers financing and cash-flows, and (e) minimize transaction costs by delegating as many project preparation activities to the bid winners or service providers.

36. Some of the *key lessons learned from the FIRCO project are:*[9] (i) to ensure optimal impact of interventions it is essential to combine investments in RET based projects with investments in productive applications, (ii) dissemination activities should be emphasized during the design stage and carried throughout the different stages of project's life cycle, especially towards the end, (iii) technical assistance must focus on demonstrating the outcomes and benefits of using RETs, not simply on showing how to use them, (iv) a wholesale approach to technical assistance can increase efficiency and also may improve outreach to further potential users, (v) when possible, subprojects must be supported by direct investments from beneficiaries, (vi) flexibility in project design and implementation can help to make subsequent modifications and improve efficiency, and (vii) that equipment and other support should not be provided for free.

6. Alternatives Considered and Reasons for Rejection

37. Several different alternatives were considered:

Development of Other Basic Infrastructure Services. The possibility to integrate a social infrastructure development package for remote communities including

[8] Source: Reiche Killian. 2006. Bolivia Rural Access: Tendering Ouput-Based Subsidies for Energy and ICT- Final Draft, Working Paper.

[9] Implementation Completion and Results Report (MULT-23251), Renewable Energy for Agriculture Project, November 31, 2006.

water, roads and/or rural telephony was considered during project preparation and design. This option however was discarded for various reasons. Although an integrated infrastructure initiative delivers a higher potential for development at the community level, the logistics and institutional complexity associated with this option are high and pose higher risks of failure or delays during project implementation. The intervention in indigenous communities is also more complex and radical. The proposed rural electrification approach, on the other hand, which considers competitive provision of subsidies against performance and sustainability, as opposed to the centralized approach currently in place, will already face the challenges associated with an innovative scheme. For this reason it was decided not to broaden the scope of the Project to include activities in other sectors. However, every effort will be made to ensure coordination with other successful government programs and initiatives, especially those being led by the Indigenous People Development Commission (CDI with the PIBAI Program), the Social Development Secretariat (SEDESOL with the Micro-Regions Program), and especially FIRCO (see Annex I for a description of these programs).

Exclusive Focus on Private Sector Participation for Investments in Centralized Systems such as Micro-hydro. Establishing a small or medium size utility company with full private ownership to sell electricity to residential customers through the use of hydroelectric or any other type of resource or fuel is not possible in Mexico. The Mexican constitutional and legal framework establishes that the State has the exclusive right to generate, conduct, transform, distribute and supply electricity as a "public service" (Article 27). Although in 1992, the Electricity Law (Article 3) was amended to allow private sector participation under the self-supply scheme --through co-generation or small generation-- the provision of the electric service to rural or urban customers through a generating asset fully owned by the private sector is still not allowed. Under the self-supply scheme, the Law explicitly allows for small production for dispersed rural communities in projects that do not exceed 1 MW, and where the ownership is constituted by a rural committee, cooperative, or a private-public partnership (the beneficiary or user has to be part of the society or partnership). Under this scheme, municipal entities, rural cooperatives and private sector parties can purchase a share of a renewable energy project to qualify as "self-generators." The Law is not explicit as to what the minimum share by the beneficiaries or users should be, allowing the possibility of having high shares owned by the private sector. Given the legal provisions, the Project will promote the creation of public-private partnerships (PPPs) to maximize the participation and value added delivered by the private sector, as well as to extend the reach of available public resources for improving social welfare.

Solar Home Systems (SHS) and the Photovoltaic (PV) Alternative. A few of the un-electrified communities visited during project preparation --especially those that are closer to the grid-- expressed their concern about the quality of service delivery associated with solar home systems. This concern has also been expressed by the Indigenous People Development Commission (CDI). The

majority of interviewed communities, however, expressed their neutral opinion with regards to the technology chosen for electrification "as long as corresponding benefits were at least similar to those characteristic of customers connected to grid."[10] Indeed, during the 1980s and 1990s the GoM implemented electrification programs almost exclusively focused on the installation of solar PV (*Pronasol* and *Progresa*) which were not particularly successful mainly due to the lack of mechanisms to ensure appropriate maintenance and service delivery. A more recent government initiative, the FIRCO project, has however fully considered previous lessons learned and has advanced its development goals successfully with solar PV for water pumping and productive applications in agriculture. Both the Institute of Electrical Research (IIE) and the CFE have recently estimated that 49 percent of non-electrified communities cannot be reached by the grid due to prohibitive costs and/or geographical, logistic difficulties. These communities --with a total of about 400,000 households-- have no choice in the medium to long term but to be electrified with off-grid solutions, especially with solar home systems. The proposed Project will therefore fully consider the SHS alternative, as this technology has the potential to serve the consumption needs of the majority of communities targeted and deter the problems associated with underdevelopment (e.g., lack of vaccine refrigeration, lack of light and computers for education, lack of rural telephony, indoor pollution). The Project is structured to implement an information campaign on the merits of renewable source based off-grid electrification alternatives targeting key Federal, State, Municipal and community stakeholders.

C. IMPLEMENTATION

1. Partnership Arrangements

38. Project preparation has been supported with resources from the Global Village Energy Partnership (GVEP) which financed a number of studies conducted by both international and national consultants including: (a) in depth analysis of case studies focused on off-grid renewable source-based projects and previous government programs, (b) an assessment of the institutional structure for the development of rural electrification projects, and (c) a technical economic modeling exercise to compare least cost electrification options considering the universe of non-electrified communities in the Southern States. It is also expected that GVEP resources will complement the efforts to promote the development of productive activities (component 4).

[10] Normally, the consumer of electricity wants: (a) permanent and un-interrupted quality of service, (b) unlimited capacity or availability, (c) quick response in case of outages, (d) prices that are affordable and fair, (e) consumption that is measured accurately and in a timely manner and (f) easy methods of payment for service. The challenge of service provision in off-grid situations are complicated however by the variety of technologies and their own special features, and factors of distance and accessibility, among others.

39. USAID, in collaboration with National Renewable Energy Laboratory (NREL), has supported SENER during the Project preparation stage with technical assistance including the financing of workshops, training sessions and pre-feasibility studies for several projects in the States of Guerrero and Veracruz.

2. Institutional and Implementation Arrangements

40. The Project is designed to be implemented over a five-year period. The institutional structure for the implementation of the Project includes the participation of key government organizations at the Federal, State and Municipal levels, community leaders, the private sector and the civil society (NGOs).

41. Through its technical units, SENER will lead, coordinate and implement the Project, promoting the participation of Federal, State, Municipal and private entities with regards to the programming, co-financing and execution of off-grid rural electrification sub-projects. The details of project implementation and the roles and responsibilities of different participating entities are described in Annex 6.

42. The Indigenous People Development Commission (CDI) will open the fiscal space necessary to accommodate both the IBRD loan and the GEF grant over the five year implementation period as established in a formal cooperation agreement with SENER. CDI will also participate as an advisory body to the Project specifically with regard to indigenous people development activities and intervention in indigenous peoples' land.

43. The National Financial Agent (NAFIN) will be responsible for project administration managing the IBRD loan and GEF grant resources.

44. Implementation also includes partnerships with State and Municipal Governments, the Federal Electricity Commission (CFE), the Secretariat of Social Development (SEDESOL) and the Secretariat of Agriculture (SAGARPA, FIRCO initiative).

45. The institutional structure agreed for the management, execution and implementation of the Project within the Government network is supported by agents whose original assigned roles and activities are already in line with the national strategic objective of increasing access to electricity in rural areas. Rather than creating a new institutional structure, the Project is designed to strengthen and streamline the functions of government units already in place.

46. With the support of NAFIN as an executing agency for resources allocation and overall program administration, SENER will retain the responsibility of strategic planning functions (e.g., planning, programming, technical oversight) relying, to the extent possible, on internal human resources. When required, SENER will outsource specific activities that may require additional skills or expertise.

47. The Project is also designed to build synergies and strengthen the liaisons between government bodies already operating in rural areas and implementing electrification initiatives such as FIRCO, SEDESOL, CDI and CFE. In particular, the CDI rural electrification initiative is mainly devoted to grid-extensions. The FIRCO initiative, on the other hand, has been focused on the provision of solar systems for water pumping --and productive-- mainly agricultural activities in the Northern States. These two initiatives are complementary to the proposed Project. Ultimately the two programs cover different segments of a large market in Mexico.

48. The institutional and implementation arrangements are structured around 5 entities: (a) the financial institution NAFIN, which serves as project financial executing agency, (b) the Program Planning and management Team, (c) the Project Advisory Committee, (d) the State Project Implementation Committees, and (e) the Project Monitoring Committee. These are described below (and are summarized below and detailed in Annex 6 – a schematic is presented in Figure 6.2 in Annex 2).

a. Financial Institution (NAFIN). NAFIN has been designated as the project financial executing agency and will be in charge of opening a special account to administer and disburse the IBRD/GEF resources based on project procurement plans for Federal and State-level implementation activities. The administration and disbursement of the resources will be executed in accordance with the conditions established in the loan and grant legal agreements signed between the GOM (SHCP) and the World Bank, the co-financing agreements with States and Municipalities, and the Project's Operational Manual. NAFIN will also be in charge of organizing the activities necessary for the execution of project financial and procurement audits.

b. Program Planning and Management Team (PPMT). The PPMT will function under the Office for Environment and Technology Development of the Under-Secretary of Energy Policy at SENER. This committee will be integrated by: (a) a Project Manager, who will be responsible for the strategic planning, management and coordination of project activities horizontally and vertically across States and participant institutions, and (b) a Technical Unit (TU) which will provide technical support and guidance to the overall program, promote workshops and training sessions benefiting stakeholders at the Federal, State and Municipal Levels, and supervise bidding processes and the overall technical efficiency of the program.

c. Project Advisory Committee (PAC). Given the number of institutions with functions in rural development and other interrelated dimensions such as environment, education and health, the Project will have an Advisory Committee. The PAC will be integrated by representatives of Treasury (SHCP), the Ministry of Energy (SENER), the Indigenous People Development Commission (CDI), the Ministry of Agriculture and Rural Development (SAGARPA, FIRCO Program), the Ministry of Environment (SEMARNAT), the Ministry of Social Development (SEDESOL), the Federal Electricity Commission (CFE), and when necessary,

academia. Ministerial representatives will meet twice a year to discuss and streamline programmatic initiatives and promote synergies. One of the main tasks of the PAC is to ensure an efficient public expenditure exercise and avoid overlap of programs and actions. This will help the coordination with States, especially with regard to legal agreements signed for the co-financing of rural development programs with social funds (*Ramo 33*). During the year the PAC will meet twice to review progress in rural electrification and ensure consistency and complementarities among different public and private initiatives. These meetings will be called and led by SENER. The PAC will meet at least once before the Ministries and other government entities submit their annual budgetary programs for approval of SHCP and the Congress.

d. State Project Implementation Committees (SPICs). The SPICs will be responsible for project planning, programming and implementation at the State Level with a representative from SENER participating on behalf of the Federal government. These committees will be integrated by a Project Manager, a Technical Unit and an Administrative, Financial and Procurement Unit (AFPU). The SPICs will be responsible for (a) reaching out to municipal and community leaders and for promoting a constructive dialogue among different key stakeholders, (b) programming annual electrification works (e.g., selecting sub-projects, conducting technical studies, carrying out public consultations at the community level), (c) bidding packages for regional service provision, and (d) monitoring service quality and overall project performance. The SPICs will work in coordination with CFE, FIRCO, and CDI networks of extension agents, technical experts and social specialists.

e. Project Monitoring Committee (PMC). The PMC will be presided by the Ministry of Energy (SENER) through the PPMT and integrated by representatives of CRE (Energy Regulatory Commission), SEMARNAT (Ministry of Environment), SEDESOL (Secretariat of Social Development), CDI (Indigenous People Development Commission), and CFE (Federal Electricity Commission). At the Federal level, the PMC will monitor Project targets and performance and review the results of Impact Evaluation Assessments. At the State level, mainly with the support of CFE, CDI and SEMARNAT's regional offices, the PMC will monitor Project efficiency and performance based on pre-specified targets and quality indicators.

49. SENER has entered into agreements with four government institutions that are considered key to the successful development of the Project: (a) the Indigenous People Development Commission (CDI), (b) the Federal Electricity Commission (CFE), c) the Secretariat of Social Development (SEDESOL) and (d) the FIRCO agency (Ministry of Agriculture). These four institutions have built efficient networks of social and technical specialists across the country and targeted States. The Project will take off and evolve with support of these four networks, taking advantage of their reputation and experience.

50. In particular, the Project will rely on the FIRCO experience, building upon its platform of equipment suppliers, promoting the transition to service provision and the participation of energy service companies. The Project will contribute to strengthen the FIRCO organizational structure through involvement of its network of qualified technicians in the works, capacity building and monitoring activities.

3. Monitoring and Evaluation of Outcomes/Results

51. Direct project output indicators will be measured and reported semi-annually by the PMC. The Project will implement a comprehensive monitoring and evaluation program consistent with Bank and GEF guidelines and requirements for measurement and evaluation. During the first year of project implementation, SENER will undertake a comprehensive survey to characterize the market in the Southern States and define the baseline for key social and economic variables. The design of the survey will have the input of the Bank's impact evaluation team (PRIME).

52. Project monitoring gives ongoing information on the direction of change, the pace of change and the magnitude of change. All these are critical to knowing whether the Project is moving in the right direction. Program monitoring, however, does not provide the basis for determining whether the observed changes in specific outcome indicators are the direct consequence of the project, such as income generation to project beneficiaries. The Project will therefore implement an impact evaluation over the period of implementation and if possible beyond. The main purpose of an impact evaluation study is to provide convincing and reliable evidence that the changes observed in key indicators are a consequence of the project and not of other factors. The PPMT will launch and supervise the Impact Evaluation Assessment the third and last years of project implementation (see Annex 17 for a methodological description and its application to the Project).

4. Sustainability and Replicability

a. Sustainability.

53. Project sustainability will be ensured through:

- The promotion of a project organizational structure that systematically fosters more sustainable capacity development and local ownership through greater use of, and support for, existing systems and institutions, while ensuring timely project implementation and disbursement.
- The streamlining of various government initiatives that target rural electrification and rural infrastructure development, as it is planned that through one or more of these initiatives the Federal Government will contribute to the co-financing of the program in the long term (i.e., fully substituting the GEF/IBRD resources by 2012).

- The provision of service delivery models and market mechanisms designed to promote synergies between "external" (e.g., ESCOs, equipment suppliers, public utility, NGOs) and "internal" service providers (e.g., community organizations, local cooperatives, individuals, private companies) consistent with their real capabilities and interests.

54. The sustainability of sub-projects, on the other hand, will be ensured through: (a) the implementation of service delivery models based on medium-term build, operate, train and transfer (BOTT) service contracts with output based subsidies, (b) strong emphasis on continuous community participation, consumer education and training,[11] (c) the service will be operated as a business (i.e., revenues will be sufficient to recover capital investments, service debt, pay for administrative systems, pricing and repayment arrangements captures households' capacity and willingness to pay), and (d) property rights or ownership of the equipment will be transferred to the communities.

55. In addition to impact evaluation assessments, the Project includes annual evaluations of Project design and performance which will allow for adjustment and improvements of the various elements driving the service delivery (e.g., bidding conditions and contracting, capacity building and training needs, ensuring that the appropriate incentives to various participant stakeholders are in place and aligned).

56. With respect to financial sustainability, the project will be co-financed by Federal, State and Municipal resources. In the period 2007-2012, resources provided by the Federal government (one third) will come from the IBRD loan and the GEF grant. Following the demonstration of the rural electrification model through the pilot project, the Federal contribution is expected to be substituted with resources from other active programs targeting rural electrification (e.g., the Micro-regions Program, being led by SEDESOL, the PIBAI Program being led by CDI). SENER, the implementing agency, is seeking letters of intent to confirm possible future commitments from these institutions. SEDESOL for instance has formally agreed to provide additional resources to complement the Municipal contribution to the development of rural electrification projects and to promote good practices at the community level. The remaining two thirds of the government support will be supplied by the States and Municipalities (through *Ramo 33*, which represents a predictable and reliable financial source for subsidies after the end of the project).[12]

57. Operation and maintenance costs as well as a pre-determined percentage of capital costs (most likely 20 percent) will be paid by the beneficiaries; these expenses are equal to or lower than the household's capacity to pay for energy services (see Annex 9 for a detailed economic and financial analysis).

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[11] Social sustainability is ensured through a demand driven approach with emphasis on local participation, training and consultation with communities, and dissemination campaigns in the different languages of targeted indigenous people.

[12] For Oaxaca, Veracruz and Guerrero resources for co-financing the first year of the project implementation (2007) have already been allocated in their annual budgetary programs.

TABLE 2. SUSTAINABILITY OF CO-FINANCING COMMITMENTS			
Levels	**First Year Implementation 2007**	**Remaining 4 Years 2008-2011**	**After the Project 2012 onwards**
Federal	• Contribution comes from IBRD loan and GEF grant (1)	• Contribution comes from IBRD loan and GEF grant (1)	• Contribution comes from other government programs * Letters of Intent will be sought
State	• Co-Financing already allocated in State Budgets	• This is an annual exercise * State Government issue formal letters of intent regarding future commitments to the program	• This is an annual exercise
Municipal	• Localities benefited will be chosen randomly every year among municipalities willing to co-finance the projects • SEDESOL will complement Municipal co-financing	• Localities benefited will be chosen randomly every year among municipalities willing to co-finance the projects • SEDESOL will complement Municipal co-financing	• Localities benefited will be chosen randomly every year among municipalities willing to co-finance the projects
Private	• SHS will require a down payment and possibly a micro-loan • Private participation expected in micro-hydro projects	• SHS will require a down payment and possibly a micro-loan • Private participation expected in micro-hydro projects	• SHS will require a down payment and possibly a micro-loan • Private participation expected in micro-hydro projects
Note (1) The GEF grant is utilized on a declining scale.			

b. Replicability.

58. The Project will target less than 6 percent of the 4,692 communities in the Southern States whose primary electrification alternative is an off-grid technological solution. The Project has, therefore, a significant potential for replication in the remaining 94 percent of un-electrified communities and in other States of Mexico. To a large extent, the replicability of the Project depends on several factors. The first factor is the sustainability and robustness of the institutional structure in charge of implementation and follow up (PAC, PMC, PPMT, SPICs). A key challenge during the implementation of the Project will be to streamline the functions of various government institutions already involved in rural electrification. The proposed technical assistance and capacity building activities will play an essential role in streamlining the focus and improving the knowledge on different electrification alternatives. The second factor is the success of the service delivery models applied and the mechanisms to mobilize additional funds. While a degree of flexibility and adaptability over time is to be expected, the Project will seek to trigger synergies between "external" and "internal" service providers. In this case, the replicability depends on the effectiveness of incentives to attract the "external" investors and service providers (i.e., private sector, ESCOs, NGOs) and the success of the transfer to "internal" agents (e.g., municipalities, communities). Ultimately however, replication will depend on: (a) long-term public support mechanisms, and (b) the long-term impact of the capacity building measures.

5. Critical Risks and Possible Controversial Aspects

59. The Project does not present any controversial aspects. The risks and related mitigation measures are set out in the table below.

Risks	Risk Mitigation Measures	Rating
Lack of commitment and/or coordination among government institutions	The organizational structure associated with project implementation includes the participation of key government institutions (NAFIN, SENER, CDI, CFE, SAGARPA (FIRCO)). During project preparation the roles, functions and commitments of different institutions were formalized through inter-institutional agreements (*convenios de cooperacion*). SENER has re-confirmed previous inter-institutional agreements, to clearly establish definition of functions and commitments. SPICs are structured and have already initiated functions (i.e., identification and selection of sub-projects for first year of implementation has already been carried out).	L
Electrification rate results lower than expected due to either a lack of prepared sub-projects or saturation within SPICs	The proposed service delivery models will target packages of sub-projects (regional) in order to reach more projects and reap the benefits of scale. Under the supervision of the PPMT and with the support of CDI, SEDESOL, FIRCO and CFE, SPICs will plan, prioritize and select sub-projects based on GIS, planning tools and technical manuals. In addition, the Project will prioritize the communities that are already demanding the service (hundreds in each State).	L
Low technical quality of installations	Through technical assistance (Component 1) the Project will support the development of regulatory measures, standards and manuals to ensure minimum quality levels in technical installations and service delivery practices. Project design places special emphasis on continuous capacity building to both external and internal agents in charge of sub-project implementation (e.g., BOTT contracts). The Project will also introduce a mechanism for technology and service provider certification and pre-qualification. Throughout implementation, CFE will closely supervise the technical quality of service delivery and sub-project sustainability.	L
Failure to create appropriate incentives to attract external agents to remote rural areas	The rural energy services in the Project will be bundled such that they will be attractive to service providers. In addition, the proposed service delivery models will seek to trigger synergies between the so called "external" and "internal" agents (i.e., promote the creation of "strategic partnerships"). In its first stage, the Project will develop a detailed design of incentives for the preparation of bidding documents. Every year, the performance of service delivery activities will be evaluated and, if necessary, adjusted.	S
Low appetite from private providers	The design of the proposed service delivery models and types of incentives under consideration have been validated through a limited survey that included interviews with the top 15 equipment suppliers and ESCOs operating in Mexico (report by consultant E. Villagran is included in the Project Files). The results of the survey confirmed the interest of all companies in participating in the bidding processes and their agreement with and input to the overall design of service provision scheme.	M

Risks	Risk Mitigation Measures	Rating
Rejection of off-grid electrification solutions by rural indigenous communities	The process of selection of sub-projects follows a demand driven approach. Only communities that want to be electrified and accept rural distributed solutions will be targeted. The Project will place special emphasis on promoting information campaigns, demonstrative mobile vehicles / modules, road shows and public/social consultation.	M
Conflicts among communities for internal reasons or even for reasons external to the sub-projects	The Project will implement a consultation and conflict resolution mechanism to minimize this risk and resolve potential conflicts between stakeholders, stakeholders and communities, and/or between communities. In principle however, the project will not authorize the installation of electrification projects where there are unresolved disputes with the potential to seriously affect project execution. Disputes concerning agrarian, religious or political matters are among those that could condition or restrict the execution of works.	M
Lack of commitment by Municipalities resulting from Program inability to mobilize their co-financing share	The Project is designed to continuously promote the participation and capacity building of municipal authorities. The eligibility criteria for the selection of sub-projects will require the approval and co-financing by Municipalities.	M
Overall Rating		**M**

H: High; S: Substantial, M: Moderate, L: Low

6. Loan/Grant Conditions and Covenants

60. a. Conditions of Effectiveness

- The GEF Grant Agreement has been executed and delivered and all conditions precedent to its effectiveness or to the right of GoM to make withdrawals under it (other than the effectiveness of this Agreement) have been fulfilled.

- The *Contrato de Mandato* has been entered into by the parties thereto and is in effect.

61. b. Covenants applicable to project implementation:

(a) GoM, through SHCP and SENER, shall enter into a contract (*Contrato de Mandato*) with NAFIN, satisfactory to the Bank, whereby NAFIN agrees to act as executing agency for the Project and as financial agent of GoM with regard to the Loan.

(b) GoM shall exercise its rights and carry out its obligations under the *Contrato de Mandato* in such a manner as to protect the interests of the Bank and to accomplish the purposes of the Loan, all with the appropriate due diligence and efficiency for the benefit of the Project.

62. SENER shall cause NAFIN (pursuant to the *Contrato de Mandato) to* establish and maintain throughout the implementation of the Project a Federal Implementation Team (FIT), to carry out the implementation of GoM's rural electrification program. The

FIT shall be comprised of a project manager, a technical unit and an administrative unit, all with staffing, functions and qualifications acceptable to the Bank.

63. SENER shall cause NAFIN (pursuant to *Contrato de Mandato*) to establish and maintain throughout the implementation of the Project a Project Advisory and Monitoring Committee (PAMC) comprised of relevant project related representatives as deemed necessary by SENER.

64. GoM through SENER shall cause the Selected States to establish and maintain throughout the implementation of the Project the State Implementation Teams (SITs) to assist SENER in the implementation of the Project at the state level.

D. APPRAISAL SUMMARY

1. Economic and Financial Analysis

65. This section summarizes the results of the economic analysis for the project focusing on the costs and benefits of providing electricity to households using photovoltaic (PV) systems, which is the main focus of the project. Together with wind home systems, which are economically and financially similar to SHS, these technologies would account for 85 percent of the total households to be served (i.e.; 75% of targeted households would be served with SHSs and 10% with WHSs). The shares of other renewable energy technologies considered in the project--biomass, microhydro, diesel-hybrid systems -- are individually small. Further, their costs tend to be site specific and their benefits depend, in part, upon commercial sales of electricity. This analysis is therefore based on solar home systems.

66. The solution of using PV systems to supply electricity to populations in remote areas targeted by the Project is, from an economic perspective, the least-cost supply option based on an economic-engineering analysis performed by the Mexican Institute of Electrical Research (*Division de Energias Alternas*).[13] Bank work on rural electrification of isolated communities in other countries is consistent with the Mexican findings.

67. This analysis draws on real data regarding the expected costs of providing PV systems to households located in the Southern States, based on surveys and quotes by PV systems suppliers in Mexico. The estimates on the benefits are based on official statistical data from household surveys available and field surveys conducted in communities located in the States targeted for project implementation.[14]

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[13] Source: IIE. December 2005. In-depth Analysis of Case Studies and Potential Projects for Rural Electrification in the Southern States, GVEP Report. See Appendix III on "Non Electrified Communities and Comparison of Energy Levelized Costs"

[14] National Income and Expenditures Survey, ENIGH, INEGI 2005, field data from public consultations with communities (reports available in the Project Files).

68. The economic benefits have two components: (i) the avoided costs for lighting and batteries (dry cells and rechargeable car-batteries) that households will not incur when the PV systems are installed, and (ii) the consumer surplus resulting from the increased consumption at lower per unit prices.

69. It should be noted that the calculated household economic rate of return (ERR) does not include the broad range of important, additional direct and indirect benefits from rural electrification. These additional benefits include, among others, the following:[15] increases in consumer surplus from information and communication technologies (TV, radio and cell phones where signal exists); avoidance of burn injuries and fires; benefit to families with higher levels of educational possibilities; time savings for household chores; benefits of earning higher levels of family income as the availability of good quality lighting extends the potentially productive hours of people; health benefits (through decreased indoor kerosene and diesel use which cause indoor pollution and burns) and improves service in health stations (emergency lights; vaccines); social benefits to the community (street light increasing safety and allowing women to participate in community life at night); multiplier effects on local and national level from replication of the successful pilot sites; and synergy effects from bundling services.

70. All these additional benefits have not been counted towards total net benefits so the resulting ERR and NPV results can be considered conservative. The benefits that will be generated by the Project stem from households, micro-enterprises and social uses 'stepping up the energy ladder' by substituting electricity for traditional energy (improving service quality and unit costs). Rural users currently mainly use kerosene, diesel, and batteries for lighting and radio/TVs, plus diesel generators in few cases (all assumptions based on data from household surveys).

71. With regards to the costs of PV panels, a recent market assessment conducted in Mexico determined that the costs of PV panels vary between 6.90 and 8.50 US$/watt peak (before taxes).[16] These prices are much higher than in Germany, Spain, Japan and USA, where average prices are estimated in 5.45, 5.60, 5.35 and 5.20 respectively. According to the analysis the reason for the high costs is associated with sales volumes and the limitations of provision lines or logistics. The Implementation Completion and Results Report (ICR) of the FIRCO Project on the other hand, attributes the high costs of PVs in Mexico – which have tended to increase over the last three years- to the strong demand for this technology in Europe.[17]

72. Based on the economic analysis, the solar home systems (SHS) component of the Project shows high economic returns. Under relatively conservative assumptions, the ERR for the total SHS component is about 40 percent, with an economic net present

[15] This section based on the World Bank's Bolivia Decentralized Infrastructure for Rural Transformation project where a more comprehensive list and additional references of such benefits are available

[16] National Association Solar Energy (ANES-Mexico); May 2006. Estudio de Mercado de las Fuentes de Energia Renovable en el Sector Agropecuario. A report sponsored by FIRCO. These prices have been confirmed with various equipment suppliers in Mexico.

[17] Implementation Completion and Results Report (MULT-23251), Renewable Energy for Agriculture Project, November 31, 2006.

value of about 805 million pesos (about US$ 73 Million), reflecting a significant improvement in the quality of lighting and battery services using PV systems in households. The economic returns of the SHS component are robust, and risks are considered minor.

73. Such high benefits are consistent with those estimated in other countries for similar projects (e.g., 30 percent ERR as estimated by the ICRs for a similar project component in India, and 43 percent for the SHS component of the Sri Lanka Energy Services Delivery Project, while a similar analysis for the Bolivia Decentralized Infrastructure for Rural Transformation project yielded about 30 percent). These benefits reflect the high willingness to pay and considerable net consumer surplus from improved levels of lighting service.

74. The Project will achieve a significant improvement in the current situation regarding energy quality, energy cost, service reliability, and sustainability. SHS allow for a level of service that is far superior to existing solutions to basic needs in non-electrified households (e.g., lighting, radio, TV). A large majority of rural households are low-intensity consumers, using less than 10 kWh per month. This level of service is consistent with the power available from SHS, when used in conjunction with compact fluorescent lamps (CFLs).

75. Given that the Project is supporting the implementation of a social program led by the GOM that subsidizes to a large extent the provision of a basic infrastructure service for poor rural communities, the analysis in only focused on the economic costs and social benefits associated to the service. In this case, there is no need to assess the "profitability" of the program and conduct a financial analysis.

2. Technical

76. The main technological options considered under the program include: (a) photovoltaic systems serving a single customer, customer clusters or community center (e.g., hospital, school, other) and (b) wind generators serving a single customer, customer clusters or community center. It is expected that these two types of technologies will be the most appropriate solution for about 85 percent of households targeted under the project.[18] The program will also consider other options on a pilot basis including: (c) isolated grids powered by a small hydroelectric plant, (d) isolated grids powered by a diesel plant,[19] (e) isolated grids powered by biomass generators, (f) battery charging stations powered by any of the above technological options and (g) combinations of (a) through (f). Additionally, the Project includes the installation of a limited number of efficient wood stoves in rural households.

[18] This conclusion is based on a least-cost modeling exercise conducted by the Institute of Electrical Research (IIE-Mexico) in 2005 (an initiative financed by the Global Village Energy Partnership, GVEP).
[19] GEF support will only be available for renewable energy options.

77. The Project will support the country in updating and developing regulatory measures, standards and manuals to ensure minimum quality levels in technical installations for the different technological arrangements that represent a solution for off-grid rural electrification.[20] The detailed technical description of the type of sub-projects under consideration is given in Annex 10.

78. *Sub-project selection and Impact Evaluation:* The process for the selection of sub-projects is based on a community demand driven approach. Proposed sub-projects will be considered eligible if they meet all of the following conditions: (i) community is included in the official data base or universe of localities that meet the criteria for off-grid projects in the targeted States,[21] (ii) targeted localities or beneficiaries express interest and/or demand for off-grid electrification services, (iii) evidence of public consultation and initial acceptance or demand by community leaders and participatory committees (*Asamblea Participativa*), (iv) households are willing to assume O&M responsibilities including payments and sub-projects meet least-cost economic considerations, and (v) full compliance with country and World Bank social and environmental safeguard policies.

79. Sub-projects for year n+1 will then be selected randomly in order to carry out a formal impact evaluation assessment as explained in Annex 17.

3. Fiduciary

Financial Management

80. The Bank has carried out a Financial Management Assessment (FMA), which involved ensuring that the project design allows for an appropriate level of transparency that facilitates oversight and control while also supporting smooth implementation. The purpose of the FMA was to assess the proposed FM arrangements to identify any weaknesses and to assess the risks these pose. The regional FM team (LCSFM) provided advice to the SENER, NAFIN and the participating states (Guerrero, Oaxaca and Veracruz, in the first phase) on the design of appropriate FM arrangements.

81. Based on the results of the FMA, LCSFM has concluded the following:

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[20] In particular, the Federal Electricity Commission (CFE) and the Institute of Electrical Research (IIE) developed in 1998 technical specifications for photovoltaic systems and electrochemical batteries for applications in rural electrification to ensure minimum technical quality standards. The FIRCO project has also advanced in this front. For the installation of micro-hydros, wind based, diesel based, biomass and hybrid projects the country has not developed technical specifications and/or manuals for appropriate design, installation and sustainability.

[21] The criteria includes: localities of 50 to 2500 inhabitants with no electricity service that are located more than 10 Km away from the grid and that will not be electrified with a grid extension in at least 5 years. Every targeted State will validate the official Data Base or Universe of eligible communities with the Federal Electricity Commission (CFE). CFE will apply criteria for decision making regarding grid extensions based on a maximum cost per connection (e.g., US$ 1000 per connection).

(i) NAFIN and the participating states have indirect experience with Bank projects (acquired from the decentralized projects that the States are currently implementing) and ample with the types of activities to be carried out in this operation, and have also institutional capacities acceptable to the Bank;
(ii) NAFIN will provide implementation support and oversight based on its many years of experience as both financial agent and implementing entity. NAFIN's record to date on financial management matters has been satisfactory to the Bank; and
(iii) NAFIN and the participating states are implementing strengthening actions which will be in place prior to launching the Bank–financed project, including written procedures, reporting formats, auditing and allocation of new responsibilities to staff in NAFIN and in the participating states.

82. The written procedures and reporting formats will reflect the simplifications proposed in the Financial Management/Disbursements section of the Bank's Review of Country Systems in Mexico, which was delivered to the Federal government in July 2005.

83. Overall FM risk for the proposed project is **Substantial** (S). It is expected that all identified risks will be mitigated through:

(i) establishment of all needed agreements (including the agreement with CDI to ensure project's counterpart funding);
(ii) capacity building during project implementation; and
(iii) permanent supervision that SENER and NAFIN will carry out to the participating States.

84. All identified risks will be monitored (and mitigated) in a structured manner throughout the life of the proposed project.

85. Due to change in government administration, the FM team has carried out additional work during and after the pre-appraisal mission which confirmed previous agreements and complemented the assessment.

Procurement Capacity Assessment

86. It has been determined that SENER does not have the structure and organization to handle procurement operations. For this reason SHCP has designated NAFIN as the project executing agency in charge of resources administration and procurement. NAFIN has the necessary experience and capacity to undertake the procurement responsibilities associated with the execution and implementation of the project.

87. At the State level, designated agencies for undertaking procurement responsibilities exhibit an average risk. For instance, the designated agency in Oaxaca (IVO) would need to hire staff to carry out procurement responsibilities. Other designated

agencies would only require certain level of capacity building (e.g., SEDESOL in Veracruz).

88. Capacity building activities will be extremely necessary at the State level to ensure an appropriate and smooth program implementation. The project costs have included these activities under sub-components 3 and 5 (see Annex 5),

89. Generic procurement plans for the works, goods and services contemplated under the Project have already been developed. These will be reviewed with designated procurement units at the Federal and State levels. The procurement capacity assessment and review of procurement plans were finalized during the pre-appraisal mission.

4. Social

90. The Project is focused on rural development. As the majority of people living in the communities targeted are indigenous, the Project is considered an indigenous people development initiative.[22] In preparation for the Project SENER, in coordination with the governments of targeted States and Municipalities, has undertaken a systematic social assessment that includes:

- A comprehensive analysis of the social context and the applicable legal and institutional framework.
- Baseline information (demographic, social, cultural, political, and other).
- A review of stakeholder dynamics (including institutions).
- A structured consultation to assess the potential positive and negative effects derived from the Project and to identify preventing or mitigating measures.

91. The Project has implemented the level of social consultation necessary to ensure the success of the implementation with a strong focus on community participation.

92. In general terms no negative social impacts are expected from the Project. Rather, there will be highly likely numerous positive social effects resulting from the project, mainly access to electricity, which facilitates improvements in education, health, household economics, community development.

93. The main potential negative expected impact may be the possibility of conflicts between stakeholders, the community and stakeholders or among communities. To avoid this, an appropriate conflict resolution mechanism will be designed and implemented. In principle however, the Project will not authorize the installation of off-grid electrification projects where there are unresolved disputes with the potential to seriously affect project execution. Disputes concerning agrarian, religious or political matters are among those that can condition or restrict the execution of works.

[22] Hence, no separate Indigenous People Development Plan (IPDP) is required.

94. In addition, the following assessments and activities have been carried out for compliance with O.P. 4.10:

- Framework for ensuring a free, prior, informed consultation with potential beneficiaries during project implementation.
- An action plan of measures to ensure that the indigenous peoples receive appropriate social and economic benefits.

95. Annex 10 present a detailed description of the social aspects of the Project, the results of the social assessment and a summary of IP framework and action plan.

5. Environment

96. Environmental impacts of the Project are expected to be minimal given the type of planned interventions. The Project considers the construction of small scale renewable energy systems, predominantly photovoltaic and wind home systems (85 percent of households targeted under the program). Other types of systems may also be contemplated, including pico and micro-hydros (3-5 percent of targeted households), and, whenever possible, other types of small scale systems based on biomass, diesel or diesel-RET hybrid systems.

97. These systems are not expected to produce major negative environmental impacts. Rather they have the potential to reduce the impact of energy use vis-à-vis use of traditional (notably diesel or wood-based) small-scale energy use:

- global environmental impacts are likely to be reduced due to the low or zero CO_2 emissions from the technologies applied; and

- local environmental impacts are likely to be reduced due to the fact that the proposed technologies have low or even zero health-threatening local pollutants (indoor pollution being a major health risk in the communities concerned) and reduce the risk of fires inside the household, among other benefits.

98. The following table lists some of the key potential impacts of several key technologies (or systems complementing certain technologies, for example, in the case of mini-grids) of the Project, and appropriate mitigation measures to be applied:

Technology	Potential Impact	Prevention / Mitigation Measure
PVs	Pollution from inappropriate battery disposal.	Adequate collection and disposal.
Community mini-grids	Potential limited impacts by mini-grids crossing natural habitats.	Guidelines to minimize impact on natural habitats, such as through appropriate and low-impact sitting of grid poles.
Hybrid systems involving diesel	Potential fuel spills	System containing potential spillage – for example using mini-dikes or impermeable construction materials or lines
Pico / Micro-hydro	Possibility of minimum impacts on water resources availability / ecological flow	Capacity, location and design will consider the engineering parameters necessary to avoid and minimize impacts
Biomass	Depends very much on the type	See Annex 10

99. The Project will only support sub-projects whose potential environmental impacts are minimal or within the parameters of a Category B project.

100. These measures are detailed further in the Project's operational manual, which presents the project's environmental management framework, to ensure that both the national environmental regulatory framework and the Bank's safeguard policies are observed.

101. The environmental management framework of the Project will also address the institutional environmental management responsibilities and capacities, and has set forth enhancement provisions as needed to ensure that participating institutions have the capacity to address any environmental impacts associated with the project.

6. Safeguard Policies

The Project has been categorized as "B".

Safeguard Policies Triggered by the Project	Yes	No
Environmental Assessment (OP/BP/GP 4.01)	[X]	[ ]
Natural Habitats (OP/BP 4.04)	[X]	[ ]
Pest Management (OP 4.09)	[ ]	[X]
Cultural Property (OPN 11.03, being revised as OP 4.11)	[X]	[ ]
Involuntary Resettlement (OP/BP 4.12)	[ ]	[X]
Indigenous Peoples (OD 4.20, being revised as OP 4.10)	[X]	[ ]
Forests (OP/BP 4.36)	[X]	[ ]
Safety of Dams (OP/BP 4.37)	[ ]	[X]
Projects in Disputed Areas (OP/BP/GP 7.60)*	[ ]	[X]
Projects on International Waterways (OP/BP/GP 7.50)	[ ]	[X]

*By supporting the proposed project, the Bank does not intend to prejudice the final determination of the parties' claims on the disputed areas

Environmental Assessment: An Environmental Management Framework (EMF), including a Social Action Plan, is included in the Project's Operational Manual.

Natural Habitats: In general, no major impacts on natural habitats are expected since 95 percent of the program is focused on stand alone small systems (connected at the household). For the particular case of pico and mini-hydro, impacts on natural habitats, if any, are also expected to be minor (for instance, no dams are expected in the construction of these plants). The program also contemplates the possibility of introducing mini-grids; these are generally installed between households inside the communities, for which no large segments of distribution lines crossing natural areas –or areas not previously intervened- are expected.

Cultural Property: This policy has been triggered given that the targeted areas have a wealth of cultural assets, such as historical and archeological sites officially recognized. The EMF includes guidelines on chance finding procedures to avoid any potential impacts on cultural property (especially during the construction of pico or mini-hydro).

Indigenous Peoples: At least 60 percent of the targeted beneficiaries are indigenous peoples. The Project has conducted a social assessment and will implement a framework for public consultations as well as an action plan in order to fully comply with O.P. 4.10.

Forests: The forests policy has been triggered given that forests are abundant in the target localities (the criterion for triggering the Forests Policy is whenever a project has the "potential" to produce impacts on the health and quality of forests). The only potential impact from the project on forests might result from the installation of mini-grids, and even there only minimal impacts are expected.

7. Policy Exceptions and Readiness

102. The operation complies with all applicable Bank policies. Indicators of project readiness include: (a) completion of the Project Operations Manual, (b) completion of the EMF, and (c) agreement on a procurement plan.

Annex 1. Country and Sector Background

This annex is organized as follows:

A) Background
B) Structural, Programmatic and Fiscal Approach to Rural Electrification in Mexico
C) Effect of Decentralization Policies on Rural Electrification Programs
D) Legal and Regulatory Frameworks
E) Electricity Tariffs and Subsidies
F) Barriers to Off-grid Electrification with Renewable Energy
G) Lessons Learned with Previous Rural Electrification Projects in Mexico
H) Renewable Energy in the Development of Social and Productive Activities
I) The Importance of Remittances

A) Background

1. According to the last population census (INEGI, 2005), Mexico had already achieved an electrification coverage of 96.6 percent, serving approximately all but 3.5 million of the 103 million population. These 3.5 million people represents about 812,000 households concentrated in small communities, the majority under 500 people.

2. Electrifying the remaining households is challenging, since the majority of them are found in small, remote, isolated communities. Further, the unelectrified population is expected to increase by 20 percent through population growth over the next decade.[23] About 60 percent of the people with no electricity are of indigenous adscription. Typically, these communities also lack other basic infrastructure services such as roads, water, telecommunications, education and health.

3. In 2000, the Government of Mexico (GoM) expressed its commitment to increase the national electrification coverage and established the goal to implement a national rural electrification program based on renewable energy (Energy Sector Program, PROSENER 2001-2006). During that period however, no national rural electrification program was set in place to provide economically efficient and sustainable solutions, mainly due to a number of institutional, programmatic and fiscal constraints.

4. The new government administration at the Ministry of Energy (2007-2012) has expressed its interest in implementing such a program, which will be part of the sector strategic platform for the energy sector starting in 2007. On December 1, 2006, President Felipe Calderon launched the "Program of 100 Priority Actions" listing rural electrification as priority number 37:

> " 37. Electrification to remote communities: The government will implement a program to electrify remote communities with technologies based on renewable energy, using local natural resources in a sustainable way"

[23] Considering an average population growth in these communities of 1.9 percent (INEGI, 2000).

5. President Felipe Calderon has also emphasized the commitment of the new administration to target the 100 Municipalities with the highest degree of poverty (i.e., lowest human development index), the majority of which are located in the same Southern States of Mexico.

B) Structural, Programmatic and Fiscal Approach to Rural Electrification in Mexico

6. From 1952 - before the nationalization of the electricity sector in 1960 - and up until 1996, the Federal Electricity Commission (CFE) was in charge of the planning, programming and execution of rural electrification works at the national level. Between 1970 and 1996 the electricity coverage rose from 61.2 percent to 94.7 percent. This succesful program was mainly based on the expansion and integration of the national interconnected system (SIN) at competitive costs. As the program developed, the CFE evolved into a large utility with a network of highly qualified regional offices across the country.

7. During the 1970s, 1980s and beginning of the 1990s CFE made a few attempts to use renewable energy to expand the electricity coverage to remote and isolated localities[24]. Despite the fact that none of these were particularly successful, many lessons were learned.

8. The first institutionalized attempt in this direction was conducted in the early 1970s under the **Tonatiuh program** (the aztec name for the Sun-God). The program was aimed at scaling the application of water pumps powered by solar heat from flat-plate solar collectors. A number of barriers, both technical and non-technical, brought the program to a premature end, reaching only 1 percent of the total number of installed systems targeted (IIE, 2005).

9. The second attempt, the **Sontlan program** (named after the German word *sonne*, sun, and the aztec work *tlan*, town) was focused on solar powered air conditioning for multi-story apartment builings located in high insolation areas (City of Mexicali, Northwest of Mexico). A multi-million investment was jointly made by the German and Mexican governments to implement "Sontlan", under the premise that the results would serve as a demonstration model for replication. However, the program halted at the proof-of-concept phase primarily due to a lack of community involvement. Program development and replication never took place (IIE, 2005).

10. During the 1980s and 1990s, the GoM invested an important amount of resources under the **Pronasol and Progresa Programs** on the installation of photovoltaics (about 40,000 under the pronasol program) –and other types of off-grid solutions- to electrify rural households, communal installations, hospitals and schools. The success of these initiatives was limited, mainly due to the lack of provisions to ensure the sustainability of service delivery and the variying degrees of equipment reliability and efficacy. None of

[24] See Institute of Electrical Research (IIE). 2005. In-depth Analysis of Cases Studies: Rural Electrification in Mexico" GVEP financed study. The report is included in the Project files in IRIS.

these programs implemented a monitoring or evaluation system, so information regarding their performance is not available (IIE, 2005). To a large extent, these programs have negatively affected the perception of rural communities towards the efficiency of off-grid renewable source based technologies.As a centralized public utility, the CFE has a mutual interdependence with Treasury (SHCP). All investments and expenditures have to be approved annually by SHCP and the Congress. CFE pays "dividends" to Treasury (*aprovechamientos*) while Treasury pays CFE the electricity subsidies (which mainly benefit residential and agricultural consumers).

C) Effect of Decentralization Policies on Rural Electrification Programs

11. In 1996 the Federal Government and the Congress agreed to strengthen the political, programmatic and fiscal power of Muncipalities with the intention of supporting a *bottom up* approach to the development of social services and infrastructure. The focus was on *empowering* communities, allowing them to decide how to grow and develop.

12. The decentralization policies of 1996 effectively transferred the administration of federal resources for social infrastructure development from the central government to the States and Municipalities. As part of the fiscal decentralization the government created a budgetary brand -*Ramo 33*- for annual distribution among States and Municipalities based on allocation rules that considered key social indexes such as "marginalization", poverty, human development, infrastructure development and other.[25]

13. As a consequence, the programmatic and executing functions associated with the development of rural electrification were transferred from CFE directly to the Municipalities.

14. However, the decentralization and devolution of the financial and programmatic control to the States and Municipalities has not been accompanied by a parallel build-up of local capacity to identify electrification needs/uses and plan cost-effective solutions accordingly. Various studies based on a recent national municipal survey have concluded that the expenditure efficiency associated with *Ramo 33* is extremely low.[26]

15. The decentralization of social development funds has however promoted the co-participation of Federal, State and Municipalities entities in the development and co-financing of national programs designed at the Ministerial level. There are two national initiatives co-financed with Federal, State and Municipal resources that to some extent target rural electrification. These are described below:

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[25] Ramo 33 is composed by 7 funds which are earmarked for several types of purposes. Among these there is only one fund (known as FAIS) that targets social infrastructure development. FAIS must be used to invest in health, education, transport, water and electrification works among other.

[26] See Hernandez, Fausto 2004. *Analisis de Aportaciones Federales para Infraestructura* for an in-depth analysis of Ramo 33. See also Diaz Cayeros, Silva Castaneda 2004. *Decentralizacion a Escala Municipal en Mexico: la Inversion en Infraestructura Social*, CEPAL, UN. Both reports are included in the Project Files in IRIS.

- The **Micro-Regions Strategy** is a poverty reduction national strategy that promotes inter-institutional coordination and the participation of Federal, State and Municipal entities for the co-financing of works and social infrastructure (through annual legal agreements). The strategy is focused on the development of community centers or *development poles* with the potential to serve a number of disperse communities (micro-region). The Micro-Regions Strategy finances a number of "white flags" per micro-region every year (a "white flag" is defined as any work that involves water supply, sewage systems, roads, schools, housing improvent -concrete-based floors-, electrification, hospitals and other). The focus on electrification is however marginal. Only 3 percent of the total number of "white flags" have financed electrification initiatives (grid extensions, works conducted by CFE). The Micro-regions strategy seeks to motivate inhabitants to move to development poles (*cabeceras municipales*) to reduce dispersion and take advantage of economies of scale and scope.

- The **FIRCO** initiative (Fideicomiso de Riesgo Compartido), operates under the Ministry of Agriculture (SAGARPA) and is aimed at improving agricultural productivity through the introduction of new technologies and procedures. Over the last ten years, FIRCO has supported farmers in the installation of diesel, wind and solar powered water pumps to meet the electrical needs of their productive activities (farming activities including irrigation, fencing, water for cattle consumption and milk coolers).[27] FIRCO has been focused on regions where agricultural activities are concentrated. The FIRCO initiative has built a functional organizational structure in almost all States, with 43 qualified technicians operating within the SAGARPA State offices. FIRCO has also built the RET market attracting about 40 qualified equipment providers that still remain and are active in Mexico. The FIRCO experience has been succesful. Yet, with the cyclical availability of resources it faces the challenge of sustaining its functional network of technicians.

16. Additionally, the Indigenous People Development Commission (CDI) has recently launched the **PIBAI Program** (Basic Infrastructure Program for the Development of Indigenous People). This program targets large scale water, transport and electricity infrastructure. In electrification, the Program is almost only focused on grid extensions (works contracted directly to CFE). Contrary to the Micro-Regions Strategy, the PIBAI seeks to respect the culture, land and dispersion of indigenous communities. The program's philosophy does not rest on economic considerations but on social criteria.[28] The program has been 80 percent financed by Federal resources.

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[27] In 1994, FIRCO installed 195 PV systems for water pumping in the Northern States of Mexico. In 1999 the Ministry of Agriculture (SAGARPA) negotiated 8.9 MUSD with GEF for RET projects nationwide for agricultural productive activities. Later on, SAGARPA, through its program "Alianza para el Campo" channelled 31 USDM of additional resources towards the same end.

[28] CDI believes that indigenous communities have been historically excluded with regard to infrastructure development on the basis of lack of cost effectiveness.

17. With the decentralization of social development funds, an emerging model of development has attracted NGOs and equipment providers to the level of municipalities.

18. There is evidence of a few projects where the private sector and NGOs partnered to service communities.[29]

19. However, to some extent, the decentralization of social development funds resulted in the atomization of efforts and lack of programmatic focus associated with rural electrification. Despite the fact that CFE is still in charge of conducting the engineering and installation of transmission and distribution lines (or grid extensions), today it is only a contractor that functions under the –sometimes opposed- philosoply and development objectives of different programs.

20. Rural electrification under the PIBAI program is 100 percent financed by the State (i.e., there is no private participation). The Federal Electricity Commission (CFE, the State Electric Monopoly) works under a contract to extend the grid. Once the lines are installed they are managed and "owned" by CFE (i.e., become CFE's assets). In this case, CFE is in charge of the operation, maintenance and billing collection. Households are in charge of installing and paying the costs of connection (*tendido*).

21. The national average cost per connection in rural communities over the last four years has been in the order of US$ 2,400 per household. This value however varies depending on the State and the degree of dispersion and isolation of communities. In Oaxaca the average cost per connection has been reported by the Federal Electricity Commission in US$ 4,208 while Sonora and Nayarit have been electrified at about US$ 3,300 per connection (see Table 1.1 below). Effectively, the range has varied from about US$ 1,000 to US$ 4,200 USD per connection.[30]

[29] See for instance the Florida del Sur Case Study by FUNDENERG (a leading local NGO focused on the provision of integrated energy services) in the Project Files in IRIS.
[30] The average cost per connection in Latin America is in the order of 900 USD.

TABLE 1.1 AVERAGE COSTS PER CONNECTION UNDER PIBAI (Jan 2001-Sep 2005)

State	Investment (USD) (1)	Inhabitants (2)	USD/(HH) (3)	No. Rural Localities	No. Suburban Localities	Total Localities	% Rural Localities
Oaxaca	2,377,240	2,825	**4,208**	22	13	35	63
Sonora	5,537,110	8,170	**3,389**	28	5	33	85
Nayarit	16,311,920	24,862	**3,280**	32	20	52	62
Jalisco	15,312,090	38,868	**1,970**	51	57	108	47
Veracruz	30,684,860	103,255	**1,486**	441	209	650	68
Chiapas	28,324,950	95,815	**1,478**	141	61	202	70
Puebla	45,865,710	220,548	**1,040**	1250	94	1344	93
Guerrero	None	None	0	0	0	0	0

(1) Includes only poles and line extensions
(2) Includes both rural and semi-urban localities, the costs of electrifying semi-urban localities is much lower than the costs of electrifying rural localities, without information on number of inhabitants per locality (for both rural and semi-urban) it is not possible to estimate the real value of the cost per connection for rural localities. The values given in this column are therefore a minimum floor for costs of connection in rural communities.
(3) CFE assumes five people per household

Source: Comisión Federal de Electricidad (CFE), Subdirección de Distribución, Programa de Electrificación Rural: data from period January 2001-September 2005

D) Legal and Regulatory Frameworks

D.1) Description of Legal and Regulatory Frameworks

22. The Mexican constitutional and legal framework establishes that the State has the exclusive right to generate, conduct, transform, distribute and supply electricity as a "public service" (Article 27). In 1992 however the Electricity Law (Articles 3 and 36) was amended to allow private sector participation under different schemes including:

i. Self-supply, through co-generation, or small generation (under 20 MW for sale to CFE or under 1 MW for supply of remote communities)
ii. Generation of electricity by independent producers for exclusive sale to CFE,
iii. Generation for export sales to neighboring countries (from cogeneration, independent production or small generation),
iv. Electrical energy import by individuals or formally established entities for self-supply only and,
v. Generation for emergencies caused by interruption of public service.

23. Under the self-supply scheme, the Law explicitly considers small production for disperse rural communities in projects that do not exceed 1 MW and where the ownership is constituted by a rural committee, cooperative or a private-public partnership (the beneficiary has to be part of the society).[31] Under this scheme full ownership by the private sector is not allowed. The new enabling environment created under the Law of Public Electrical Energy Service (Electricity Law) has however created a nascent "self-

[31] Interested parties must constitute a rural committee, cooperative or civil society.

generators" market. Under such arrangements, municipal entities, rural cooperatives and private sector parties can purchase a share of a renewable energy project to qualify as "self-generators."[32] In a public-private partnership (PPP) the ownership is explicitly defined in a legal contract, and the legal framework is clear in this respect.

24. The Project will promote PPPs to maximize the participation and value added delivered by the private sector as well as to extend the reach of available public resources for improving social welfare.

25. For self-supply projects with capacities lower than 1 MW no explicit permit is required. For the case of hydroelectric projects of less than 0.5 MW, Article 80 the National Waters Law (*Ley de Aguas Nacionales, LAN*) states that it is not necessary to get a concession for the exploitation and use of National water bodies (as long as the exploitation of the water body does not deviate its curse and/or alter the quantity and quality of the stream).

D.2) Property Rights

26. The definition of property rights is not clear in the case of off-grid rural electrification projects financed with public resources (*Ramo 33*) and operating in remote isolated communities, explicitly serving households. Today there are no legal instruments or protocols established to transfer the property rights of systems to rural communities or families.

27. Back in the 1990s, when installing diesel based systems in remote rural communities CFE organized informal events for the transfer of property rights to community associations or *patronatos*. This is however no mentioning of this aspect in the legal or regulatory frameworks associated with social infrastructure development in general or with electricity provision in particular.

28. The Project will devote resources to the review and design of legal and regulatory instances focused on a more explicit definition of property rights.

E) Electricity Tariff and Subsidy

29. The tariff setting system of the Mexican electricity sector is extremely complex, with 112 different billing possibilities that draw from 7 basic tariffs, 2 seasons and 8 billing options by consumption level. Distribution of subsidies in the electricity sector amongst households with varying income levels is highly regressive –concentrated in deciles 6 to 9- as shown in Table 1.2 and Figures below.

[32] Profitable municipal projects such as landfill-to-gas-to-electricity initiatives (which operate under the self-supply scheme) function under property rights where the private sector participates with 99% and the municipality with 1%. In this electricity surplus can be sold to the CFE.

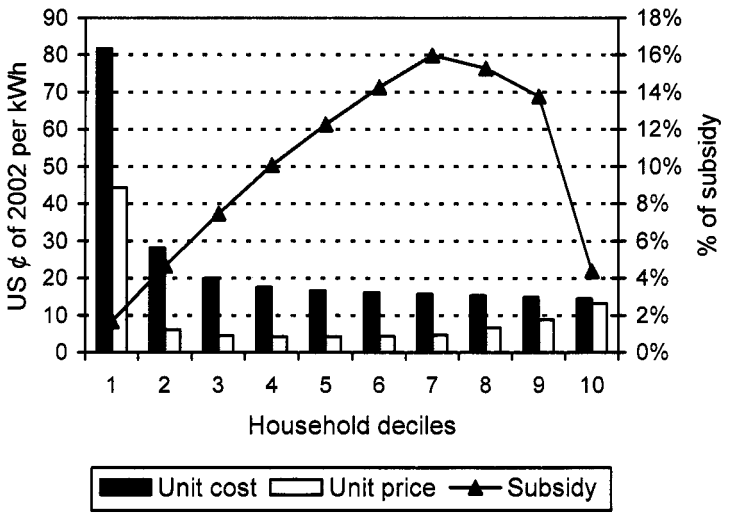
Table 1.2 Mexico's Residential Tariffs in 2002 by Household Deciles

Average residential monthly consumption – kWh	140.8
Total number of households	23,851,010
Total residential consumption – GWh	40,298

hh	Average consumption	Unit cost	Unit price	Unit subsidy	Subsidies by household deciles			
Deciles	kWh/hh-month	US¢ / kWh	US¢ / kWh	US¢ / kWh	$/hh –year	M$/hh –year	%	Σ %
1	5	81.8	44.4	37.43	22	54	1.7%	1.7%
2	24	28.2	6.2	22.00	63	151	4.7%	6.3%
3	55	20.0	4.5	15.53	102	244	7.5%	13.8%
4	86	17.6	4.3	13.31	137	328	10.1%	23.9%
5	113	16.7	4.3	12.35	167	399	12.3%	36.2%
6	138	16.1	4.4	11.73	194	463	14.3%	50.5%
7	165	15.7	4.7	11.02	218	520	16.0%	66.5%
8	202	15.3	6.7	8.57	208	495	15.3%	81.8%
9	255	14.9	8.8	6.14	188	448	13.8%	95.6%
10	365	14.5	13.2	1.37	60	143	4.4%	100.0%
	140.8	16.05	7.99	8.05	136	3,246	100.0%	

Source: World Bank (2002), Mexico Expenditure Review

Figure 1.1 Price, Cost & Subsidies by Households, 2002



30. The 2002 public review of the residential tariff was aimed at reducing the overall volume of subsidies and targeting more efficiently the lower income households (price increments affected only deciles 8, 9 and 10). However, analytical assessments on the

effects of this reform, argue that despite the adjustment the subsidy remains concentrated in deciles 6 to 9.[33]

31. The following table summarizes the types of subsidies provided to grid-connected customers:

Table 1.3 Types of Subsidies in Electricity	
Type of Subsidy	**Application in Mexico**
Connection	High cost of line extension but flat connection fee
Consumption	Tariff below cost (cross subsidy)
Consumption	No meters in poor households/ low billing collection (with no disconnection policy)

32. The poorest five percent of the population – rural households not connected to the electricity grid - are excluded from the subsidy as there are no legal provisions establishing tariff levels for off-grid solutions.

33. In Mexico, previous government programs covering off-grid electrification (*Pronasol* and *Progresa*) tended to ignore both the issue of tariff vis-à-vis cost recovery and the issue of sustainability. More recent initiatives (FIRCO and strategic partnerships that involve private sector or NGO providers) have placed special emphasis in community participation either through co-financing or through cash and/or in-kind contributions. Indeed, one of the most important experiences of FIRCO is that systems and equipment should never be provided for free.

34. The Project will devote resources to review and develop a frame for the definition of tariff and subsidy schemes that apply to the provision off-grid electricity services.

F) Barriers to Off-grid Electrification with Renewable Energy

34. The following are the main barriers to the development of rural electrification projects in Mexico.[34]

1. Lack of legal framework addressing specific provisions for the development of renewable energy

35. As explained before and except for the "self supply scheme", Mexico does not have legal and regulatory frameworks that establish provisions, rules and/or incentives for the development and operation of small scale off-grid renewable or non-renewable energy projects. The lack of legal and regulatory transparency with regards to tariff schemes and property rights affect the long term sustainability of stand-alone systems and micro-grids, and hinders the participation of the private sector.

[33] Mexico Public Expenditure Review, World Bank (2003).
[34] This section is based on several interviews with the Federal Electricity Commission (CFE), the Institute of Electrical Research (IIE) and FIRCO. It is also based on reports by Ernestina Torres (2005), Arturo Romero (2005) and Jorge Huacuz (2005), included in the Projects Files.

2. High level of consumer subsidies affects the competitiveness of RETs

36. When the levels of subsidization in the electricity system as a whole are high, the introduction of renewable energy in off-grid applications is difficult as their competitiveness depend on transparent energy levelized costs and the consideration of environmental externalities.

3. Lack of understanding regarding the performance and benefits of renewable energy.

37. The institutions in charge of social programs that -among other- promote rural electrification projects lack the technical and economic expertise necessary to identify electrification needs/uses and plan cost-effective solutions accordingly. There is a generalized lack of understanding regarding the technical merits and types of benefits provided by renewable source based technological solutions. There is also a generalized resistance to the implementation of off-grid solutions among social development agencies and a marked preference to the installation of transmission and distribution lines at any cost. Even the CFE has lagged behind in its capacity to propose and implement state-of-the-art technological arrangements not connected to the grid. Today CFE's intervention as a contractor in rural electrification initiatives is limited to grid extensions.

38. In addition, the failure of previous government programs has affected the perception of communities with regards to off-grid technological solutions and for this reason there is a degree of resistance to the installation of solutions that do not include "electricity lines".

4. Lack of a rural electrification national program that considers and balances the economic and social benefits of different electrification alternatives

39. Since the decentralization policies of 1996 Mexico has not implemented a national rural electrification program *per se*. The rural electrification initiatives being led by SEDESOL and CDI do not consider or integrate any of the key economic, financial, technical, social or environmental aspects that most accompany the planning and implementation of rural electrification projects.

5. Lack of an institutional structure and policy-strategic framework mainstreaming the expertise of key government agencies towards the provision and/or oversight of sustainable integrated energy services

40. Despite the fact that Mexico has a number of government agencies with the technical capacity to quickly learn and support the implementation of rural electrification projects in remote rural communities, there is an atomization of efforts and a lack of institutional coordination. For instance, there are two government agencies with strong representation at the State, Municipal and Community levels working separately on rural electrification: CDI (with a network of social workers) and SEDESOL (with a network of planning commissions at the State and Municipal levels). CFE on the other hand has

strong representation and enjoys a high reputation across the country (with regional offices and numerous technical agents in every State). Additionally, the FIRCO initiative has built a solid base of equipment and service providers servicing rural agricultural farmers across Mexico, especially in the Northern States.

41. Yet, the objectives towards rural electrification are not aligned or coordinated. On the contrary, while some programs support the development of community centers and aggregation (to rip economies of scale and scope), others seek to respect dispersion and the social endowment of rural indigenous communities (nevertheless bringing the electricity grid at any cost).

6. Municipal entities do not prioritize investments in social infrastructure unless there is an incentive (generally in the form of a matching federal fund)

42. Previous studies on the impacts of fiscal decentralization policies have demonstrated the high degree of inefficiency associated with the use of social funds for basic infrastructure at the Municipal level. However, when social programs at the Federal level contribute with fiscal resources aimed at co-financing rural basic infrastructure projects, Municipalities have been willing to match these initiatives with their *Ramo 33* resources effectivelly.

G) Lessons Learned in Previous Rural Electrification Projects in Mexico

43. The implementation of different programs and individual initiatives in Mexico has thrown important lessons.[35] These are described below:

1. The lack of understanding regarding the economic frontier between grid and off-grid solutions and the benefits offered by RET based systems results in an inefficient exercise of public expenditure.

44. New programs leveraging State and Municipal resources have little knowledge regarding technological solutions for off-grid electrification. For instance, the PIBAI has pushed the economic frontier between on and off-grid electrification solutions to US$ 4,200 per connection with grid extensions. This is almost five times higher than the Latin American average.

45. The GoM through the Ministry of Energy (SENER) has recognized the need to invest resources and effort in capacity building activities to improve understanding and skills on the use and installation of RET based off-grid systems as well as on the different benefits offered by on and off-grid solutions (i.e., vis-à-vis the characteristics of different market segments). Capacity building activities should target CFE, SEDESOL, CDI as well as different government and non-government stakeholders involved in rural electrification.

[35] This section is based on several interviews with the Federal Electricity Commission (CFE), the Institute of Electrical Research (IIE) and FIRCO. It is also based on reports by Ernestina Torres (2005), Arturo Romero (2005) and Jorge Huacuz (2005), included in the Projects Files.

2. The capacity of the institutional structure in place to promote and support the development of rural electrification projects, is key to the continuity and success of rural development programs

46. The FIRCO experience demonstrates that the sustainability of programs targeting rural development depends to a large extent on the strength and capacity of the managing institution including its network of extension agents and technical specialists (for supervision and support). In the past, project implementing agencies frequently lacked the technical knowledge to develop project concepts and procurement guidelines, resulting in poor quality systems.

3. Service delivery models implemented to advance off-grid electrification must be based on mechanisms and incentives explicitly designed to ensure the long term sustainability of installed systems:

47. Off-grid electricity generation projects need to be accompanied by sound maintenance schemes and the right incentives to stakeholders in charge of ensuring project sustainability. These mechanisms and incentives must be efficient, effective and equitable.

4. A demand driven approach to rural electrification is preferred over a top down initiative:

48. It is essential that targeted communities explicitly express their demand for the electricity service. Communities need to be informed and social consultations must be conducted prior to the implementation of projects. In this sense, the FIRCO project has demonstrated the effectiveness of "demonstrative modules" in detonating the demand for new projects (e.g., a vehicle showing videos and demonstrating the use of photovoltaics or other RETs to power a number of essential appliances or for productive activities, etc.). User training on the other hand should not be limited to simple operational practices and concentrated during the early stages of the project.

5. To the extent of possible, rural electrification programs must promote the participation of the private sector:

49. Programs and individual initiatives should promote the participation of government and non-government stakeholders including the private sector and NGOs in order to maximize the efficiency of different market segments and leverage co-financing schemes. In particular, the private sector can play an important role in the co-financing of profitable projects as well as in adding value to the implementation and technological arrangements of projects. It is clear that the private sector cannot be expected to serve poor populations in remote areas without some form of public policy support.

6. The lack of technical guidelines and specifications establishing minimum quality standards for installations and equipment can be detrimental to the sustainability of rural electrification initiatives:

50. Mexico has developed technical standards for the installation of photovoltaics and –under the FIRCO initiative- of solar powered water pumps. However, specifications for other off-grid RET based systems does not exist yet. Ensuring minimum quality standards in off-grid installations require not only formal technical specifications, but also -- in some cases -- the certification of qualified service providers (e.g., equipment and spare parts). According to the IIE poor detail engineering and the low quality and/or lack of components -- inefficient or unreliable electronic charge controllers -- have been a common source of failure in previous rural electrification programs.

7. The design of rural electrification program should analyze carefully the capacity of existing after-sales and spare parts distribution networks to deliver the service

51. System sustainability relies highly on the availability of after-sales services and spare parts. Previous experiences in Mexico failed in part because appropriate networks and markets were not developed along with the implementation of new projects.

8. Transparent economics and cost recovery mechanisms are essential to the sustainability of off-grid installations:

52. Community participation – including capacity building – and ownership is essential to the sustainability of off-grid electricity systems. No system or service should be provided for free as this leads to lack of ownership and appreciation which minimizes the chances of long term sustainability (i.e., photovoltaic systems installed under the Pronasol and Progresa programs were stolen, vandalized or sold, some of these systems have been found in Guatemala). The FIRCO experienced demonstrate that end-users of the Northern States (the richer States though) are willing to finance 20-70 percent of systems' costs, resulting in a higher commitment to the project and appropriation of the technologies.

9. Both property rights and tariff-subsidy schemes must be formalized and made explicitly transparent:

53. Rural electrification initiatives most carefully analyze the capacity and willingness to pay of communities. Today rural families being reached by the grid have the fear that they will not be able to pay the electricity bill. It has been observed that communities do not necessarily substitute the use of candles, batteries and wood fuel even after connection to the grid due to a lack of understanding and training.

10. Monitoring and evaluation systems are required in order assess the benefits of specific programs as well as for timely adjustments:

54. Project monitoring and follow up has been absent in most of previous rural electrification initiatives in Mexico, especially due to the lack of provisions associated with the long terms costs of associated activities.

11. Targeted technical assistance and the implementation of incentive based mechanisms are successful in promoting the development of productive-income generating activities.

55. This has been demonstrated by the FIRCO program and the SEDESOL 3x1 Program (described below under "remittances")

H) Renewable Energy in the Development of Social and Productive Activities

56. There are various cases that demonstrate the link between renewable energy and productive applications in rural areas of Mexico. This section summarizes two cases taken from a recent GVEP financed study conducted by the Institute of Electrical Research (IIE-Mexico).[36]

1. "Productive Activities with Renewable Energy in Indigenous Communities".

57. La Vainilla is a poor native community on the mountains of the state of Guerrero. As in many other communities of this type, migration to larger towns and even to the US in search of better living conditions and higher income has been a trend for many years. Productive activities in the community were limited to harvesting beans, corn and chili for self-consumption. In order to ease the hardship of these conditions, the Municipality promoted a project whereby the use of renewable energy could help improve the quality of life in the community and open the opportunity for income generation. Financial resources would come from several stakeholders, mainly a loan to the community from the State Government.

58. The project would foster teamwork in a very poor community and would prove that poor communities with good natural resources could become productive and less poor, should the government provide enough funding and capacity building for the creation of a micro-enterprise. The whole project includes PV lights for homes and a school and a water bottling facility created as the basis for a micro-enterprise that would sell disinfected bottled water to hotels in nearby towns. One battering ram pump supplies water for a water filtration system and energy for water bottling, as well as by-product water for wild animals. PV powered ultraviolet disinfection equipment was installed to purify the water. To seal full water bottles a PV powered hot air pistol was also installed.

59. Total project cost is now estimated at around US$ 100,000, at least 70 percent of which would be paid back to the State Government by the community from the proceeds of the water business. This project was carried out in the late 1980s; ten years later most system components were still working properly and plans were underway to establish an ecotourism project in the town of La Vainilla. Reports indicate that the water business went well and the community paid back its debts.

2. "La Florida Sur Productive System":

[36] The assessment is included in the project files.

60. The Non-Government Organization FUNDENERG promoted the implementation of the La Florida Sur project, consisting in a modular scheme to provide electricity for domestic uses and productive applications. For domestic services, groups of 13 houses in town have been connected to an independent PV-Wind hybrid system consisting of close to 1 kWp of PV modules, a small wind machine of 250W capacity, one battery bank of 7.9 kWh, electronic controls and a one-kW inverter, 24VCD/127VAC. The installed load per house consists of three-15W high efficiency fluorescent lamps and 3 electrical outlets where users are allowed to connect electric appliances with total power of no more than 20W. Maximum peak power allowed per user is established at 65W. Similar hybrid systems were installed, one to power three refrigerators to preserve seafood, and another one to provide electricity for the kindergarten and primary schools. Additionally, a PV powered water purification system was installed to eliminate the need to purchase bottled drinking water in the nearest town which is 61 kilometers away. Total funds for the project, amounting to US$172,471, were supplied by a private company. The community has established fee mechanisms for both, domestic interconnections and storage of seafood products, so that a fund for battery replacement could be available when necessary. Fishing is the main economic activity in town, which employs 70 percent of the population, currently around 165 people. Agriculture and cattle rising are secondary economic activities and are considered as complementary only.

61. Local agricultural products are sorghum, wheat and maize. Before the project was introduced, some houses got electricity from PV solar home systems. Water for cleaning purposes was formerly supplied from a well by an old wind pump, but the service was unreliable due to the bad condition on the wind machine. Project objectives included providing basic energy services for the integral development of the community, by supporting fishing, agricultural and cattle rising activities, and improving communal services such as health and education. Improving the conditions for commercialization of sea products, by means of refrigeration systems, providing access to the Internet in support of primary school education, installing a water purification system to supply drinking water and to reduce the expense incurred in buying bottled water, checking migration of young people to the US, and reducing fossil fuel consumption by producing electricity with renewable energy. IMPREMA, a renewable energy company established in Mexico City, was responsible for the supply and installation of the hybrid systems and balance of system components, all as turn-key packages imported from Germany. The project has been operational for only a few months and it is too early to pass judgment on long-term sustainability. However, the modular concept (i.e., distributing the loads among different generating systems) looks promising as it represents a compromise between low power disperse systems and higher risk concentrated mini-grids. Project monitoring to be carried out by FUNDENERG during 5 years could yield important lessons on this experience.

I) The Importance of Remittances[37]

62. Mexico ranks among the top three remittance recipients of the world, and the U.S.-Mexico corridor is at an advanced stage of shifting from informal to formal services. In comparison with other recipient countries, which typically receive significant inflows from more than one country, Mexico has a unique bilateral relationship with the United States, from which the great bulk of its remittance receipts originate.

63. In 2004 remittances in Mexico amounted to US$16.6 billion (Source: IADB). Nowadays they represent the second largest source of external finance after oil, eclipsing foreign direct investments (FDI) and tourism receipts. The geographical distribution of remittances has recently shown signs of spreading more evenly throughout Mexico. Remittances in Oaxaca, for instance, doubled in five years reaching an estimate of US$750 million in 2003. In the same year, the average remittance amounted to US$321 and the financial transactions involved were slightly below 40 million. Remittances are delivered through a variety of outlets in Mexico including banking and microfinance institutions, money transfer operators (MTOs), department stores, small neighborhood stores, telegraph offices, exchange houses and post offices. Besides benefits to individual families, financial resources from migrants are of paramount importance to promote public initiatives such as the "3x1 program" where every dollar sent back from overseas is matched by three dollars from federal, state and municipal governments to fund roads, schools and other projects (Source: Hernandez-Coss (2005), "The U.S. – Mexico Remittance Corridor").

Box 1.3. Home Town Associations "3x1"

The "3x1" program channels community remittances form overseas into small-scale development projects in Mexico. Every dollar sent back is matched by three dollars from federal, state, and municipal governments to fund roads, schools, and other projects.

From 1993 to 2000, investments financed by the program totaled US$16.2 million. Typical projects have included road construction, road paving, irrigation, sewerage, and electricity. The program also funds works in churches, cemeteries, parks and civic squares, community centers, and athletic facilities. New investment projects include providing computers for high schools and dam and water-treatment projects. These small-scale projects have an average cost of $56,000. Almost two-thirds of the projects have been located in small communities of less than 2,000 inhabitants. Investment decisions are made by a joint committee of local government and home town associations (HTA) representatives.

Observers have attributed the success of this small-scale program to the strong leadership of the HTA and the demonstrated commitment on the part of migrant clubs.

Source: "Migrant's Capital for Small Scale Infrastructure and Small Enterprise Development in Mexico", World Bank, January 2002.

[37] This section is taken from two sources: (1) Hernandez-Coss Raul; 2005. The U.S.-Mexico Remittance Corridor: Lessons on Shifting from Informal to Formal Transfer Systems, World Bank Working Paper No. 47, and (2) The World Bank, 2005. Remittances: Development Impact and Future Prospects, Editors Maimbo and Ratha, Washington D.C.

64. During project implementation, SENER will seek to build capacity at the State and Municipal levels to promote private investments in projects aimed at rural economic development and small or micro-businesses.

Annex 2. Major Related Projects Financed by the Bank and/or other Agencies

1. Following a long period of low engagement by the World Bank in the energy sector in Mexico, a wide range of related projects is now under development, (supervision PSR ratings not available), including:

2. The Competitiveness Development Policy Loan contains a substantial energy sector component. No fundamental energy sector reforms are supported under the DPL, but the operation promotes sector transparency and performance monitoring, both important elements in promoting sector efficiency.

3. A 30 MW solar thermal hybrid/gas combined cycle electric project, supported by a $49 million GEF grant was approved by the Board on October 5, 2006, but has been delayed in effectiveness due to certain unforeseen circumstances in the bidding procedure. An extension to effectiveness was approved till April 4, 2008.

1. Several Carbon Finance projects are being pursued including wind (La Venta II), gas flaring reduction and energy efficiency. Following-on from a successfully implemented first-in-LAC GEF project in Monterrey, a second landfill gas capture site is being developed in Monterrey, as well as another gas capture facility in Guadalajara. A Biomass Residues Based Co-generation project is being developed for reduction of Greenhouse Gases emissions, estimated at 100,987 tCO2/year, through partial substitution of fossil fuel (Heavy Fuel Oil) used to heat vapor and co-generate electricity at a brewery, by bagasse residues, which is a by-product of the brewing process. There is substantial additional potential for carbon finance in the Mexican urban-waste-to-energy sector.

2. An ESMAP technical assistance grant supports a pilot project in financial intermediation for energy efficiency. New ESMAP assistance is planned for energy efficient housing and national strategy for energy efficiency.

Other related World Bank projects include:

4. Integrated Solar Thermal Combined Cycle Power Project for Morocco (in preparation)

5. Integrated Solar Thermal Combined Cycle Power Project for Egypt (in preparation)

6. Carbon Finance projects in the World Bank's Latin America and Caribbean portfolio:

i) Nova Gerar Landfill Gas, Brazil
ii) Alta Mogiana Sugar Bagasse Cogeneration, Brazil
iii) Lages Woodwaste Cogen Facility, Brazil
iv) Chacaboquito Run-of-River Hydro, Chile
v) Hornitos Hydro, Chile
vi) Quilleco Hydro Power, Chile
vii) Jeparachi Wind Power, Colombia
viii) Rio Amoya Run-of-River Hydro, Colombia
ix) Furatena Energy Efficiency and Rural Development Project, Colombia
x) Cote Run-of-River Hydro, Costa Rica
xi) Abanico Hydro, Ecuador
xii) Skeldon Sugar Modernization Project, Guyana
xiii) La Esperanza Hydroelectric Development, Honduras
xiv) Poechos Hydroelectric Plant, Peru
xv) Santa Rosa Hydroelectric Project, Peru
xvi) Huaycoloro Landfill Gas Recovery, Peru

7. Wind Farm projects in the World Bank's Carbon Finance portfolio:

i) NorthWind Bangui Bay Project, Phillippines
ii) Huitengxile Wind Farm, China
iii) Burgos Wind Power Project, Philippines
iv) Bahia Wind Irrigation, Brazil
v) Shandong Luneng Jiaodong Wind Farm Project, China
vi) Puck Wind Farm Project, Poland

Other Development Agencies:

i) UNDP/GEF: Action Plan for Removing Barriers to the Full-Scale Implementation of Wind Power in Mexico (Phase 1), October 15, 2002
ii) GEF/UNDP China: Capacity Building for the Rapid Commercialization of Renewable Energy
iii) BMZ/GTZ: Promotion of Renewable Energies in Mexico (PROMOVER)
iv) USAID: Various technical assistance projects

Annex 3. Results Framework and Monitoring

Results Framework

Note: This is a combined World Bank – GEF Project and the results framework presented below concerns the whole Project. The Project Development Objective, outcomes and indicators refer to the overall Project, however specific outcomes and indicators on the GEF components are presented below and indicated by an asterisk (*).

PDO	Project Outcome Indicators	Use of Project Outcome Information
1) Increase access to Efficient and Sustainable Integrated Energy Services in Rural Areas	Number of new electricity connections Costs per new electricity connection Number of private companies operating as service companies Amount of private equity invested in rural projects Number of extension agents trained Number of new social/productive activities and micro-businesses developed kWh of electricity consumed by productive uses, social activities (subsistence, health, education centers) and micro-businesses in targeted areas (* reported separately for projects using renewable energy)	YR1 YR2 Measure effectiveness of Project in installing and sustaining new electricity connections YR3 Mid-term review of service delivery model performance and subsidy provision. YR5 Assess overall effectiveness (target in terms of new connections) YR3 Mid-term review of service delivery model performance and degree of competition in bidding processes YR5 Assess overall effectiveness
2) Global Environmental Objective (*) Reduction of greenhouse gas emissions through provision of electricity using renewable energy)	(*) Number of new electricity connections using renewable energy (*) Carbon emissions reductions (tCO2e)	(*) YR1 YR2 Measure effectiveness of Project in leveraging public and private financing for rural electrification projects (*) YR1-YR5 Measure ERs (*) YR5 Assess overall effectiveness
Intermediate Outcomes	**Intermediate Outcome Indicators**	**Use of Intermediate Outcome Monitoring**
Outcome 1 PPMT and SPICs demonstrate capacity to manage the program and promote the market	**Outcome 1** PPMT and SPICs follow closely a pre-agreed annual program of activities (1a), or PPMT and SPICs operating with trained technical staff and adequate budget(1b)	EOY1 EOY2 Assess capacity of PPMT and SPICs to manage and promote the program YR3 Midterm review of capacity building / technical assistance

Outcome 2 SENER develops strategy, policy, regulatory measures, guidelines and manuals to strengthen the market for rural electrification and promote the introduction of renewable energy (*)	**Outcome 2** Issuance of strategic measures, regulations, guidelines, manuals (2a)	YR3 Mid-term Project Review YR5 Project Completion Report
Outcome 3 Municipalities co-finance the program	**Outcome 3** Percentage of sub-projects with co-financing from municipalities	YR1 to YR5: Annual review of co-financing from municipalities
Outcome 4 Electricity service companies invest and/or service in rural areas/sub-projects	**Outcome 4** Total investments by public and private entities (3a) Number of companies servicing rural areas or specific sub-projects (3b) Private sector participation (KWs, ownership) (3c)	YR3 Mid-term review of program's sustainability, service delivery model performance and subsidy provision. YR3 Midterm review of number of new connections YR4 Measure effectiveness of refinancing mechanism
Outcome 5 Rural families/individuals go through (graduate) training to develop economic/productive activities Rural families/individuals embark in new productive economic activities that require use of electricity (*)	**Outcome 5** Number of families/individuals trained in specific productive/economic activities (4a) Number of productive/economic activities being developed (4b)	YR2 YR3 Review of program development YR3 Mid-term Review Project Design YR4 Measure effectiveness of re-financing mechanism
Outcome 6 Monitoring and Evaluation Systems established	**Outcome 6** M&E plan agreed (5a) M&E unit in PPMT and SPICs staffed (5b)	

Arrangements for Monitoring

		Targeted Values					Data Collection and Reporting		
Project Outcome Indicators	**Baseline**	**YR1**	**YR2**	**YR3**	**YR4**	**YR5**	**Frequency and Reports**	**Data Collection Instruments**	**Responsibility for Data Collection**
Number of Households electrified	0 (1)	2,670	7,239	12,638	13,765	13,688	Annual	Field Surveys Progress and Completion Reports	Federal and State Implementation Units (PPMT & SPICs) Advisory and Monitoring Committees (SECs, TSMG) supervising
Number of HH electrified with RET	0 (2)	1,965	6,539	11,938	13,.65	12,988			
Costs per New Connection (USD/HH)	2400	1,200	-	1080	-	960 (3)			
kW New Renewable Energy	0	267	723	1,263	1,376	1,368			
Emissions Reductions (thousand tones CO2e)	0	-	-	625	-	625	YR3 / YR5		
Incremental increase in MWh/year of electricity consumed for productive uses in targeted communities (MWh/year)	0	190	350	5,240	5,450	5,650			
Income generation to project beneficiaries due to increased productive/economic uses of electr.	0 to 2 USD/day (4)	> 3 (5)	> 3	> 3	> 3	> 3			
Number of new social/productive activities and micro-businesses developed	0	50	250	500	750	1000	YR3/Y5		
Number of private companies operating as service companies	0	5-10	5-10	10-15	10-15	>15			
Amount of private equity invested in rural projects (% total investment)	0	10%	10%	10%	10%	>10%	YR3/YR5		
Number of extension agents trained	0	50	140	250	250	250	YR3/YR5		

Intermediate Outcomes	Baseline	YR1	YR2	YR3	YR4	YR5	Frequency and Reports	Data Collection Instruments	Responsibility for Data Collection
PPMT/ SPICs / PAC/PMC/TSMG operational	None	All					Annual	Annual Project Report	PPMT
Design of Bidding Documents	None	Complete EOY					Annual		PPMT
Issuance of technical guidelines	None	Complete EOY					Annual	Annual Project Report	PPMT
Design procedure for technology and service provider pre-qualification / certification	None	Complete EOY					Annual		PPMT
Baseline Impact Evaluation Assessment	None	Complete EOY					Annual		PPMT
Medium Term Impact Evaluation Assessment	None			Comp lete EOY			Annual		PPMT
Successful ownership transfer of SHS to Households	None				At least 50% of SHS installe d in YR1		Annual	Service Companies Report Verification Report by TSMG	SPICs / TSMG

(1) It is estimated that of the 700,000 households with no electricity in the targeted States, a total of 343,000 (49%) will not be reached by the grid within at least the next 5-10 years. These households are located in communities settled more than 10 km away from the electricity network.

(2) The total number of households considered in the baseline (343,000) have no electricity and none of them will be electrified by a grid extension within at least the next 5 years. In a recent study by the Institute of Electrical Research (IIE-Mexico), it was established that the least cost electrification option for the majority of these communities is based on solar or wind home systems and only a small percentage could be based on non-renewable sources of energy (e.g., diesel generators).

(3) For this project it is assumed that on average, the capital costs of a 100 WP PV system is US$1,200 and that its cost will decline by about 20% at the end of year 5. The Implementation Completion and Results Report (ICR) of the GEF MX Renewable Energy for Agriculture Project states that the average cost per watt installed of PV water pump systems sold during project implementation, lowered in 24-25% from 2001-2002 to 2004-2005. However, given the uncertainties of the PV market (panel availability and other factors) this project assumes a 20% decrease over the five year period of implementation.

(4) Encuesta Nacional de Ingresos y Gastos de los Hogares, Instituto Nacional de Estadistica, Geografia e Informatica (INEGI), 2006

(5) The GEF MX Renewable Energy for Agriculture Project is the first experience in Mexico with evidence on how the development of productive uses of renewable energy impact the income of beneficiaries (farmers). The ICR of this project reports the average increase in income more than doubled (rising by 139%).

Annex 4. Detailed Project Description

1. The Project is a five year, adaptable program financed by the Global Environmental Facility, the Government of Mexico and the private sector. The Project is designed to increase access to electricity services and promote social and economic development in the rural areas of the poorest States of Mexico. The geographical scope of the Project includes primarily Oaxaca, Veracruz and Guerrero (period May 2007-2012) with the possibility of extending to Chiapas and Puebla after 2008.

2. The initiative will start with sub-projects in the States of Oaxaca, Veracruz and Guerrero, where State Governments have already committed budgetary resources to co-finance the development of the program starting in 2007 and have participated intensely in preparation activities over the period 2005-2006. It is expected that Chiapas and Puebla will join the program in January 2008, as their new six year government administrative cycles initiate December 2006 and a period of preparation as well as resources allocation in annual budgetary cycles are necessary.[38]

3. The Project targets communities of 50 to 2,500 inhabitants located more than 10 kilometers from the grid and that will not be reached by the grid within at least 5 years. The project is focused on off-grid, mainly RET based, electrification options including mini-grids and stand alone systems.

4. The Project is complementary to other government initiatives which are increasing access to electrification with grid extensions (see Annex 1 for a description). The project intends to electrify 50,000 households in the period July 2007 – June 2012.

A. Component 1. Policy, Regulation and Strategy (*Estimated Cost US$ 4.1 Million, US$ 1.35 Million from GEF, US$ 1.17 Million from IBRD, US$ 1.57 Million GOM*)

5. This component will finance activities and consultant work to contribute to strengthen the strategy, policy and regulatory frameworks under which off-grid rural electrification projects operate, including:

i. Strengthening of policy, legal and/or regulatory frameworks specifically with regards to tariff and subsidy schemes and the definition of ownership rights
ii. Development of financial, policy and regulatory incentives to foster the development of RET based off-grid electricity services
iii. Development of regulatory measures, standards and manuals to ensure minimum quality levels in technical installations and service delivery practices (for each type of renewable source based technological arrangement)

[38] This period of preparation is important, as programmatic activities for negotiating, allocating and disbursing public resources for the co-financing of projects have to consider political and annual budgetary cycles.

iv. Develop methodological guidelines and tools for public consultation activities consistent with the Mexican legal and regulatory frameworks as well as with Bank social safeguard policies
v. Develop methodological guidelines and tools for environmental protection and oversight activities consistent with the Mexican legal and regulatory frameworks as well as with Bank environmental safeguard policies
vi. Design a conflict resolution mechanism to support project implementation, ensure transparency and reduce risks

(i) Strengthening of policy, legal and/or regulatory framework: tariff and subsidy schemes and the definition of ownership schemes rights.

6. As discussed in Annex I, the Mexican legal and regulatory framework for the electricity sector (*Ley del Servicio Publico de Energia Electrica*) establishes specific provisions for rural electrification.[39] There are however two important areas that need to be strengthened: (a) the definition of the tariff and subsidy mechanisms for projects not connected to the national interconnection system (SIN), and (b) the formal definition of ownership for projects co-financed either with Federal, State and/or Municipal public resources or with a combination of public and private resources. In particular, the consultant work will analyze how the subsides provided under the Project, compare to other social protection infrastructure programs in terms of their ability to accurately target poor households and to reduce poverty levels.

(ii) Development of financial, policy and regulatory incentives to foster the development of RET based off-grid electricity services

7. Small scale renewable source based power generation faces a number of different types of barriers that limit their introduction and sustainability (see Annexes 1 and 15). The Ministry of Energy (SENER) has expressed its commitment to explore the possibility to introduce policy, regulatory and/or financial incentives to support the development of rural electrification projects based on renewable energy. The consultant work will focus on analyzing potential alternatives and proposing a set of well justified incentive mechanisms.

(iii) Development of regulatory measures, standards and manuals to ensure minimum quality levels in technical installations and service delivery practices

8. Experts of key institutions such as the Institute of Electrical Research (IIE), the Federal Electricity Commission (CFE) and the Ministry for Agriculture (SAGARPA-FIRCO) have emphasized the need to develop technical standards and manuals to ensure minimum quality levels for different types of off-grid or small scale renewable source based rural electrification projects. This sub-component will finance the development of such tools, considering the need to balance costs and the competitiveness of local suppliers with quality assurance and technical excellence.

[39] Through either the self-supply scheme or for small production in disperse small rural communities (projects must be lower than 1 MW).

(iv) Development of methodological guidelines and tools for public consultation activities

9. In the social front, despite the merits of socially oriented programs led by SEDESOL and CDI, the quality of public consultation and community participatory activities is not always homogenous and consistent with minimum requirements and best practice. There is a lack of official tools and methodological guidelines to support the work of government and non government organizations conducting social consultation activities (e.g., NGOs are frequently called to conduct these activities in rural communities).

(v) Development of methodological guidelines and tools for environmental protection

10. The development of methodological guidelines to ensure the implementation of adequate prevention and mitigation measures is essential to the development of a sustainable program. Although no major environmental impacts are expected during project implementation, it will still be necessary to introduce best practice in the collection and disposal of used batteries, the construction of biogas and micro-hydro, the handling of fuels for diesel based systems, and other.

(vi) Design of a conflict resolution mechanism to ensure transparency and reduce risks

11. A particular aspect of community involvement is management and mediation of conflict. Recent social assessments conducted by the World Bank in the targeted regions, highlight several areas where there are intra- and inter-community tensions.[40] In particular, rural indigenous communities face a number of difficulties associated with the use of land and with access to scarce natural resources which frequently result in conflict. This is particularly common in Chiapas and Oaxaca, where indigenous communities maintain historical conflicts with the government and among themselves in relation to land and natural resources access and ownership. Fortunately, the social assessment has identified several agencies and institutions that contribute to conflict resolution.

12. The Project will support the design of a conflict resolution mechanism to help minimize risks during project implementation and/or problems between stakeholders, stakeholders and communities and/or between communities.

13. A conflict resolution mechanism will be designed in the context of a Conflict Analysis Framework (CAF). The CAF has the following objectives: (a) identify and analyze prevailing conflicts among communities, (b) analyze local strategies and mechanisms for conflict resolution and their performance and, (c) design a conflict resolution mechanism that considers the local and participatory management of conflicts as well as the best approach with regards to the support or arbitration by external third

[40] See Annex 10 and PAD Indigenous People Development Project, available in the Project Files.

parties (e.g., justice management at the municipal and community level). The CAF will be focused on those aspects that concern both rural electrification and the promotion of social and productive activities.
In principle however, the project will not authorize the installation of off-grid electrification projects where there are unresolved disputes with the potential to seriously affect project execution. Disputes concerning agrarian, religious or political matters are among those that can condition or restrict the execution of works.

B. Component 2. Rural Electrification Sub-Projects *(Estimated Cost US$ 68.41 Million, US$ 5.76 Million from GEF, US$ 6.89 Million from IBRD, US$ 49.22 Million GOM and US$6.54 from private sources)*

14. The investment component of the Project will be financed with resources from the IBRD loan, the GEF grant, counterpart funds from the State and Municipal Governments, the communities and the private sector (electricity service providers). The component will provide capital cost support for a portion of the investment cost of rural electrification sub-projects and other output-based subsidies focused on service quality and market development.

15. The sub-projects will be implemented by qualified public or private electricity service providers. Two different service delivery models will apply depending on the type of sub-project as described below. Rural electrification sub-projects are defined as projects that provide electrification services to remote rural communities and improve the quality of life at the household level (i.e. installation of efficient stoves to reduce indoor pollution). The sub-projects will be mainly based on renewable energy technologies (RETs), and when appropriate the project will also support limited fossil-fuel based sub-projects (e.g., diesel/RET/Battery Hybrids).

16. Decision making regarding technology choice for specific communities will be based on planning exercises (with tools such as Homer) and appropriate project evaluation methods to determine the least cost option.

i) Targeted Universe of Communities

17. Based on official statistical data (INEGI, CFE), the Institute of Electrical Research (IIE) has recently estimated that the universe of localities to be electrified with off-grid options reaches about 4,692 in four of the targeted States (Oaxaca, Veracruz, Guerrero and Chiapas).[41] The Project will focus on communities or aggregates of communities in the range of 50 to 500 households. The idea is to focus first on the most accessible in order to build successful cases that can later on serve as demonstration models for replication.[42] According to the IIE, about 49 percent of the total number of

[41] IIE-Mexico. December 2005. In-Depth Analysis of Case Studies and Projects in Rural Electrification Developed in the Southern States, a report financed by the Global Village Energy Partnership (GVEP). Available in the Project Files.
[42] Without compromising the focus of the Program on communities that are poor and isolated, rural electrification sub-project development –especially for sub-projects not based on wind or solar resources-

non-electrified communities in Southern States should be serviced by an off-grid electricity solution, based on least considerations and given their geographic conditions and distance to transmission and distribution networks.

Table 4.1 Universe of Non-Electrified Localities Southern States			
State	**No. Non Electrified Communities**	**Universe Grid Ext**	**Universe Off Grid**
Oaxaca	1750	769	981
Chiapas	2315	1308	1007
Guerrero	2050	839	1210
Veracruz	3540	2047	1492
	9655	**4963**	**4692**
Source: GVEP 2005, "In-depth Analysis of Cases Studies Rural Electrification Mexico" , IIE-Mexico Note 1: the State of Puebla was not included in the study,			

ii) Potential Service Delivery Providers

18. Two main market segments with complementary potential for electricity service provision have been identified and will be targeted. One is composed of the "external" service providers and includes energy service companies, equipment suppliers, NGOs, the private sector and even public institutions. The other segment is "internal" and includes community organizations, individuals, local cooperatives and locally restricted NGOs.

19. Mexico has an active market of external off-grid electricity service providers. Some of these agents include:

- Current suppliers of the FIRCO program extant in its 180-strong data bank, of which 60 are deemed potentially responsive[43]
- Diverse NGOs
- The Federal Electricity Commission (CFE) itself, who could participate in bidding processes competing with private energy service companies (ESCOs)
- Private sector companies under the self-supply scheme when the sub-project has the potential to deliver minimum levels of profitability

20. Many of these agents are in a position to provide all or some of the following services:

- Due diligence on specific project assumptions and project design

will start in the larger communities or in areas where significant customer aggregation is possible. This is advisable in order to have a better opportunity to configure service packages that are attractive to the private equipment and service suppliers. As experience develops, it will become easier to maintain private service providers interested in serving communities that are more remote and dispersed.

[43] For a description of the FIRCO program see the Project Appraisal Document (PAD) of the GEF Renewable Energy for Agriculture Project, available in the Project Files.

- Final system configuration including changes based on functional requirements as permitted by Program's bid documents
- Equipment supply and installation
- Spare parts and service
- Short to medium term system operation
- Training of local personnel
- Equity when the expected profitability is high

21. However, it is unlikely that most of these external providers are willing and/or able to stay in a community for the long term (20 years), except perhaps in the case of profitable initiatives such as hydroelectric plants or similar installations. The Project will however take into consideration potential private or "internal" service providers at the community level. These include:

- Community level associations or other forms of organizations
- Cooperatives serving one or more communities
- Private companies
- Individuals serving as technicians or commercial agents for rural systems
- Individual users acting on their own behalf

22. The Project will attempt to trigger market mechanisms to promote the development of optimal synergies between these two service provider segments.

iii) General Description of Service Delivery Models

23. While a degree of flexibility and adaptability over time is to be expected, the Project will seek to create synergies between "external" and "internal" service providers using two different types of service delivery models:

(A) Those applying to home systems such as PV and wind, where the technology is simpler and the training terms for local personnel may be correspondingly shorter;

(B) Those that apply to systems where a mini-grid is needed, such as mini-hydros, biomass, diesel hybrids and diesel based, where the technology tends to be more complex, a community organization must perform the commercial functions and training terms will be longer.

24. Participation by external service providers will be secured through medium-term build, operate, train and transfer service contracts with output based subsidies (BOTT models). Key features of these contracts include their overall length, timing of payments to successful bidders, devolution of contributions to communities in the form of reduced O&M charges and provisions for eventual system ownership by communities and individual users. Awarded on a least subsidy basis, these contracts will cover equipment procurement and installation, operation and maintenance for a specified number of years, training of local individuals or organizations in operation, maintenance and commercial

activities and transfer of the rural systems to local organizations or households after training is completed.

25. Participation by internal service providers will be secured through any or a combination of the following approaches:

- Outreach and extension activities implemented by the Project itself (e.g., training of local agents with the potential to become local technicians with responsibilities for repair, metering, and tariff billing/collection)
- Spontaneously, for example when a local NGO decides to respond to a call for bids, most likely in association with an external service provider (i.e., strategic partnership)
- In response to Project requirements for external providers to train local organizations and individuals
- In response to publicity generated by the Project, for example when a community organization or an individual user approaches an open Project subsidy window.

26. Complementarily, the Project will play a proactive role and engage in community organization, consumer education and training. While a significant portion of local personnel training will be conducted by external service providers as part of their operations and maintenance contracts, it is anticipated that Project will complement these efforts, as necessary. A second area for direct Project involvement will be the identification, organization and training of local groups willing and able to take on the commercial functions of metering, billing and collection.

27. Under Mexican law a private operator may not sell electricity directly to the public and thus local organizations will have to fulfill this role (see Annex I for a description of legal and regulatory frameworks). Additionally, since local NGOs may be willing and able to associate themselves with equipment and service providers to participate in service contract bids, the Project will try to make them aware of these and other opportunities for participation.[44] Last, in all instances systems will be transferred to local organizations or individual users at the end of service contract terms. The institutional structure of the Project will continue to provide advice, training and assistance in these matters as well.

28. The Project will closely monitor the performance of service delivery periodically and will also analyze lessons learned to adjust the design of service delivery models to be applied in subsequent generations of sub-projects. The details of the proposed service delivery models for different types of technologies are described in sections below.

iv) Service Delivery Model for Photovoltaic or Solar Home System

[44] There is evidence in Mexico of the creation of strategic partnerships that involved the complementary work of NGOs and private equipment suppliers for the development of off-grid systems (see Annex I).

29. For the case of photovoltaics or SHSs, the service will be provided through **delivery model A**, which has the following features:

- Equipment provision, operation & maintenance, training and transfer contracts are bid out to a potential list of 180 private service suppliers existing in the FIRCO data base. Insofar as possible, functionality requirements will be applied to give bidders the opportunity to improve on preliminary project designs. Bids are evaluated and awarded based on least subsidy requirements, provided functional and other requirements are met. Boundaries for training terms and tariffs, as well as training and transfer conditions may be established in the bidding documents, while optimal technological solutions may be left to bidder discretion. Part of the investment cost is paid with a combination of: (i) down payments (communities and government subsidy), (ii) payment in tranches (e.g., payments deferred for up to three years), and/or (iii) a balloon payment upon successful system transfer.
- The design of service delivery models and associated contractual terms and conditions will include provisions for system growth (e.g., response to increases in electricity demand and consumption by households, community centers or businesses).
- The private supplier makes arrangements with local individuals and organizations for metering, billing and collection. The private supplier operates and maintains systems for a period of time, during which it conducts training of local operations and maintenance personnel for eventual systems take over. The private supplier puts in place a mechanism for providing spare parts such as fuses, controllers and batteries as well as complementary appliances such as inverters.
- Program implements ways of testing the effectiveness of training and the readiness of local organizations for system take over (e.g., through TSMG as described in Annex 6). Upon successful system transfer, the Program releases remaining investment payments to service provider.

30. Program establishes a formal relationship with an established public service provider such as CFE or FIRCO, to provide backstopping to local based rural electric service organizations. Complementarily, the Project extends the life of the program to the long term (20 years) to continue to support backstopping activities.

31. Through this service delivery model, the Project will provide four different types of subsidies:

1. Direct up-front output-based subsidies of up to 90 percent on the initial investment costs, paid to the supplier on the basis of actual installations. These installations will achieve full coverage in the chosen communities and attempt to serve the needs of all potential productive uses. Residential customers unable to pay

the tariff will obtain access through community payment arrangements, cross or direct subsidies, through mechanisms to be determined.[45]

2. Output based service quality subsidies, paid to the supplier against installation and service performance targets. Bidders will "package" their incremental operations, maintenance costs into their investment calculations and mechanisms will be put in place to ensure the provision and quality of these services. For instance, a portion of investment cost payments may be deferred for up to three years, to be paid in trenches or as a balloon payment at the time of system transfer.

3. Output based market development service subsidies, paid to the supplier against training of local technicians, programmed visits, users training and other. A portion of these subsidies may be disbursed through the Program's account over the long term (20 years) to support backstopping activities (SUSTAINABILITY SECTION).

4. A subsidy window open for the duration of Program to provide for system expansion resulting from increased demand and/or the emergence of additional customers in communities electrified under the Program. Applicants will have to submit several competitive bids from qualified suppliers. Subsidy conditions will be at least equivalent to those granted to the first batch of users in Year 1 of the relevant community.

32. Medium term service contracts will be bid for specified areas of the targeted States every year. Based on estimates by the Institute of Electrical Research (IIE-Mexico)[46] the least cost option to electrify about 75 percent of targeted households, especially the smallest ones, will be based on photovoltaic or solar home systems.[47] The Project will target the following number of household over the five year period installing SHSs:

Table 4.3 Expected Number of Households to be Electrified with PV/SHS 2006-2010

	No. Households	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Oaxaca	7,560.00	400	1,000	1,920	1,920	1,920
Guerrero	7,560.00	400	1,000	1,920	1,920	1,920
Veracruz	7,560.00	400	1,000	1,920	1,920	1,920
Chiapas	6,160.00	0	1,000	1,920	1,920	1,920
Puebla	6,160.00	0	1,000	1,920	1,920	1,920
TOTAL	**35,000**	**1,200**	**5,000**	**9,600**	**9,600**	**9,600**

[45] Detailed studies for optimizing the nature and provenance of these subsidies will be conducted as a first step of program development.

[46] The estimate is based on the use of a Geographic Information System (GIS) tool and data on renewable energy resources, electrification costs and other. The work was part of the GVEP financed assessment "In-depth Analysis of Case Studies on Rural Electrification" (delivered November 2005). It is important to note that there is a serious lack of data on renewable sources especially for micro-hydro. Wind and biomass based projects are very much site dependent and measurements and studies will be required.

[47] These calculations did not consider diesel options.

33. The Project will follow a strategy that starts with a few projects in years 1 and 2 to then ramp up in years 3-5. This will allow for the participation of the strongest companies at the beginning and the strengthening of other companies during the process. Since the medium term service contracts will package a number of communities per region, it is expected that about 5 bidding process in each State will take place the first year of project implementation (end of 2007, after the program completes subsidy tender design).

34. The PV component targets communities with household average consumptions of about 100 Watts. Productive activities in these communities are expected and for this reason the project will support both the implementation of individual solar PV systems and solar battery charging stations (SBCS) when appropriate as these have the capacity to serve a large number of customers (1 KW SBCS could serve about 40-50 households).

35. It is expected that an additional 1000 households will be benefited by the use of SBSCs.

v) Service Delivery Model for Wind Home Systems

36. The majority of wind systems will serve a single customer or a small cluster of customers. Service delivery will be provided using model A, as describe above. According to the IIE, there are about 1,130 communities located in the States of Oaxaca and Veracruz (with a few in Chiapas) whose least cost electrification option would be a wind based system. Sub-projects will be identified on the basis of resource assessments. As with solar home systems (SHS), sub-projects will be bid out to local and international suppliers, and contracts awarded on a least subsidy basis.

37. The Project intends to electrify an estimated number of 7,500 households (about 38 to 150 communities depending on the size) with small wind based systems over the proposed five year period. This represents 15 percent of the Project universe. The expected electrification program is given in the following table:

Table 4.4. Expected Number of Households to be Electrified with Wind Based Systems 2006-2010

	No. Households	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Oaxaca	2550	100	300	600	900	1050
Guerrero	0	0	0	0	0	0
Veracruz	4120	100	300	600	900	1050
Chiapas	830	0	100	300	500	700
Puebla	0	0	0	0	0	0
TOTAL	**7500**	**200**	**700**	**1500**	**2300**	**2800**

38. The wind based component will also target communities with household consumptions of about 100 Watts.

vi) Service Delivery Model for Micro-Hydro and Hydro Based Mini-grids

39. These projects have already been identified on the basis of resource assessments and other available information with the support of USAID. Feasibility studies will be finalized during program implementation. Selected projects will be bid out using a build, operate, train and transfer modality and contracts awarded based on least subsidy criteria, as with solar and wind home system. However, due to the nature and complexities associated with this type of technology including their capital intensiveness and the need for private sector participation, it is possible that private service suppliers may prefer to stay for longer terms. Additionally, the existence of a mini-grid, the need to involve community organizations in the metering, billing and collection functions, the increased complexities of demand management and a larger per customer demand warrant a different approach from that of PV and wind systems.

40. Off-grid electricity service with micro-hydro will be provided through **delivery model B**, which has the following features:

- Program conducts studies to characterize the projects: determine potential number of customers -- including residential users and productive activities -- demand levels, customer dispersion, willingness to pay, mini-grid design including service drop and house wiring provisions as well as potential for local equity participation (e.g., municipality, cooperative, community association).
- Program works and makes arrangements with local individuals and organizations to provide for metering, billing and collection. Communities may be organized in cooperatives, associations, PPPs or other forms. Before contracts go out to bid, an organization will be in place to be able to handle the commercial functions from the start, with the help and training from both the private supplier and the Program itself.
- Equipment provision, mini-grid installation, operation & maintenance, training and transfer contracts are bid out to potential equipment and service providers. The Program will actively seek to develop suppliers' market through presentations, promoting links between different organizations and inviting international suppliers, as required. Bids will be evaluated and awarded using least subsidy requirements. Maximum investment subsidy is expected to be 33 percent under this component. The private supplier operates and maintains systems for a period of time, during which it retains the responsibility of training local operations and maintenance personnel for eventual system take over. This period of time may be longer than in the case of PV and wind systems as private co-investors must have the opportunity to recover their capital investments and profit. The possibility exists that some co-investors remain as partners with the community for the life of the project.
- Program implements ways of testing the effectiveness of training and the readiness of local organizations for system complete or partial take over (e.g., through TSMG as described in Annex 6). Partial take over may involve the mini-grid only, or the conversion of capital subsidy components into community shares, or additional community share

purchases. While the proposed financial engineering provides for greater private involvement in the long term, the projects will tend to be small and this may in turn encourage and facilitate community take over.

- Program establishes links between micro-hydro operators and other long term backstopping and technical support instances to shore up projects' sustainability.

41. For the particular case of mini-hydro, service delivery models may fall into three categories[48]:

1. A "community service" model consisting of a very small or "pico" hydro plant -between 25 and 250 kW- serving one community or a cluster of communities.
2. A "small hydro utility" model consisting of a small hydro plant of at least 0.25 MW serving a cluster of communities and one or several "export" or "transit" productive uses that significantly increase electricity demand over and above the communities' domestic needs.
3. A "strategic partner hydro utility" model consisting of a plant with a capacity sufficient to attract a private investors who develops, co-owns and operates the facility.

42. Through service delivery model B, the Program will provide four different types of subsidies:

i. Direct up-front output-based subsidies of up to 33 percent on the initial investment costs, paid to the supplier on the basis of actual installations. These installations will achieve full coverage in the chosen communities and attempt to serve the needs of all potential productive uses, although for practical purposes some customers may be served through battery charging stations.[49] Residential customers unable to pay the tariff will obtain access through community payment arrangements, cross subsidies or direct subsidies, through mechanisms to be determined.

ii. Output based service quality subsidies, paid to the supplier against installation and service performance targets. Bidders will "package" their incremental operations, maintenance costs into their investment calculations, and mechanisms will be put in place to ensure the provision and quality of these services.

iii. Output based market development service subsidies, paid to the supplier against training of local personnel and technicians, programmed visits, users training and other. A portion of these subsidies will be disbursed

[48] For details on these types of service delivery models see the consultant report by Eduardo Villagran, April 2006. Service Delivery Models for the Program; which was sponsored by GVEP.

[49] The shape of the daily demand curve in relation to capacity provides for the opportunity to develop battery charging services off peak. This may help optimize the design of the mini-grid itself, increase plant capacity utilization factor and provide service to the more remote customers.

through the Program's account over the long term (20 years) in order to support backstopping activities.

iv. A subsidy window will stay open for the duration of Program to provide for system expansion through increased demand and additional customers. Subsidy conditions will be at least equivalent to those granted to the first batch of users in Year 1 of the relevant community.

43. The Project intends to electrify an estimated number of 2,524 households with micro-hydro (in mini-grids when applicable) over the proposed five year period. This represents a little over 5 percent of the universe of non-electrified communities in the Southern States. The micro-hydro component targets communities of 50 to 100 households and design demand is expected between 350 and 500 Watts per customer.

The expected electrification program is given in the following table:

Table 4.5 Expected Number of Households to be Electrified with Micro-Hydro / Mini grids 2006-2010

	No. Households	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Oaxaca	885	89	276	100	420	0
Guerrero	741	366	50	250	0	80
Veracruz	611	56	112	143	250	50
Chiapas	287	0	62	0	120	100
Puebla	0	0	0	0	0	0
TOTAL	**2524**	**511**	**500**	**493**	**790**	**230**

44. Technical evaluation and pre-feasibility studies are being prepared for a total of 19 potential micro-hydro sub-projects in three different States with a potential aggregated capacity to supply 1,637 households (see Table below).[50]

Table 4.6 Micro-Hydro Sub-Projects Pre-feasibility Stage Ranges 10-250 KW

State	No. Sub-projects	No. Households
Oaxaca	3	686
Guerrero	8	696
Veracruz	8	255
TOTAL	**19**	**1,637**

45. The portfolio of potential hydroelectric sub-projects will be gradually built over the five year period. The technical assistance component of the Project (component 3) includes measurement and data collection activities.

[50] Results from pre-feasibility studies are expected December 2006. These studies have been sponsored with resources from USAID under a partnership arrangement with SENER. A data base of potential micro-hydro sub-projects is included in the Project Files.

vii) Service Delivery Model for Small Scale Biomass Power Generation

46. Rural communities of the Southern States of Mexico rely greatly on fuel wood to supply their energy needs. According to ENIGH, in 2002 between 40 and 50 percent of average energy expenditures in households of the Southern States was concentrated in wood and other biomass such as *ocote*. Substituting fuel wood for sustainable biomass and other renewable options will have an important impact on deforestation and land degradation in the region.

47. Biomass energy has a number of unique attributes that make it particularly suitable to climate change mitigation and community development applications: (a) biomass resources are readily available, (b) biomass based industries can be a significant source of jobs in rural areas, and (c) by promoting biomass energy to provide clean and efficient modern energy services countries can address many of the negative aspects of current unsustainable biomass consumption (including effects on health through a reduction of indoor pollution).

48. In sum, there is some potential for developing biomass based projects burning agricultural or forestry residues. If any of these materialize in the course of the community and resource assessments, its treatment will be analogous to that of the mini-hydros. Special attention will be paid to the availability and cost of the biomass residue over the life of project and to the appropriateness of technology to local conditions.

49. Yet, it is important to acknowledge that off-grid biomass based electricity generation systems are more difficult to develop, operate and maintain and that experiences with other Bank programs have demonstrated the need for careful technical consideration and an intense supervision.

50. To the extent of possible, the Project will try to support the development of small-scale gasification systems - for household or village use- to benefit 30 to 75 communities depending on the size. The expected electrification program is given in the following table:

Table 4.7 Expected Number of Households to be Electrified with Biomass Based 2006-2010

	No. Households	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Oaxaca	117	17	25	25	25	25
Guerrero	108	20	20	20	20	28
Veracruz	117	17	25	25	25	25
Chiapas	83	-	23	-	30	30
Puebla	75	-	25	25	25	-
TOTAL	**500**	**54**	**118**	**95**	**125**	**108**

51. Service delivery for the estimated 500 customers to be served through biomass projects will be provided under model B, as described above.

viii) Service Delivery Model for Diesel/RET/Battery Hybrids

52. Diesel based systems and diesel hybrids are the "fall back" option when no renewable energy alternatives are available. Diesel in small quantities is widely used in rural communities across Mexico, especially in Guerrero where diesel accounts for almost 50 percent of household energy expenditures. It is expected that diesel-based systems for rural electrification will be the least cost alternative in some cases.

53. In general, diesel technology is readily available in rural Mexico. Obtaining the fuel is not a problem and there is sufficient availability of mechanics and spare parts. However, the operation of a diesel system requires more discipline than other systems; regular maintenance must be carried out, water quality monitored and enough money collected and set aside to conduct timely overhauls. These additional requirements frequently represent a problem in isolated rural communities.

54. In this case, the supplier-operator will have to remain involved for the longest possible term. This will depend on system size and degree of isolation, among other things. Accordingly, training periods to extension agents or local technicians will tend to be longer and training itself must be more closely monitored than with other technologies.
Diesel hybrids may be hybridized with wind and even PV projects. Diesel-wind hybrids have proven to lower the fuel costs of diesel systems in some cases. When customer demand requires it, productive activities in a wind-based or PV based system may be served using small diesel generators. Under appropriate community ownership arrangements, a productive use of a certain significant size such as a corn mill may provide electricity service to some of its neighbors and thus enhance the robustness of a PV or wind system.

55. The service delivery model to introduce diesel hybrids may be a hybrid between models A and B. For example, a community may be served primarily with PV systems through service delivery model A, but at least some of the features of model B would have to be imported, such as the requirement for greater equipment supplier participation in system's operations and maintenance and user training.

56. The Project intends to electrify an estimated number of 3,505 households with diesel based and diesel based hybrids with renewable energy technologies over the proposed five year period.

Table 4.8 Expected Number of Households to be Electrified with Diesel and Diesel Hybrids 2006-2010

	No. Households	2008-2009	2009-2010	2010-2011	2011-2012	2012-2013
Oaxaca	795	235	140	140	140	140
Guerrero	795	235	140	140	140	140
Veracruz	795	235	140	140	140	140
Chiapas	560		140	140	140	140
Puebla	560		140	140	140	140
TOTAL	**3505**	**705**	**700**	**700**	**700**	**700**

57. Table in Attachment 1 of this Annex, provides a summary view of service delivery models A and B in relation to available off grid technologies. It is important to note that under component 3 (sub-component 3.4) the Project will hire consultant services to design in detail the economic, financial and structural features of bidding packages including the design of subsidies, economic and financial incentives and other.

ix) Participation of Private Companies: From Equipment Supply to the Provision of Service Delivery

58. The design of the proposed service delivery models and types of incentives under consideration has been validated through a limited survey that included interviews with 15 of the top equipment suppliers and ESCOs operating in Mexico.[51] The results of the survey confirmed the interest of all companies in participating in the bidding processes and their agreement with the overall design of service provision proposed including:

- Acceptance to BOTT model and their willingness to defer 10-25 percent of contract amount for a period of 3 years based on performance
- Willingness to form alliances or strategic partnership with NGOs to leverage their expertise (e.g., in training communities and extension agents, conducting public consultations, community work or other)
- Companies favor flexible bidding conditions that allow for the introduction of innovation and creative arrangements (as opposed to rigid specifications)

59. The survey demonstrated however that only one third of these companies, have direct experience in working with communities in the Southern States of Mexico. According to the survey, the 15 companies interviewed would have no problem in provide the entire needs of the Project.[52] Yet, they mentioned the need to program activities considering the time it takes between ordering and receiving photovoltaic panels (including spare parts) which varies between 3 and 6 months. Only one company reported producing PVs locally.

x) Efficient Stoves (Improved Wood Stoves)

60. Component 2 will also finance a limited number of efficient stoves given their importance in improving the quality of life and health of rural families. Indeed, the Project opens a window of opportunity to support the GOM in providing integrated energy services that include both electricity services – which bring better lighting conditions and the opportunity to connect electric appliances/equipment –and measures that improve the efficiency of cooking and heating while substantially improving the indoor ambient conditions of rural households.

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[51] For details on the survey see consultant report by Eduardo Villagran, April 2006. Service Delivery Models for the Program; sponsored by the Global Village Energy Partnership (GVEP).

[52] On average, companies stated they were able to install 221 PV systems per month. All together would therefore be able to supply 39,780 systems per year.

61. In Mexico, the use of fuel wood supplies between 35 and 45 percent of energy needs in the residential sector. Approximately 28 million people, the majority concentrated in rural areas (especially Chiapas, Guerrero, Oaxaca and Veracruz); use fuel wood as the main source for cooking and heating. Since 1990, and in absolute terms, the number of fuel-wood users in rural areas of the Southern States has gradually increased.[53]

62. The main technology for cooking and heating which uses fuel wood in Mexico is known as a traditional open fire stove (*fogon abierto tradicional de 3 o 4 piedras*), which exhibits an energy efficiency of only 5-17 percent. Burning traditional fuels in ill-designed stoves or hearths exposes women and children to harmful concentrations of particular matter and gaseous pollutants (e.g., carbon monoxide, particulate matter 2.5, volatile organic compounds, carcinogenic pollutants, and other).

63. A World Health Organization (WHO) report has concluded that exposure to biomass smoke increases the risk of a range of serious diseases in both children and adults (e.g., premature deaths in children under age 5, acute lower respiratory infections, asthma, and pneumonia in children, and other).[54] The literature and the experience of various countries indicate that mitigation of the health impacts associated with indoor air pollution (IAP) can be achieved through moving up the energy ladder (i.e., from fuel wood to cleaner liquid and gaseous fuels to electricity). At the lower end of the energy ladder, better ventilation and the use of stoves that vent smoke through a chimney can decrease exposure to the harmful emission of pollutants.

64. In coordination with the programs for the introduction of efficient stoves being led by the Ministry of Health, the Project will finance under sub-component 2.6, (a) a training and information campaign on the construction and benefits of efficient stoves, and (b) the installation of a limited number of improved stoves targeting the same households which result benefited by the off-grid electricity services.

xi) Eligibility Criteria and Selection Process

65. The process for the selection of sub-projects is based on a community demand driven approach. Proposed sub-projects will be considered eligible if they meet all of the following conditions:

i. Eligible sub-projects will have to serve localities included in the official data base or universe of localities that meet the criteria for off-grid projects in the targeted States[55]

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[53] Source: R. Diaz Jimenez, C. Alatorre Frenk, O. Masera. 2003. El uso de bioenergia en los hogares: impactos ambientales y en la salud. Working Paper, Grupo Interdisciplinario de Tecnología Rural Apropiada.

[54] Source: K. Ahmed, Y. Awe, D. Barnes, M. Cropper, and M. Kojima. 2005. Environmental Health and Traditional Fuel Use in Guatemala. ESMAP, The World Bank.

[55] The criteria includes: all those localities of 50 to 2500 inhabitants with no electricity service that are located more than 10 Km away from the grid and that will not be electrified with a grid extension in at least 5 years. Every targeted State will validate the official Data Base or Universe of eligible communities with

ii. Targeted localities or beneficiaries will have to express interest and/or demand for off-grid electrification services. Eligible sub-projects will have to present evidence of public consultation and initial acceptance or demand by community leaders and participatory committees (*Asamblea Participativa*)
iii. Eligible sub-projects will have to present a preliminary project design and meet least-cost economic considerations
iv. Eligible sub-projects will have to comply with country and World Bank social and environmental safeguard policies
v. Projects with private sector participation that comply with previous conditions will be considered

The above conditions will apply to both public and private sector sub-projects.

66. The communities will be encourage to assume responsibility for establishing a system that provides all households with electricity, also the households that cannot afford to pay the tariff. This is in line with the overall objective that the program shall reach the poorest and will also reduce the risk of potential conflicts in the community. The poorest consumers could provide different type of services in kind to the community as payment.

67. The communities will be encouraged to include women in the training of local technicians, commercial responsibilities and maintenance of household equipment. Indeed many rural development programs have shown that women and children as prime beneficiaries of basic infrastructure services have more ownership and greater incentive to secure the sustainability of the service delivery.

xii) Identified Sub-Projects for First Year of Implementation

68. Over the Project preparation period (February 2005 to December 2006) the Ministry of Energy (SENER) worked together with State government entities in the structuring of both State Project Implementation Committees (SPICs) and State Energy Committees (SECs). The Governors of the States of Veracruz, Oaxaca and Guerrero have appointed coordinators for these SPICs and proposed the integration of SECs -whose members are the representatives of institutions already working at the State Level (CFE, SEDESOL, CDI and other).[56] The SPICs of these three States are already operational and so far they have already (a) integrated their data bases of non-electrified communities including their economic and social characterization, (b) conformed and characterized a portfolio of potential sub-projects for the first year of project implementation, and (c) conducted preliminary technical assessments and public consultations of potential sub-

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the Federal Electricity Commission (CFE). CFE will apply criteria for decision making regarding grid extensions based on a maximum cost per connection (e.g., US$1,000 per connection).

[56] Several workshops organized by GVEP and project preparation funds have brought together the different PIUs and their members (SEDESOL,CDI,CFE, other) to analyze: (a) their structure and functioning roles, (b) project selection criteria and processes, (c) project characterization, and) planning tools (HOMER, with co-financing from USAID). The results of these workshops, together with in-depths consultant reports have helped shape and organize the structure and functions of already operational State PIUs.

projects included in the portfolio. In the States of Guerrero and Oaxaca, pre-feasibility studies of hydroelectric plants have already initiated.

69. *GEF Intervention in Component 2, US$ 5.64 Million*: The portion of the GEF grant allocated to this component will only support the investments and output-based subsidies associated with (a) the PV/SHS market development and (b) the renewable source based sub-projects that exhibit an incremental cost when compared to fossil-fuel based alternatives.

70. No subsidy investments from the GEF grant are expected for micro-hydro sub-projects or fossil-fuel based alternatives.

C. Component 3. Technical Assistance for Rural Electrification (*Estimated Cost US$ 12.46 Million, US$ 5.13 Million from GEF, US$ 2.81 Million from IBRD, US$ 4.31 Million GOM and 0.2 from Enterprises*)

71. This component is designed to provide the technical assistance and capacity building activities necessary to ensure the success of the Project including:

i) Technical assistance and capacity building to ensure the success of sub-project at different stages of implementation
ii) Promotion of renewable source based off grid electrification projects
iii) Promotion of private sector participation
iv) *Technical Assistance and Capacity Building Activities*

72. This sub-component aims to assist the various stakeholders that will have to work together under the Project. The activities contemplated will strengthen the capacity of Federal, State, Municipal and Community stakeholders to identify, plan, prioritize, and implement sustainable off grid rural electrification sub-projects in cooperation with electricity service providers, the private sector, decentralized government institutions such as the CFE and when appropriate, NGOs and the academia.

73. The component is focused on all those stakeholders that will be ultimately responsible for the planning, identification, selection, implementation and monitoring of sub-projects. The component will include the activities and actions necessary to strengthen the different stages of the project cycle as described below (see also Table in Attachment 2 at the end of this Annex).

74. **Planning Stage**. Technical assistance and capacity building activities will be focused on State Project Implementation Committees but will also benefit SENER (Planning and Management Team, PPMT) at the Federal level (see Annex 6 for a description of their roles). This subcomponent will include (a) provision of computer hardware and software (b) training in the use of GIS based project information systems, (c) measurement and data collection on renewable energy resources, and (d) training in

the use of planning and relevant modeling tools for rural electrification projects (e.g., HOMER).

75. **Selection of Sub-Projects**. Component III will build the capacity of not only SPICs, but also of other key participants including CFE, FIRCO and CDI (members of the TSMG as defined in Annex 6). The subcomponent includes the design of (a) an information campaign on off-grid renewable source based electricity services including the promotion of social and economic or productive activities, (b) a public consultation format for rural electrification projects adapted to the specific cultural and social characteristics of targeted communities (in line with CDI procedures), (c) a survey questionnaire to collect relevant social, environmental, technical and economic data on a sample of pre-selected projects, (d) guidelines for the preliminary description of sub-projects, and (e) a framework (manual and rules) for the final selection of sub-projects (this framework will integrate the necessary considerations for consistency with the impact evaluation method proposed as described in Annex 17).

76. **Preparation Stage**. To strengthen the capacity of key stakeholders in charge of the preparation stage of sub-projects, technical assistance activities will include the design of: (a) guidelines to ensure minimum quality technical standards of sub-project installations, (b) guidelines and/or models for economic and financial analysis of sub-projects, (c) a framework (guidelines, format and rules) for public consultation methods and activities with communities, and (d) service delivery models and bidding packages and processes. Capacity building activities will mainly target technical units of SPICs and State and Municipal representatives of CDI, CFE and FIRCO.

77. **Construction Stage.** To ensure a harmony during construction stage, technical assistance activities will include: (a) design manual with rules for contractors (social, environmental, cultural property chance finding procedures, and other) and, (b) design of guidelines for roles and compensation of community participants. Capacity building activities will mainly target electricity service providers and CDI/CFE/FIRCO extension agents.

78. **Implementation Stage**. To strengthen the capacity of key stakeholders to support the implementation stage of sub-projects, technical assistance activities will include: (a) training to community leaders, local technicians or extension agents and, (b) design of guidelines and procedures for inspections, repair, metering, billing and collection.

79. **Monitoring and Evaluation.** Technical assistance activities will include (a) design of manuals and procedures for monitoring activities and, (b) design surveys for impact evaluation assessment. It is expected that the CFE will monitor the performance quality of installations on a biannual basis.

(ii) Promotion of Renewable Source Based off-grid Electrification Projects

80. Annex I contains an analysis of the barriers to the introduction of renewable energy in Mexico. This sub-component includes actions to remove a number of barriers

preventing the introduction of renewable energy in rural electrification initiatives including: (a) measurement and data collection for evaluation of renewable energy resources, (b) capacity building of key stakeholders for renewable energy development and technology transfer, (c) design of an information campaign on off-grid renewable source based electricity services including promotion of social and economic or productive activities and, (d) development of public awareness and promotional printed material on renewable, clean and sustainable integrated energy services.

(iii) Promotion of Private Sector Participation

81. This component aims to catalyze the participation of the private sector in new off-grid rural electrification projects. The activities include: (a) definition of legal and regulatory measures for the provision of capital cost subsidies to private sector service providers, (b) legal definition of private-public partnerships and development of model contractual agreements, (c) review and design of financial incentives and applicability in Mexico (e.g., tailored credits, targeted co-financing grants, partial risk guarantees vi-a-vis the development and capabilities of microfinance institutions) and, (d) business development activities for identifying potential private investors in electrification.

82. In particular, the design of output based subsidy schemes and the terms and conditions specified in bidding documents will consider the lesson learned so far in Bank projects that have already introduced novel, medium term service contracts for solar and wind home systems (e.g., Bolivia), for instance:[57]

- Subsidy tender design require in-depth analyses as it has a direct influence on private sector participation
- Room for creativity in OBA design and bidding preparation leads to efficiency gains when a balance between the following elements is introduced and fined-tuned throughout the consultation process with the potential bidders: (i) output and input requirements (i.e., data provided, data required), (ii) room for creativity and binding specifications, and (iii) information dissemination
- The transparency and reliability of bidding process is of fundamental importance to attract private sector participation
- Careful tender design attracts the participation of both local and international bidders and promotes the creation of strategic partnerships (e.g., area sizes are chosen small enough to attract the participation of local Small Medium Enterprises (SMEs), but at the same time a large number of areas can be included in a first bidding round to attract international bidders)
- Subsidy disbursement schedules are frequently the most debated issue in meetings with participant bidders, especially with local SMEs (who have more limited access to financing): disbursement schedules must balance the need to increase Government control (e.g., paying subsidies against

[57] Source: Reiche Killian. 2006. Bolivia Rural Access: Tendering Ouput-Based Subsidies for Energy and ICT- Final Draft, Working Paper.

performance as late as possible) with the limitations of provider's cash flows

- Whenever possible, minimize transaction costs by delegating project preparation activities (market and technical data, pre-feasibility/feasibility studies) to the bid winners or service providers.

83. *GEF Intervention in Component 3, US$ 3.75 million*: GEF resources allocated to this component will be mainly focused on actions and activities directly linked to the reduction of barriers to the development of renewable source based off-grid electrification initiatives.

D. Component 4. Co-Financing and Technical Assistance to Increase Productive Uses of Electricity (*Estimated Cost US$ 6.0 Million, US$ 1.25 Million from GEF, US$ 1.75 Million from IBRD, US$ 1.25 Million from GOM and 1.75 from the private sector*)

i) General Description of the Component

84. There is almost unanimous agreement that energy plays an important role in increasing productivity of enterprises and in improving livelihoods. In the context of rural areas, this generally implies productive use of energy for the provision of power for agricultural and small industrial or commercial uses. For example, motors are used to grind grain, operate power tools, irrigate farmland, process agricultural produce, and facilitate many commercial activities. Electric power can result in productivity gains and economic growth, thus transforming the underdeveloped rural landscape (if ancillary services such as market access, human and enterprise capacity, financial services, and resources/raw materials are available). From an electricity company point of view, productive uses are essential to establish the long term economic viability and sustainability of rural electrification.

85. Load factor and capacity utilization in rural areas of Mexico are generally low. Power demand peaks usually occur late in the evening while daytime loads are low, as electric power is mainly used for domestic power and appliances after around 6:00 pm (e.g., radio, TV). Typically, daytime loads are 30-50 percent of peak generation capacity.

86. Preliminary surveys of the population targeted by the project – municipalities of the Southern States of Mexico (Oaxaca, Chiapas, Guerrero and Veracruz) – show that communities to be electrified by the project are relatively small, comprising an average of 50-500 households. The majority of them are located in remote areas of the four States and poorly served by infrastructure such as roads and telecommunications. Many of the targeted communities currently live on small-scale agriculture and do not necessarily have the whole range of skills (technical, financial, organizational, and other) to start non-agricultural local businesses

87. Achieving increases in productive uses of electricity in rural areas confronts constraints on both the supply (electricity Service Company) and demand (enterprise)

sides. On the enterprise side these include: lack of knowledge, inadequate access to investment financing, lack of trained personnel, uncertainties regarding availability of raw materials, and other. On the electricity service company the following can be mentioned: problems with service quality (particularly outages and voltage fluctuations) delays in responding to business requests for connection and expansion of installed capacity, the lack of 24 hour service in some isolated systems, and an incentive structure that does not encourage the electricity service company staff to promote productive uses.

88. The objective of this component is two fold:

- Promote a more intense use of electricity while contributing to increase the number of social and productive activities and improve the utilization of electric supply infrastructure
- Engage the private sector to support the development of social and productive activities (i.e., community members, community associations or cooperatives or private companies)

89. The proposed approach for this component relies on providing cost-shared and targeted technical assistance to entrepreneurs, associations or communities in rural areas interested in expanding their businesses through the use of electric energy. The proposed approached is broadly one of capacity building. It is a marketing approach in the broadest sense – identifying target markets and segments, increasing awareness and skills, assisting potential productive users, user groups and communities to identify opportunities, barriers and solutions; working closely with the electricity service suppliers to easy access; and facilitating access to other necessary services including financing.

90. Being the financing one the major barriers to the development of this type of activities, the Project will maintain a fund to leverage this initiative in its pilot phase through co-financing of most promising activities in terms of their energy intensiveness, potential for social and economic development, potential for replication and entrepreneurial characteristics.

The component includes three main sub-components:

4.1) Technical assistance and capacity building activities associated with:

- The development of social or community projects (e.g., consumptive and social activities with development effects)
- The development of productive and economic activities
- Better access to micro-financing, better management of remittances
- Better understanding of financial schemes and preparation of business plans

4.2) Financing of social activities including:

- Consumptive and social activities with development effects (e.g., education, health)

4.3) Co-financing of economic and productive activities including:

- Profitable energy intensive productive activities
- Profitable energy intensive micro-business or entrepreneurial activities

91. Table 4.9 below provides a classification of different enabling and facilitating applications.

Table 4.9
Energy End-Uses and Productive Uses -- Enabling/Facilitating Applications

Enabling		Facilitating	
Links to Markets	*Social Functions*	*Domestic Uses*	*Communal Services*
- Cold Chains	-Education and Health	- Blending	- Water Supply
- Clean Water	- Refrigeration vaccines	- Grinding	- Grain Milling
- Small Shops	- Schools	- Sewing	- Food Preservation
- Eco-Tourism	- Radio Broadcasting	- Water Lifting	- Cattle Shepherding
- Process Facilities / workshops	- Dancing Parties	- Corn Shelling	- Rural Telephony
- Water pumping / irrigation	- Other	- Other	- Other

Note: applications in italics are considered universal applications with broad social/economic productivity benefits. Education and health have important productivity benefits which are often not described in local economic terms.

92. It is important to note that the Project will not co-finance economic or productive activities with the potential to derive in major environmental or social impacts (i.e., of the magnitude of a Category A project). Only those with minor impacts that can be easily prevented or mitigated will be taken into consideration.

93. The proposed component is in line with the Global Environmental Facility (GEF) and UN Food and Agricultural Organization (FAO) working definition of "productive uses of energy" which states "in the context of providing modern energy services in rural areas, a productive use of energy is one that involves the application of energy derived mainly from renewable resources to create goods and/or services directly or indirectly through the production of income and value."[58]

ii) Implementation Strategy of Component 4

94. Component 4 will aim at capacity development of micro-entrepreneurs, associations or communities in rural areas willing to create or expand their businesses or community services through a more intense use of energy. The project will start on a small scale to test viability, working with the newly electrified communities with the

[58] See White R. (2002), GEF-FAO Workshop on Productive Uses of Renewable Energy: Experiences, Strategies and Project Development, June 18-20.

most potential to take full advantage of the training. The following activities will be necessary:

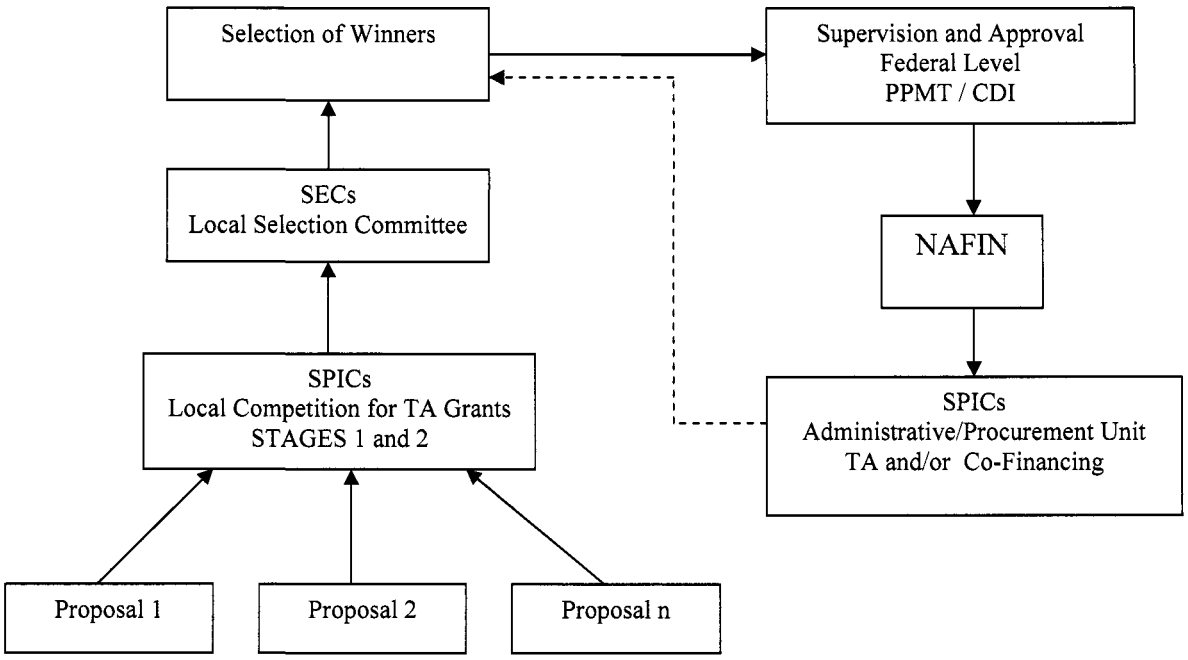
- Conduct diagnostic to screen for promising areas/communities with significant opportunities for increased productive uses of electricity where there are no electricity supply constraints
- Identify constraints to productive uses in these areas and develop approaches to mitigating the barriers
- Test them out in several marketing pilots, evaluate, adjust, reiterate, replicate

95. Given the remote areas to be targeted by the project and the extreme poverty of the communities to be electrified, the proposed component makes use of a two-stage scheme. During the **first stage**, the selected communities will benefit from training to enhance their technical, commercial and financial skills on how to profitably run a micro-business. Capacity building for economic and productive activities will be tailored to the resources of the region, for instance: eco-tourism (national parks, hotels for trail paths, guided tours, etc.), flower market (especially orchids), spring water commercialization and handicrafts.

96. **Stage two** of this initiative is a pilot program that will be implemented in a few pre-selected communities. Once a target community has electricity and stage one capacity building has raised awareness on the key elements of scaling up productive activities; individuals or groups of individuals will be able to bid for additional technical support and if necessary for co-financing to be specifically directed toward increasing their productive use of renewable energy.

97. The provision of technical assistance and co-financing for rural activities in this second pilot stage will be demand-driven and cost-shared. Communities and individuals benefiting from the financial support to finance their business initiatives will be selected through a competitive bidding process in each of the Mexican States targeted by the project. With the help of local project facilitators (e.g., NGOs), bidders will have to present their business plans, including the type of technical assistance required to start / improve their businesses or socially productive activity, the amount to be financed, and their own contribution to the endeavor. The costs of the technical support as well as the financing will be co-shared between the project sponsors and the beneficiaries, according to their financial capacities.

Figure 4.1 Competitive Process for TA and Co-Financing



98. In some instances it is projected that remittances - which are a large source of income for many of these communities - will be a source of capital for the productive activities. In 2005 Mexican immigrants in the United States sent an estimated $21.8 billion dollars to their relatives in Mexico.[59] For some countries in Latin America remittances are larger than ODA and even FDI. However, while these poor communities will receive advice on how to best invest part of their remittance income for productive activities, it is unreasonable to expect them to risk all (much of which will be needed to meet basic needs.) Therefore the communities will need advice not just on investing remittances effectively but also leveraging those funds by borrowing through access to micro financing. The combination will provide a stronger platform to start a socially productive activity (be it a micro business or community project). Further examples of renewable energy projects that have also provided technical assistance for generation of community productive activities are provided in Attachment 3 of this Annex.

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[59] Close to Home: The Development Impact of Remittances in Latin America. Pablo Fajnzylber and J. Humberto López. The World Bank, 2006. Report available at: http://web.worldbank.org/WBSITE/EXTERNAL/COUNTRIES/LACEXT/EXTLACOFFICEOFCE/0,,contentMDK:21105202~pagePK:64168445~piPK:64168309~theSitePK:870893,00.html

iii) Possible Participation of Private Companies through Socially Responsible Programs

99. Preliminary discussions indicate there is potential private sector interest in the project. It is planned that companies will be involved in all stages of the project through: (1) contributing to the project design and training sessions with their expertise; (2) potentially co-financing the implementation of the social and productive activities, and (3) including relevant newly created micro-businesses in their supply chains.

100. During the design phase, the private sector will be consulted to help shape the component. These consultations will help choose the most promising activities within the communities. Their involvement in the second phase will also be fundamental, however at this point it will become necessary to differentiate companies interested in participating through a philanthropic contribution and companies interested in participating through their corporate responsibility programs.

101. Companies that wish to contribute to this program through philanthropy will initially be asked to contribute to the common fund for selected projects – also financed by the program - that will help co-finance the successful proposals for productive or social activities selected in the bidding process. Companies interested in participating through their corporate responsibility program might contribute in other forms that complement their core operations and will potentially source from rural producers through their supply chains.

102. See Attachment 4 in this Annex for a list of companies consulted and the main results of the meetings.

The implementation of the component would require:

- Having the SPICs lead the effort with the support of an external organization (either an NGO or a private company) to coordinate/supervise the capacity building activities, and NAFIN for the administration of the funds
- Engaging locally based implementers as much as possible, with guidance and support from SPICs and NGOs
- Conducting the necessary participatory approaches to maximize social and economic benefits and minimize the possibility of conflicts
- Providing the beneficiaries key decision making authority during the various steps of the process – including design and implementation – and on all different dimensions (e.g., technical, economic, financial).

103. Potential non-private sector partners for Stage One training delivery include:

1. SEDESOL through their Micro Regions program which has the objective of supporting the development of rural regions through programs with an impact in social, economic and human development.

2. E-Mexico and Community Learning Centers that could support the training process by providing access to their web based training material as well as guidance from the center's promoters. The establishment of community centers in target communities is a socially productive activity that the project will encourage.
3. Inter-American Development Bank through their "Base of the Pyramid" project which consists of a $2 million grant that will help Mexican micro, small and medium-size enterprises operating at the "base of the pyramid" meet market opportunities to provide better products and services to low-income consumers.
4. The Young Americas Business Trust (YABT) from the OAS can also be an important partner in the project, by supporting youth entrepreneurship training.

104. The conditions for the Stage Two component may not yet be in place in the targeted communities; however several initiatives exist in the four States which could be linked to the present project.[60] Preliminary talks with financial institutions targeting rural micro-entrepreneurs such as *Compartamos* and the *Associacion Mexicana de Uniones de Credito del Sector Rural* (AMUCCS) revealed a positive interest for the initiative of linking provision of energy services with productive activities. It is expected that at an advance stage of the technical assistance, financial intermediaries would be attracted by the possibility of financing promising entrepreneurial activities in remote areas of the country. FinComun is another possibility to provide micro financing, they are a socially responsible enterprise which provide community development micro credit and are associated with the Women's World Banking.

105. The network of hometown associations (HTA) in USA will be an important partner for coordinating training on productive activities. CEMEX and *Paisano* Program of the Mexican government would also be useful partners given their already extensive experience managing remittances. BANSEFI, a government-owned bank with a comprehensive technological network linking small credit unions, could provide lower cost remittance services as well as additional financial services such as savings and loans.

106. *GEF Intervention in Component 4: US$ 1.25 million*: The portion of the GEF grant allocated to this component will only support capacity building for the development of social, productive and economic activities with the potential to increase daytime electricity loads and lower global and local environmental impacts (e.g., lower emission reductions through displacement of fossil fuel based energy sources).

E. Component 5. Project Management *(Estimated Cost US$ 7.51 Million, US$ 1.50Million from GEF, US$ 2.37 Million from IBRD, US$ 3.64 Million GOM)*

[60] See Didoni (2005), "Microfinance and Rural Electrification in Mexico: Consulting report" for a detailed description of the local microfinance industry and the reasons why the direct involvement of financial intermediaries has not been taken into consideration.

107. This component will support the overall management of the proposed Program Planning and Management Team (PPMT) and the State Project Implementation Committees (SPICs) as well as their technical and social and environmental oversight teams. It is expected that the actual administration of the GEF and IBRD resources will be carried out by *Nacional Financiera* (NAFIN).

Attachment 1 to Annex 4

Table Attachment 1 Matrix Summarizing Service Delivery Models and Features by Technology	
Service delivery model "A"	**Service delivery model "B"**
PV Home Systems	
• Program conducts willingness to pay (WTP), community and user studies • Functional requirements introduced as evaluation criteria • BOTT contracts are bid out • Bidders conducts due diligence and submit bids • Contracts assigned under least subsidy parameter • Winners train local technicians • Program monitors and complements training • Systems transferred to users after 1 – 3 years	
Wind home or Multiple Home Systems	
• Program prepares resource, WTP, community and user studies • Some users are grouped in clusters or mini-grids • Functional requirements introduced as evaluation criteria • BOTT contracts are bid out • Bidders conducts due diligence and submit bids • Contracts assigned under least subsidy parameters • Winners train local technicians • Program monitors and complements training • Systems are transferred to users after 1 – 3 years	
Hydro Based Systems	
	• Program prepares resource, demand, WTP and community studies • Users grouped in mini-grids and as clients of battery charging station • Community organizations are developed for the commercial tasks • Functional requirements are introduced as evaluation criteria • BOTT contracts are bid out • Bidders conduct due diligence and submit bids • Contracts assigned under least subsidy parameters • Winners engage community organization for commercial tasks • Program monitors and gives complementary training • Systems are transferred to users after 3 – 5 years, perhaps more
	• Program prepares resource, demand, WTP and community studies

	• Users grouped in mini-grids or as clients of battery charging stations • Community organization developed for commercial tasks • Functional requirements introduced as evaluation criteria • BOTT contracts are bid out • Bidders conduct due diligence and submit bids • Contracts assigned under least subsidy parameters • Winners engage community organization for commercial tasks • Program monitors and complements training • Systems are transferred to users after 3 – 5 years, maybe more
Diesel Based Grids and Diesel Hybrids	
	• Program prepares resource, demand and WTP studies • Users grouped in mini-grids or as battery charging station clients • Community organization developed for commercial tasks • Functional requirements introduced as evaluation criteria • BOTT contracts are bid out • Bidders conduct due diligence and submit bids • Contracts assigned under least subsidy parameters • Winners engage community organization for commercial tasks • Program monitors and complements training • Systems are transferred to users after 5 – 10 years or not at all

Attachment 2 to Annex 4

TABLE ATTACHMENT 2. TECHNICAL ASSISTANCE NEEDS AT DIFFERENT STAGES OF PROJECT CYCLE		
PROJECT CYCLE ACTIVITIES	**RESPONSIBLE AGENTS**	**TA / CAPACITY BUILDING**
1. Planning		
1.1.General	SPICs	Computer hardware and software for SPICs
1.2. Reliable renewable energy data	CFE, IIE, Academia	Measurement and data collection on renewable energy resources
1.1 Data Base and Information System Organization	Technical Unit, SPICs	Development and Implementation of a GIS-Based Project Information System State Level
1.2 Evaluation of Least Cost Technology Options	Technical Unit, SPICs	Planning and Modeling Tools (HOMER, other)
1.3 Pre-selection of sub-projects	SPICs	Develop Criteria
2. Selection of Sub-projects		
2.1 Information Campaign	SPICs, TSMG	Design of Information Campaign
2.2 Preliminary Targeted Social Consultation	SPICs, TSMG	Design Public Consultation Format adapted to specific cultural and social characteristics of targeted communities, design survey
2.3 Preliminary Project Description (Technical/Social/Environmental, other)	Technical Unit, SPICs Private Sector	Design Guidelines and Format
2.4 Final Selection of Sub-Projects	SPICs	Design Manual (Integrate Impact Evaluation Methods)
3. Preparation Stage (depth of studies varies depending on technology)		
3.1 Pre-feasibility, Feasibility, Engineering Design	Technical Unit, SPICs Private Sector	Design Technical Guidelines per Type of Sub-project
3.2 Economic and Financial Scheme	SPICs Private Sector	Design guidelines with methods / Training Training on micro-financing / windows
3.3.Bidding Public Social Consultation	SPICs	Design bidding package
3.3 Public Consultation	SPICs, TSMG Private Sector	Design Guidelines: methods, format
3.5 Service Delivery Models	SPICs	Design Detailed Models
3.6 Bidding Service Delivery	SPICs	Bidding Documents / Processes
4. Construction Stage		
4.1 Prepare program of activities for construction stage	Electricity Service Providers	Design manual with rules for contractors (social, environmental, cultural property chance finding procedures, etc.)
4.2 Community Participation	Community Members	Design Guidelines for roles and compensation
5. Implementation Stage		

5.1 Service Delivery	Electricity Service Providers	-
5.2 Operation and Maintenance	Electricity Service Providers and Community Extension Agent	Training to Community Extension Agents/Local Technician
5.3 Billing Collection	Electricity Service Providers Private Sector or Community designated leader	Design Guidelines (Tariff vis-à-vis Subsidy)
6. Monitoring and Evaluation		
6.1 Monitoring Activities (biannual)	TSMG	Design manual
6.2 Impact Evaluation Survey (annual)	PPMT	Design survey

Attachment 3 to Annex 4 Micro financing and Remittances

BOX 1.1: INTER-AMERICAN DEVELOPMENT BANK 'BASE OF THE PYRAMID' PROJECT IN MEXICO

A $2 million grant from the IDB will help finance a project to involve Mexican micro, small and medium-size enterprises in **"base of the pyramid"** market opportunities to provide better products and services to low-income consumers.

The project draws from a concept of University of Michigan business school professor **C. K. Prahalad**, author of *The Fortune at the Bottom of the Pyramid: Eradicating Poverty through Profits*. In this book Prof. Prahalad describes cases of companies that are successfully serving low-income people, a market of four billion potential consumers worldwide, by developing new business models and strategies. This base of the pyramid represents an important opportunity for private sector growth and innovation, responding to the needs of poor households.

By leveraging the advantages of smaller firms – their proximity to clients, vast distribution networks and knowledge of local needs and culture – the project will involve micro, small and medium-size enterprises in business ventures with larger companies to supply the base of the pyramid market in Mexico, where some 55 million people live on less than three dollars a day. Among the sectors where innovative, lower cost and better quality goods and services are needed, and therefore could be developed for low-income Mexican consumers, are housing and construction, food processing and distribution, energy, water, recycling and waste disposal.

The MIF's resources will contribute to the development of project plans for new products and services, as well as provide assistance to ventures backed by sponsoring companies, associations of small businesses or NGOs interested in working in the base of the pyramid market. Through the project's competitive grant component, the MIF will finance up to 50 percent of the cost of eligible initiatives, which will range from $50,000 to $200,000. Venture sponsors will make matching contributions. CCE will provide $2 million in counterpart resources, of which at least half will be in cash.
Complete press release available at: http://www.iadb.org/NEWS/Display/PRView.cfm?PR_Num=291_05&Language=English

BOX 1.2: CHANNELING THE REMITTANCE FLOOD

- There are 11 million Mexicans living in the U.S. -- some legally and some illegally -- who are expected to send a record $20 billion to Mexico in 2005, a 20% increase over last year. Mexico is the world's largest recipient of "remittances," or funds sent home by migrant workers abroad. As a whole, Latin America and the Caribbean have an estimated 25 million citizens living abroad, of whom some 20 million send home $2,500 a year on average. The region is set to receive $52 billion this year, up from $45 billion in 2004.
- These figures are more than the region receives annually in foreign direct investment and foreign aid combined. The importance of the inflows cannot be exaggerated. Throughout Latin America, the remittances reach poor rural areas that get little development assistance. The money flows provide such basic necessities as food, clothing, and schooling.
- For years, governments have sought to leverage the remittances to boost economic development, so that future generations of Latin Americans will not have to migrate to find economic well-being. In Mexico, the government has helped communities refurbish schools, pave streets, and build small factories by offering matching funds to some 1,500 "hometown associations" formed by Mexicans in the U.S. Governments and multilateral organizations such as the Inter-American Development Bank are trying to expand the impact of remittances by encouraging recipients to save money and build credit histories, so they can get mortgages and small-business loans. Today, fewer than 10% of remittance recipients have bank accounts, largely because traditional banks haven't been interested in small clients.
- Text extracted from article "Channeling the Remittance Flood" by Geri Smith. The complete article is available online at: *http://www.businessweek.com/bwdaily/dnflash/dec2005/nf20051228_4272.htm?campaign_id=rss_daily*

Attachment 4 to Annex 4

Results of Preliminary Meetings with Private Sector Representatives

Companies contacted and interviewed in Mexico:

- Wal-Mart
- Bimbo
- Grupo Salinas
- Microsoft
- PEPSICO, Gamesa-Quaker
- CEMEX
- Grupo ALFA
- Procter and Gamble

Some of the main findings during the preliminary meetings are:

- Companies want to be involved in the design process
- Productive projects have to match their core business activities as well as their existent Corporate Social Responsibility Programs
- All visited firms are interested, but need business like proposals and clearer guidelines on how they can get engaged
- It will be important to differentiate between philanthropic contributions (largely financial support for local projects) and corporate responsibility projects (linking into the value chain).
- Issue of how to manage corporate involvement: there is the need to develop common procedures
- Offer a clear value added for the companies: a) capacity building for corporations (building strong relations with local stakeholders), b) recognition in the project publicity materials, c) recognition as socially responsible firms, d) value chains – potential new suppliers/consumers, e) market development opportunities for their core business in the communities, f) partnership in a project with the WB and Mexican government.
- Invite more companies whose core business is related to energy like GE
- Invite IFC client companies

Annex 5. Project Costs

TABLE 5.1 ESTIMATED PROJECT COSTS BY COMPONENT						
		US$ Million				
COMPONENT		GOM	IBRD	GEF	Private	Total
I Policy, Regulation and Strategy						
1.1	1.1.1 Review Off-Grid Electricity Tariff and Subsidy Schemes	0.050				0.050
	1.1.2.Design policy, legal and/or regulatory frame (as required)	0.200	0.200	0.400		0.800
1.2	1.2.1 Review Ownership Rights and Schemes	0.050				0.050
	1.2.2 Design policy, legal and/or regulatory frame (as required)	0.200	0.200	0.400		0.800
1.3	Design Conflict Resolution Mechanism (All Levels)	0.050	0.100			0.150
1.4	Design incentives to promote renewable source based off-grid projects		0.200	0.050		0.250
1.5	Develop technical specifications, manuals and standards RETS	0.525	0.475	0.500		1.500
1.6	Develop methodological guidelines/tools social consultation	0.500	0			0.500
	TOTAL	**1.575**	**1.175**	**1.350**		**4.100**
II Rural Electrification Subprojects (Investment and OBA subsidies)						
2.1	SHS / Photovoltaics Market Development	33.750	2.830	4.190	4.530	45.300
2.2	Wind Market Development	8.600		0.850	1.050	10.500
2.3	Microhydros and Microhydros with mini-grids	2.140	4.060		0.680	6.880
2.4	Biomass Based Projects	0.650		0.070		0.720
2.5	Diesel/Diesel Hybrids	2.080		0.530	0.280	2.890
2.6	Efficient stoves (Improved Wood Stoves)	0.500				0.500
2.7	Social Consultation (Municipalities + Communities)	1.000		0.125		1.125
2.8	Conflict Resolution Activities	0.500				0.500
	TOTAL	**49.220**	**6.890**	**5.765**	**6.540**	**68.415**
III Technical Assistance for Rural Electrification						
3.1	Computer hardware and software/modeling tools planning stage		0.010			0.010
3.2	Measurement, data collection on renewable energy resources	0.200	0.400	1.000		1.600
3.3	Capacity building to PPMT and SPICs to support all project stages	1.000	0.300	0.700		2.000
3.4	Design and implementation communication strategy, information campaign, social consultation (including didactic materials)	0.500		0.500		1.000
3.5	Pre-feasibility, Feasibility, Engineering of Selected Subprojects	0.250	0.500	0.500		1.250

TABLE 5.1 ESTIMATED PROJECT COSTS BY COMPONENT						
COMPONENT		US$ Million				
		GOM	IBRD	GEF	Private	Total
3.6	Design model bidding packages, incentives, service delivery models	0.100	0.200	0.300		0.600
3.7	Permanent training to community extension agents	0.500	0.300	0.500	0.200	1.500
3.8	Impact Evaluation (surveys / analysis)	0.450	0.300	0.500		1.250
3.9	Monitoring Activities (technical / social / environmental)	1.000	0.500	0.750		2.250
3.10	Technical, Social and Environmental Oversight	0.315	0.300	0.385		1.000
	TOTAL	**4.315**	**2.81**	**5.135**	**0.200**	**12.460**
IV Technical Assistance to Increase Social and Economic/Productive Uses of Electricity						
4.1	Capacity building social and productive activities / micro-businesses	0.250		1.250		1.500
4.2	Financing of social activities (consumptive with development effect)	1.000				1.000
4.3	Investments in Micro-Businesses (entrepreneurial activities)		1.750		1.750	3.500
	TOTAL	**1.250**	**1.750**	**1.250**	**1.750**	**6.000**
V Project Management Five Year Period						
5.1	Federal Level: Management, Procurement, Financial, Technical	0.500	0.875	0.850		2.225
5.2	State Level: Management, Procurement, Financial, Technical	1.250	1.500	0.200		2.950
5.3	Legal, Fiduciary Management including Fee for Administration of Project Account	1.890		0.450		2.340
	TOTAL	**3.640**	**2.375**	**1.500**		**7.515**
TOTAL		**60.000**	**15.000**	**15.000**	**8.490**	**98.490**

Annex 6. Implementation Arrangements

A. Introduction

1. Institutional and implementation arrangements for rural electrification projects not connected to the grid are inherently complex and represent one of the most important challenges for ensuring the sustainability of high quality off grid electricity services. For the proposed project, and considering the specific fiscal, economic, and social conditions prevailing in Mexico, these arrangements necessarily involve the participation of various stakeholders including: (i) government entities at the Federal, State and Municipal level, (ii) institutions and commissions that play important roles in supporting project implementation needs with specific expertise (e.g., technical supervision, social consultation, other), (iii) communities, (iv) potential private and public sector energy service providers (ESCOs) as well as equipment suppliers, (v) NGOs, and (vi) international partners (e.g., GVEP, USAID).

2. The institutional arrangements for project implementation are characterized by an organizational structure that requires the participation of a national and sub-national coalition of stakeholders through cross-sectoral (horizontal) and inter-governmental linkages (vertical). Every effort has been made to design simple but robust institutional and implementation structures. Indeed, the replication of the program and its long term impact will to a large extent depend on how well the program is rooted institutionally at the Federal, State and local levels.

3. The proposed arrangements are the result of various consultant assessments which included field visits, workshops and expert interviews in Mexico with all key potential participants.[61] In addition, the task team had numerous meetings with the SENER, NAFIN, CDI, State governments and all relevant key government institutions to validate the final implementation arrangements.

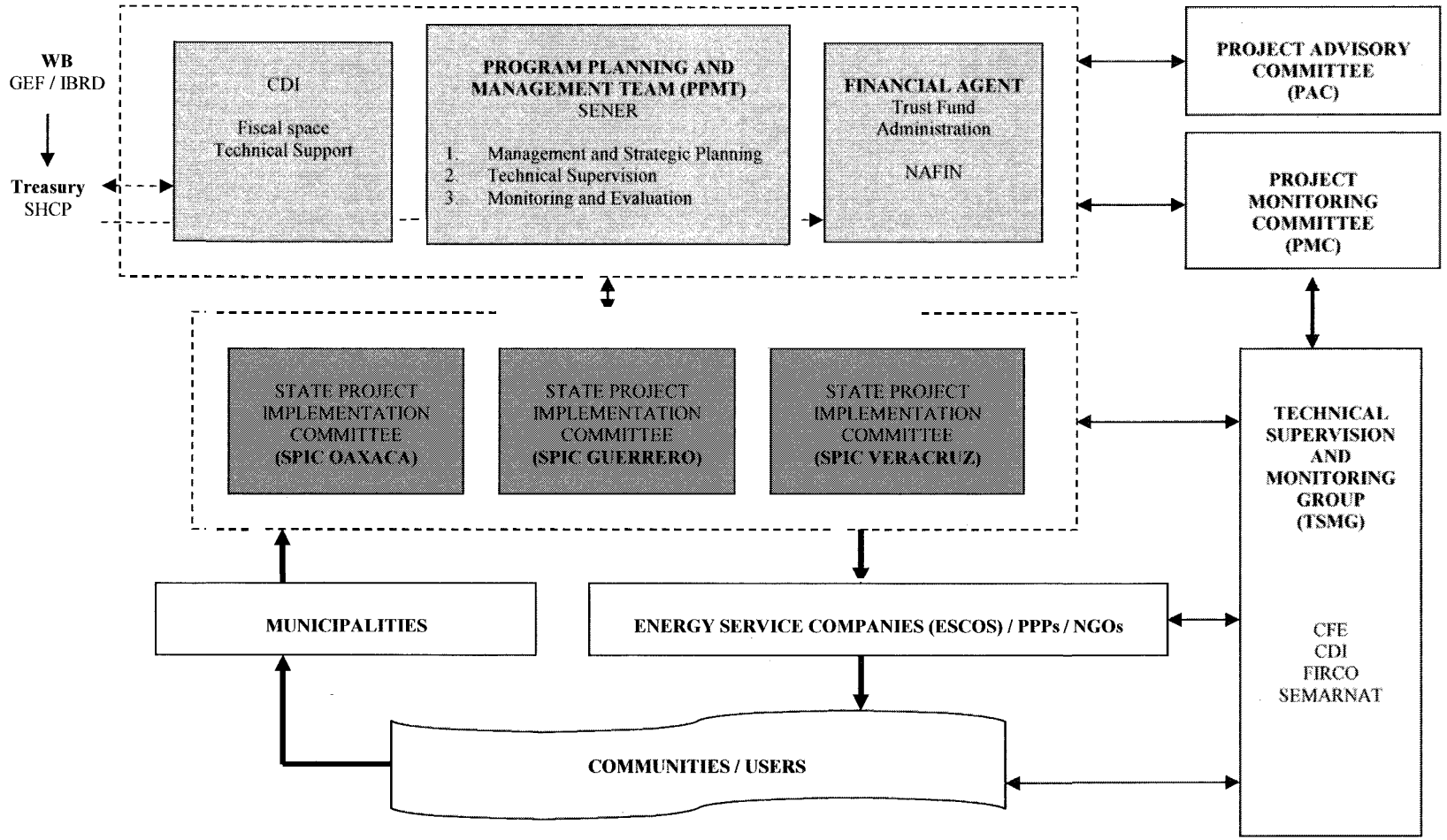
B. General Institutional Structure

4. The organizational structure agreed for the execution and implementation of the Project within the Government network is supported by agents whose original assigned roles and activities are already in line with the national strategic objective of increasing access to electricity in rural areas. Rather than creating a new institutional structure, the Project is designed to strengthen and streamline the functions of government units already in place. The Project will be implemented over a five year period, starting May 2007.

Figure 6.1 below depicts the general project organizational structure.

[61] These assessments include: (1) Intermediate Technology Consultants (ITC). 2005. Institutional Structure for the Development of Rural Electrification Projects in Mexico; sponsored by GVEP, (2) Santa Maria, Benjamin. 2006. Proposal for the Institutional and Implementation Arrangements Project, sponsored by GVEP, (3) Villagran, Eduardo. 2006. Service Delivery Models for the Program, jointly sponsored by World Bank and GVEP. These three documents are included in the Project files.

Figure 6.1 General O anizational Structure



5. At the **Federal level**, the project will be implemented by the Ministry of Energy (SENER) in coordination with the National Financial Agent (NAFIN). Two committees will be integrated to support project execution and implementation at this level, a Project Advisory Committee (PAC) and a Project Monitoring Committee (PMC). Meetings with the PAC and PMC will be called periodically by SENER.

6. *Program Planning and Management Team (PPMT).* At SENER, a PPMT has been created to plan, manage and supervise the implementation of the overall rural electrification program. The PPMT will function under the Vice-Ministry for Energy Planning and Technology Development (*Subsecretaria de Planeacion Energetica y Desarrollo Tecnologico*) and presided by the Director General for Research, Technology Development and Environment (*Direccion General de Investigacion, Desarrollo Tecnologico y Medio Ambiente*). The PPMT will be composed of:

- A Project Manager, who will be responsible for the strategic planning, management and coordination of project activities horizontally and vertically across States and participant institutions. In particular, the Project Manager will guide the activities of State Project Implementation Committees (SPICs), supervise the overall performance of the project and encourage synergies and complementarities among the various Federal programs focusing on rural development

- A Technical Unit, which will provide technical support and guidance to the overall program, promote workshops and training sessions benefiting stakeholders at the Federal, State and Municipal Levels, and supervise bidding processes and the overall technical efficiency of the program.

- An Administrative Unit, which will liaise with NAFIN when the preparation of terms of reference and bidding processes require the participation of the PPMT.

7. With the support of SENER as the executing agency for resources allocation and NAFIN as an executing agency for overall resources administration, the PPMT will retain the responsibility of strategic planning functions (e.g., planning, programming, technical oversight, promotion, inter-governmental coordination) relying –to the extent of possible- on internal human resources. However when required the PPMT will outsource specific activities that may require additional skills or expertise.

8. There will be various implementing entities:

- *National Financial Institution (NAFIN).* NAFIN has been designated as the implementing entity and the financial agent. The former implies the financial management operation at the national level as well as the coordination with the participating States. The latter implies that NAFIN will be responsible for disbursements (and reimbursements), processing, management of the Designated

Account, project reporting, coordination of annual audits, and flow of funds at the (including transfer to the National Treasury, TESOFE). The administration and disbursement of the resources will be executed in accordance with the conditions established in the loan and grant legal agreements signed between the GOM (SHCP) and the World Bank, the co-financing agreements with States and Municipalities, and the Project's Operational Manual.

- *Indigenous People Development Commission (CDI).* CDI will actively participate in supporting the project implementation, integrating a technical team to coordinate activities with SENER, and aligning programmatic efforts aimed at rural electrification. CDI has signed a cooperation agreement with SENER with commitments that include the opening of the fiscal space necessary to accommodate the IBRD loan and if necessary the GEF grant.

- *Secretariat of Social Development (SEDESOL).* SEDESOL will support the project technically and financially at the level of the Municipalities. A formal cooperation agreement has been signed with SENER that establishes the commitments set forth by SEDESOL to support the Program.

- *Project Advisory Committee (PAC).* Given the number of institutions with functions in rural development and other interrelated dimensions such as environment, education and health, the Project will have an Advisory Committee. The PAC will be integrated by representatives of Treasury (SHCP), the Ministry of Energy (SENER), the Indigenous People Development Commission (CDI), The Ministry of Agriculture and Rural Development (SAGARPA, FIRCO Program), Ministry of Environment (SEMARNAT), Ministry of Social Development (SEDESOL), Federal Electricity Commission (CFE), and when necessary, the academia. Ministerial representatives will meet twice a year to discuss and streamline programmatic initiatives and promote synergies. One of the main tasks of the PAC is to ensure an efficient public expenditure exercise and avoid the overlapping of programs and actions. This will help the coordination with States, especially with regard to legal agreements signed for the co-financing of rural development programs with social funds (*Ramo 33*). Throughout the year the PAC will meet periodically to review progress in rural electrification and ensure consistency and complementarities among different public and private initiatives. These meetings will be called and led by SENER. The PAC will meet at least once before the Ministries and other government entities submit their annual budgetary programs for approval of SHCP and the Congress.

- *Project Monitoring Committee (PMC).* The PMC will be presided by the Ministry of Energy (SENER) through the PPMT and integrated by representatives of CRE (Energy Regulatory Commission), CDI (Indigenous People Development Committee) and CFE (Federal Electricity Commission). The PMC will monitor Project targets and performance – which will be reported by the PPMT with information from the TSMG and SPICs – and review the results of independent impact evaluation assessments

9. At the **State level,** the project will be executed by the State Project Implementation Committees (SPICs) with the support of the PPMT and the TSMG (i.e., technical networks being operated in the field by CFE, FIRCO and CDI). The functions of these entities are described below.

- *State Project Implementation Committees (SPICs).* SPICs function within the organic structure of State Governments (SGs). The SPICs will be responsible for the planning, programming and implementation of the Project at the State Level. These committees will be integrated by a Project Manager, a Technical Team and an Administrative, Financial and Procurement Unit (AFPU). The SPICs will be mainly responsible for:

  - Programming project co-financing arrangements in their annual budgetary allocation
  - Promoting the program (e.g., launch promotional campaigns; organize informative meetings with municipal and community leaders, etc.)
  - Prioritizing and selecting sub-projects based on eligibility criteria and transparent procedures (see Annex 4 for a description of eligibility criteria)
  - Supervising public consultations at the municipal and community levels to ensure the implementation of a demand-driven approach
  - Conducting technical characterization of eligible sub-projects with the support of the TSMG, consultants and when possible the academia.
  - Programming annual electrification works
  - Characterizing packages of regional sub-projects and launching bidding processes for regional service delivery
  - With the support of the TSMG, monitoring service quality and the performance of service delivery companies

10. The SPICs will operate in coordination with the State Energy Committees (SECs) and the Technical Supervision and Monitoring Group (TSMG, networks of extension agents, technical experts and social specialists). Figure 2 shows the general organizational arrangements and institutional structure for project execution at State Level.

- *State Energy Committees (SEC).* The SECs are committees mainly integrated by representatives of the State Planning Body (COPLADE), the State Secretariat of Finances (SSF), the State Secretariat of Economy (SSE) and representatives of Municipal Governments. The SECs will organize working groups to discuss periodically, together with the SPICs the different aspects associated with the implementation of the program (e.g., planning at the municipal and community levels, complementarities among programs and developmental initiatives, monitoring and supervision, etc.). As required, the SECs will invite members of the TSMG to discuss execution performance and field issues. The SECs will be mainly responsible for approving the decisions taken by SPICs, providing general advice and overseeing project execution activities.

- *Technical Supervision and Monitoring Group (TSMG).* The TSMG will be composed of representatives of the networks of local technicians and/or specialists (*delegaciones*) functioning under CDI, CFE, FIRCO and SEDESOL[62]. Selected local technicians (e.g., social specialists, electrification specialists) will retain the responsibility of monitoring the performance of project at the community level, making sure that a) the energy service providers, private local technicians (i.e., extension agents in charge of repair, metering and billing collection) as well as households are operating the off-grid systems in a sustainable and technically appropriate way and b) communities are appropriately consulted and trained.

- Members of the TSMG (preferably the institution entrusted by the government to replicate and expand the Program in the future) will take on the long term technical supervision and the back stopping role necessary to ensure the sustainability of the program after the service provision contract is completed.

Municipalities

11. Municipalities are local governments run by Councils, headed by popularly elected representatives, who assist localities within its jurisdiction in designated areas of development. Municipal governments will participate by undertaking the following responsibilities:

- Programming project co-financing arrangements in their annual budgetary allocation considering the number of eligible communities that have been chosen and pipelined for electrification by the SPIC
- Supporting and complementing the activities associated with the promotional and information campaign launched by the SPIC
- Conducting periodic public consultations with communities that exhibit potential for eligibility to encourage their interest in off-grid electrification alternatives.

Municipal representatives will participate in SECs working sessions and decisions.

Communities

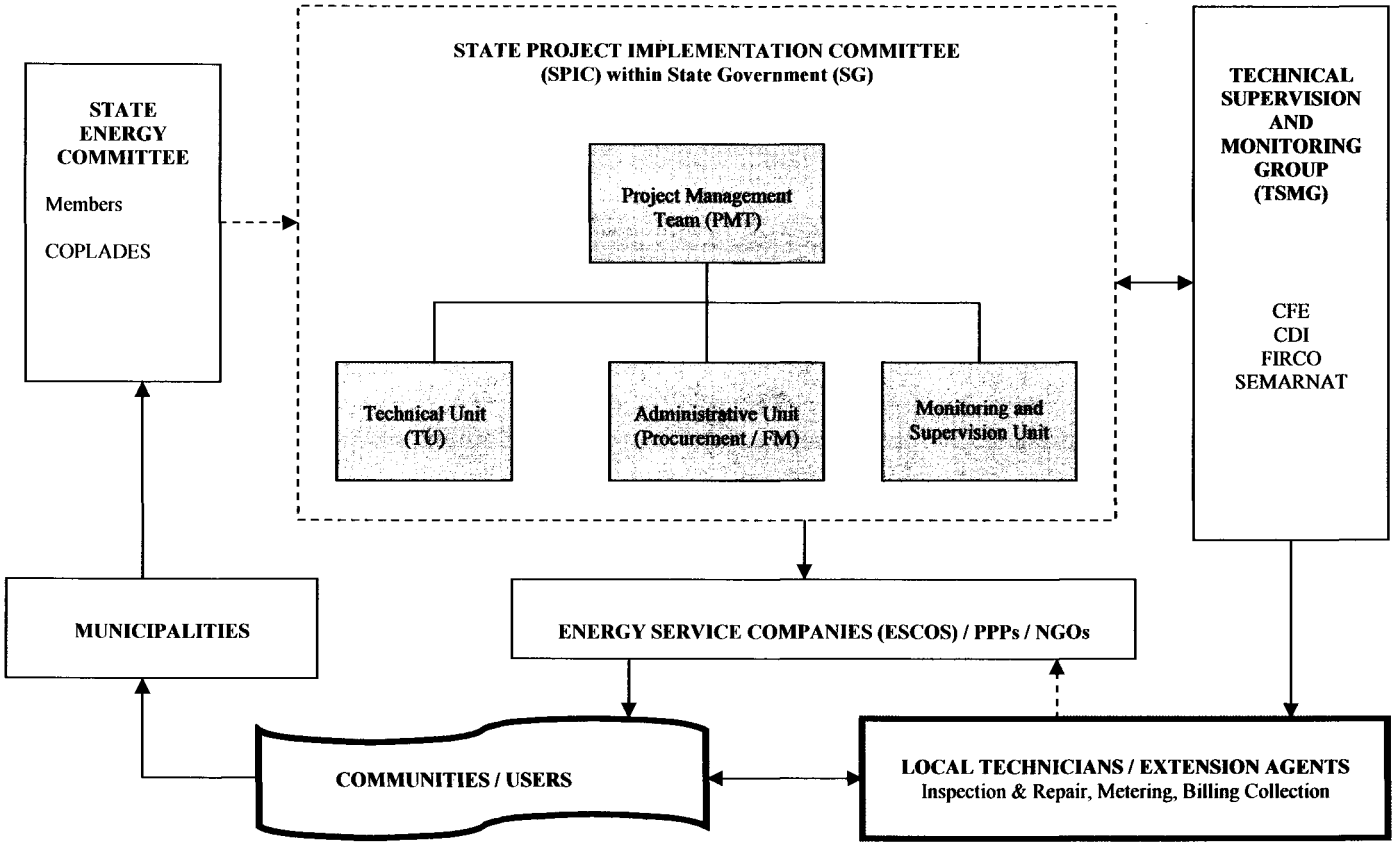
12. The project targets communities or localities in the range of 50 to 500 households. The process of selection of sub-projects is based on a community demand driven approach. As described in Annex 4, proposed sub-projects will be considered eligible only if the community explicitly expresses interest and demands the off-grid electricity

[62] For instance, the FIRCO initiative has already 28 regional agencies with about 48 trained technical advisors who have played a key role in promoting PVs among rural communities and in advising farmers on how to benefit from their investments (source, Implementation Completion and Results Report (MULT-23251), Renewable Energy for Agriculture Project, November 31, 2006).

service as offered in the program through their community leaders, participatory committees, municipal governments, or directly to the SPICs.
Today, communities are organized to identify their local infrastructure investment priorities for basic services, which are validated at their general assembly (*Asamblea Participativa*). Each community, through its representative, will voice these priorities as potential sub-project proposals which are subsequently channeled to the municipal authorities. All communities will be exposed to a continuous promotional and information campaign that will allow them to consider the off-grid option. Municipal governments, in coordination with the TSMG, will conduct period public consultations with communities that exhibit potential for eligibility (e.g., communities located more than 10 km away from the grid, etc.).

13. During the period of service delivery, beneficiaries will be mainly responsible for the appropriate use of the systems and for paying a portion of the capital cost (e.g., 10 percent down payment, possibility of a micro-credit) and variable costs associated with the service (i.e., operation and maintenance expenditures).

Figure 6.2 Project Implementation Structure at the State Level



ESCOs / NGOs

1. ESCOs and NGOs – working in partnerships with ESCOs – will provide electricity services as established in their Build Operate Train and Transfer (BOTT) contracts. There is also the possibility of creating a community cooperative or a private-public partnership (PPP) for the delivery of electricity services under the scheme of *self-generation.* In this case, a private company in partnership with a municipality or a community association alone can undertake an off-grid electricity generation project (e.g., building, operating and maintaining a micro-hydro and a mini-grid). Potential service providers can therefore be either "external" (i.e., ESCOs, NGOs) or "internal" (i.e., community organizations, local cooperatives, PPPs). Annex 4 describes in detail the nature of this type of service delivery models.

Local Technicians / Extension Agents

2. Engaging a permanent local technician for system inspection and repair, metering and billing collection is considered essential for project's sustainability, especially for the implementation of solar and wind home systems. Local technicians will be responsible for collecting fees and depositing them into a Bank account under the supervision of community leaders and municipal authorities. These payments will be used to replace batteries and other spare parts as well as for the salary of the local technician. Local technicians will draw their monthly salaries from these accounts against evidence of number of households visited, billing collection rates, response to repairs, and other issues (e.g., receipts signed by household members).

Normative Agencies

3. Normative agencies include all those government bodies whose primary function is providing legal and/or technical clearance to sub-projects. These include: the Ministry of Environment (SEMARNAT at the Federal level) and associated State delegations, the National Water Commission (CNA) for the particular case of micro-hydro, and other government entities (e.g., issuing rights of way for the case of mini-grids, construction permits, and other relevant permits). In this case, it is the responsibility of energy service providers (external and internal) to comply with the laws and regulations associated with technical, social, environmental and other legal aspects.

C. Project Operational Procedures

4. A Project Operational Manual (OM) has been prepared to guide Project execution and implementation activities. The operational manual will include detailed procedures for the implementation and execution of the program and sub-projects as well as the cooperation agreements signed between the participating institutions.

D. Instruments for Inter-Institutional Cooperation and Collaboration

5. To ensure that all participating agencies endorse and work collaboratively to achieve the project objectives, cooperation agreements and letters of intent have been signed between executing and implementing government institutions. These are briefly described below.[63]

6. SENER-CDI. SENER and CDI have signed a formal agreement (*convenio de cooperacion*) which defines the respective roles of CDI and SENER, and which pledges co-financing resources from CDI for the project. Through their technical units, both parties will promote the participation of Federal, State, Municipal and private entities with regards to the programming, co-financing and execution of off-grid rural electrification sub-projects. CDI will open the fiscal space necessary to accommodate both the IBRD loan and the GEF grant over the five year implementation period. CDI will participate as an advisory body to the Project specifically with regard to indigenous peoples development activities and intervention in indigenous peoples' land. SENER as will coordinate, supervise and implement the program at the Federal level and represent the Federal Government at the State level.

7. SENER-NAFIN. The Ministry of Energy (SENER) has formally requested Treasury (SHCP) to designate the National Financial Institution (NAFIN) as the project implementing agency and financial agent to administer the GEF grant and IBRD loan as established in the corresponding legal agreements. On September 2006, SHCP formally requested NAFIN to retain these responsibilities, including the execution of actions necessary to fulfill the commitments established in the loan and grant agreements.

8. SENER-State Governments. Each of the States participating in the program have issued letters of intent (LOIs).formalizing their intention to (a) co-finance one third of the annual cost of the program during the period of implementation, (b) integrate a team (SPIC) to manage and execute project activities and (c) conduct the necessary activities to prepare and develop off-grid RET based rural electrification sub-projects.

9. SENER-SAGARPA (FIRCO): The Secretariat of Agriculture, Livestock and Rural Development (SAGARPA), which has been successfully implementing off-grid RET based electrification projects for agricultural production since 1999 (Trust for Shared Risk, FIRCO Program), which confirms SAGARPA's support to the Project across the targeted States through its network of qualified technicians already operating in the field. The FIRCO unit has fully supported the preparation of the project, continuously sharing information, participating in workshops, meetings and field trips.

10. SENER-CFE: During project implementation, the Federal Electricity Commission (CFE) will retain the responsibility for technical supervision and monitoring in the fields (as part of the TSMG). CFE will also be a member of both, the Project Advisory Committee (PAC) and Project Monitoring Committee. CFE has already fully supported

[63] Copies of cooperation agreements are included in the Project Files.

the preparation of the project, continuously sharing information, participating in workshops, meetings and field trips.

11. The roles and responsibilities of all participating institutions are clearly defined in the procedures and rules established in the Project's Operational Manual.

E. Accounting, Financial Reporting and Auditing Arrangements

12. The Bank carried out a Financial Management Assessment which involved ensuring that the existing accounting, financial management, flow of funds, and internal control systems allow adequate transparency, oversight and control while supporting smooth implementation. Some measures have been suggested to further strengthen the accounting and internal control systems, for compliance with Bank requirements. While the responsibility for project financial reporting (in the format of FMRs) will rest with NAFIN and the Project Planning and Management Team (PPMT), the task will require receiving financial information from the State Project Implementation Committees (SPICs). Project disbursements will be based on Statements of Expenditures (SOEs).

13. An external auditing firm will be contracted by NAFIN to carry out the Project's annual financial audits. The firm will be selected by *Secretaria de la Funcion Publica*, in accordance with the Technical Memorandum of Understanding (MOU) agreed between the GOM and the Bank. Details on the accounting, financial reporting and internal control system, including the arrangements for the flow of funds and methods of disbursement are given in Annex 7.

F. Subproject Cycle

All sub-projects will pass through the following key stages:

14. Identification and Prioritization: The SPICs will maintain a data base with the universe of localities whose electrification option is an off-grid solution.[64] This database already exists for the targeted States, including the specification of the potential renewable energy based technologies applicable given the location and geographic conditions of communities.[65] Municipalities with the support of the TSMG will conduct periodic public consultations among localities in the data base to identify what localities would welcome and/or demand the off-grid solution and are willing to participate in the program. The SPICs, with the support of municipalities will also launch promotional campaigns and organize periodic informative meetings with community leaders. Only those communities that express interest and explicitly demand the service will be included in the data base for actual selection.

[64] That is, localities of 50 to 500 households with no electricity service, located at least 10 km away from the grid or in geographic areas where extending the grid is not feasible, and that are not contemplated for on-grid electrification by other programs within the next 5 years, among other.

[65] Yet, further technical studies will be necessary to confirm the best technological choice for each particular case.

15. Selection: Following impact evaluation methods, the SPICs under the supervision and in the presence of SECs will randomly select every year a limited number of eligible communities for their inclusion in the annual electrification program.

16. Determination of Technical Option: For every community selected, technical studies will be launched to confirm the best technological choice and characterize the size of the sub-project (e.g., demand projections, identification of potential social and productive activities, systems' capacity, basic design, etc.). These studies will be launched by the SPICs and co-financed, when possible, with resources provided by other partners (e.g., USAID, GVEP).

17. Characterization of Service Package: The SPICs technical unit will prepare service packages and pass all relevant information to the administrative/procurement unit for preparation of bidding packages.

18. Bidding: Based on bidding documents design, the bidding packages will be prepared, launched and processed by the SPIC's administrative/ procurement unit under the supervision of the SECs and NAFIN.

19. Build, Operate, Train and Transfer: These activities will be conducted by ESCOs based on the conditions of their medium term or five-year service contracts (a detailed description of the BOTT model is given in Annex 4). Following the completion of the medium term service contract, the already trained households and/or community centers will be transferred full ownership of the systems and will continue operating and maintaining the services with the support of the local technicians and/or extension agents. The TSMG will support the SPICs in constantly monitoring the appropriate implementation of service contracts. Additionally, the SPICs will periodically retain the services of external supervision consultants to verify the performance of ESCOs and the program in general.

G. Project Execution

20. The Project is designed to be implemented over a five year period. Matrix 6.1 below presents an abbreviated sequence of activities from year 1 to year 5 of project implementation.

MATRIX 6.1 ABBREVIATED SEQUENCE OF ACTIVITIES YEARS 1-5 AND RESPONSIBLE STAKEHOLDER

Program Development Year 1 to 5	RESPONSIBILITIES OF PARTICIPANT STAKEHOLDERS											
	PPMT SENER	NAFIN	CDI	PAC	PMC	TSMG	SG SPIC	ESCO PPP	Municipal	Community	Local Technician	SEC
I General Studies (Consultant work and goods, only first year)												
Review Off-Grid Electricity Tariff and Subsidy Schemes	√	√										
Review ownership rights and schemes	√	√										
Design of Policy, Legal and Regulatory Frameworks for Rural Electrification	√	√										
Measurement, Data Collection on renewable energy resources	√	√										
Computer hardware and software for SPICs		√					√					
II Activities Preceding the Launching of Rural Electrification Sub-Projects (Activities and Consultant Work, Years 1 to 5)												
Sign/formalize annual subsidy agreement between Federal, State and Municipal Entities: Years 1-5	√						√		√			√
Design bidding documents for different types of packages (service delivery models BOTT against minimum subsidy required, output based subsidies, micro-financing): During 1st Year	√	√										
Conduct a "Conflict Analysis Framework" Design Mechanism for Conflict Resolution: During 1st Year	√	√										
Design guidelines for sub-project technical characterization (including all technologies and the design of TORs for pre-feasibility-feasibility studies, technical specifications, manuals and standards): Years 1-2	√	√										
Design Guidelines for identification of productive activities: During 1st Year (Note 1)	√	√										
Design Guidelines / Tools for community selection based on eligibility criteria and for public consultations: During 1st Year	√	√	√	√			√					√
Design guidelines/tools to ensure appropriate social and environmental practices	√	√		√	√							

Note 1: The consultant work associated to these activities might be co-financed by international partners such as USAID and GVEP.

Program Development Year 1 to 5	RESPONSIBILITIES OF PARTICIPANT STAKEHOLDERS											
	PPMT SENER	NAFIN	CDI	PAC	PMC	TSMG	SG SPIC	ESCO PPP	Municipal	Community	Local Technician	SEC
Design and launch promotional campaign /	√	√					√					

communication strategy: Years 1-5												
Design procedure for technology and service provider certification and pre-qualification: During 1st Year	√	√										
III Sub-Project Selection and Technical Characterization (Activities Years 1-5)												
Maintain data-base of eligible sub-projects							√					√
Conduct periodic public consultations and information campaigns		√				√	√		√			
Prioritize and select sub-projects year n+1							√		√			√
Sub-project technical characterization per community or community clusters (demand projections, type of technology, capacity, etc.)		√				√	√					
Identification / characterization of potential productive activities		√				√	√		√			
Identification / characterization social activities (subsistence, quality of life)		√				√	√		√			
For projects other than SHSs / WHSs Pre-feasibility – Feasibility Studies (basic engineering completed and safeguards met)		√				√	√					
Characterize package for bidding							√					√
IV Bidding and Project Development (Sub-Project Cycle) Annual Activities Years 1-5												
Bid Service Packages		√					√					
Installation / Construction								√				
Operation, Maintenance & Training (users)								√				
Training of local technicians: repair, metering and billing collection		√				√	√					
Metering, Billing and Collection											√	
Transfer of assets to community at the end of service contract or equipment recovery in case the grid has reached community								√	√			

Program Development Year 1 to 5	**RESPONSIBILITIES OF PARTICIPANT STAKEHOLDERS**											
	PPMT SENER	**NAFIN**	**CDI**	**PAC**	**PMC**	**TSMG**	**SG SPIC**	**ESCO PPP**	**Municipal**	**Community**	**Local Technician**	**SEC**
Permanent Training to community extension agents / local technicians		√				√	√					
Conflict Resolution Activities	√		√				√					√
V Annual Program Evaluation												
Overall annual program evaluation and adjustments for improvement	√	√										
Impact Evaluation Assessments: First and Third Years only	√	√										

Annex 7. Financial Management and Disbursement Arrangements

Background

1. The proposed Project is a fully blended operation that includes both a GEF grant (US$ 15 million) and an IBRD loan (US$ 15 million). The lending instrument is a Sector Investment Loan (SIL) to be implemented over a five-year period. The main development objectives of the proposed Project are to: (i) Increase access to efficient and sustainable integrated energy services in --predominantly indigenous-- rural areas of Mexico; and (ii) Promote the development of social and productive activities to increase the use of electricity.

2. The proposed Project has the following five components: (i) Component 1 - Strengthening of strategy, policy, and regulatory frameworks; (ii) Component 2 - Investment in Rural Electrification Sub-Projects; (iii) Component 3. Capacity Building to State, Municipal and Community Stakeholders; (iv) Component 4. Co-Financing and Technical Assistance to Increase Productive Uses of Electricity; and (v) Component 5. Project Management. The project will be implemented at the national level by Secretaria de Energía (SENER) and Nacional Financiera S.N.C. (NAFIN) and at the sub-national level by the states of Guerrero, Veracruz and Oaxaca. The Comisión Nacional para el Desarrollo de los Pueblos Indigenas (CDI) will finance the contribution of the GOM through SENER.

3. The estimated costs of the project and the contribution of the GEF grant and Loan are indicated in the following table.

TABLE 7.1 ESTIMATED PROJECT COSTS BY COMPONENT

COMPONENT		US$ Million				
		GOM	IBRD	GEF	Private	Total
1	**Policy, Regulation and Strategy**	1.575	1.175	1.35	0.00	4.10
2	**Rural Electrification Subprojects (Investment and OBA subsidies)**	49.22	6.89	5.765	6.54	68.415
3	**Technical Assistance for Rural Electrification**	4.315	2.81	5.135	0.20	12.46
4	**Technical Assistance to Increase Social and Economic/Productive Uses of Electricity**	1.25	1.75	1.25	1.75	6.00
5	**Project Management**	3.64	2.375	1.5	0.00	7.515
	TOTAL	**60.00**	**15.00**	**15.00**	**8.49**	**98.49**

4. A FM assessment (FMA) was carried out and included a risk review. Based on the results of this FMA, overall FM arrangements (and agreements) for the proposed project are acceptable to the Bank. Some of these arrangements will allow for the use of existing country FM systems that are acceptable to the Bank, thus minimizing any additional program specific requirements. The FM arrangements are already operational; however, to be fully acceptable to the Bank require certain adjustments, e.g., to produce financial reports in the agreed format, have the operation and financial statements of the project audited by an acceptable auditor under terms of reference (TORs) satisfactory to the Bank, adjust the systems to produce statements of expenditure (SOEs), and establish the Designated Account).

Financial Management Assessment (FMA)

5. The Bank has concluded the FMA, which involved ensuring that project design allows for an appropriate level of transparency, facilitating oversight and control while also supporting smooth implementation. The FMA included a risk review, and evaluated the institutional capacity of SENER, NAFIN, Guerrero, Veracruz and Oaxaca. CDI was not included in the FMA as this entity will fund GoM's contribution through SENER but it will not implement any components of this project.

6. Based on the results of the FMA, the overall FM-related risk for this project is Substantial (S). The risk is Substantial based on the results of the combined evaluation of: (i) the inherent risk (the implementing entities at the subnational level do not have experience with Bank-financed projects, and the project involves transfers, the national and subnational levels, trust funds managed by subnational entities, and GEF and Bank funds); and (ii) the control risk (systems for budgeting, accounting, internal control, funds flow, financial reporting and auditing at the subnational level are heterogeneous or will be based on spreadsheets). To mitigate FM risk, the Bank and NAFIN will carry out supervision missions twice a year during the first year of implementation, complementing the review of interim financial reports (IFRs) & audit reports.

7. It is expected that mitigating actions will be implemented, including capacity building during project operation, NAFIN's supervision to all participating States, and implementation of strengthening actions by all participating states. Risks will be monitored (and mitigated) in a structured manner throughout the life of the proposed project.

	Risk rating						
Risk	Mexico	SENER/NAFIN	Guerrero	Veracruz	Oaxaca	Risk Mitigating Measure Incorporated into Project Design	Conditions of Negotiations, Board or Effectiveness
Inherent							
Country	M					The Bank is working with the country on the improvement of the accounting system at the federal level, with emphasis at the subnational level e.g. accounting harmonization.	N
Entity		M	S	S	H	The State Project Implementation Committees (SPICs) are responsible for the coordination and supervision at the state level. Training on FM will take place before project effectiveness (this training will involve NAFIN, SENER and the Bank).	N
Project		S	S	S	S	Since coordination is essential, NAFIN will be responsible for all financial aspects at both national and subnational level, and SENER for all technical aspects. Both NAFIN and SENER will carry out supervision activities.	N
Control							
Budgeting	M	M	M	M	S	SENER will coordinate with each state planning committee project activities, and NAFIN will coordinate the flow of information for planning and disbursement purposes. Additionally NAFIN will review the periodic reports which will submit each state (the implementing entity at the state level).	N
Accounting	M	M	M	M	S	The states will improve their accounting arrangements within the first six months of project implementation. This activity will be financed by each state and will be coordinated by the Bank.	N
Internal Control	M	M	S	S	H	The internal control units of each implementing entity at the state level will carry out internal control reviews with the aim to recommend corrective and strengthening actions.	N
Funds Flow	M	S	S	S	H	The Bank will review the establishment of the national trust fund in NAFIN and of each state account. Before first reimbursement (of the portion of the loan) or disbursement (of the portion of the grant), the Bank will review the supporting documentation and reports provided by the states (NAFIN will review the documentation before submitting it to the Bank).	N
Financial Reporting	M	M	M	M	S	Training to participating states and NAFIN on the IFRs (FMRs) will take place before project effectiveness. The Bank will review the reporting process during the first supervision mission, which will take place within the first semester of implementation.	N
Auditing	M	M	S	S	H	The auditors will be contracted before ending the audited year to carry out interim work, SFP will supervise audit execution and the state *contralorías* will carry out at least two reviews each financial year.	N
Overall	***M***	***M***	***S***	***S***	***H***		N

H - High *S - Substantial* *M - Modest* *L - Low*

Implementing entities

8. SENER will implement the proposed project through NAFIN, which will have two responsibilities: (1) implementing entity; and (2) financial agent. The former implies the FM operation at the national level and the coordination with the three participating states: Guerrero, Oaxaca and Veracruz. The latter implies that NAFIN will be responsible for disbursements (and reimbursements) processing, management of the Designated Account, project reporting (in the format of IFRs), coordination of annual audits, and flow of funds at the national level (including transfer to the national treasury TESOFE). Since SENER will be responsible for all technical aspects of the project, NAFIN and SENER will enter into an agreement for project implementation with the participation of the Secretariat of Finance (SHCP).

9. The participating states will implement the project through the following state institutions: (i) Guerrero: State Public Works Secretariat, SOP (in coordination with the state planning committee COPLADEG and the state Secretariat of Finance); (ii) Veracruz: State Secretariat of Social Development and Environment, SEDESMA (in coordination with the state planning committee COPLADEV and the state Secretariat of Finance); and (iii) Oaxaca: State Public Works Secretariat, SOP (in coordination with the state planning committee COPLADEO and the State Secretariat of Finance). At the same time, an implementation committee in each state will ensure proper coordination. These implementation committees are integrated by all involved entities in each state. The committees of Guerrero and Veracruz are in place and resuming activities, however the Oaxaca's committee will be integrated soon (subject approval of the Governor). The annex to this PAD on institutional arrangements provides additional information on these committees. Except for NAFIN, the implementing entities at the subnational level do not have direct experience with the implementation of Bank-financed projects. The subnational level entities have indirect experience as they implemented or are implementing projects which are financed by the Bank, but that are fully coordinated by the national level (through operating rules and direct instructions for example). Nevertheless, these subnational level entities up to now have demonstrated institutional capacity for an adequate project FM. NAFIN, in its capacity as financial agent, will provide its services, including advice on project FM, during the entire implementation period.

Flow of funds and information

10. The Secretariat of Finance (SHCP) will not pre-finance project spending for the GEF's grant part (US$ 15 million), thus grant funds will be directly transferred from the Bank to NAFIN. Respecting GoM's counterpart funds, it will be provided by CDI through SENER (US$ 30 million).

11. Regarding the Bank's loan, as traditionally done in these projects, the National Treasury TESOFE (in SHCP) will pre-finance through CDI/SENR all activities linked to it (US$ 15 million as well), and the Bank will reimburse eligible expenditures. The GoM's counterpart funds will be provided by CDI through SENER's budget (US$ 30 million).

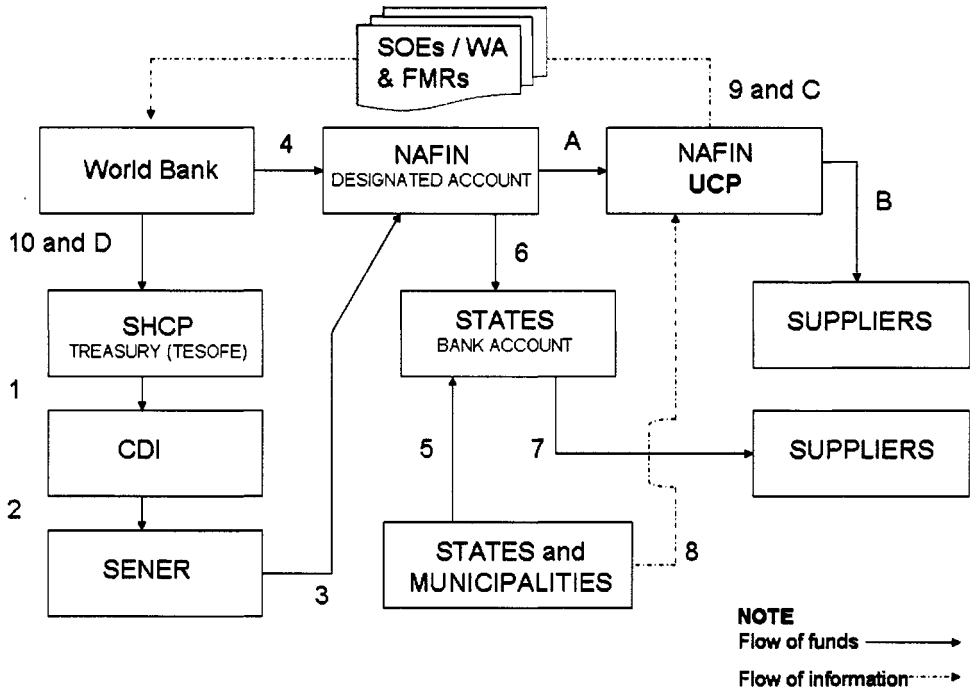
12. All project funds will be managed by NAFIN, which will establish a Designated Account for both GEF's grant and Bank's loan. Table 7.1 (above in this annex) provides information on the estimated project costs by component.

13. Grant funds will flow to NAFIN, which will process payments for the national level operation and will transfer funds to the participating states for the subnational level operation. Loan funds will flow from the Bank to NAFIN for further transfer to the national treasury TESOFE to reimburse pre-financed expenditures by CDI/SENER.

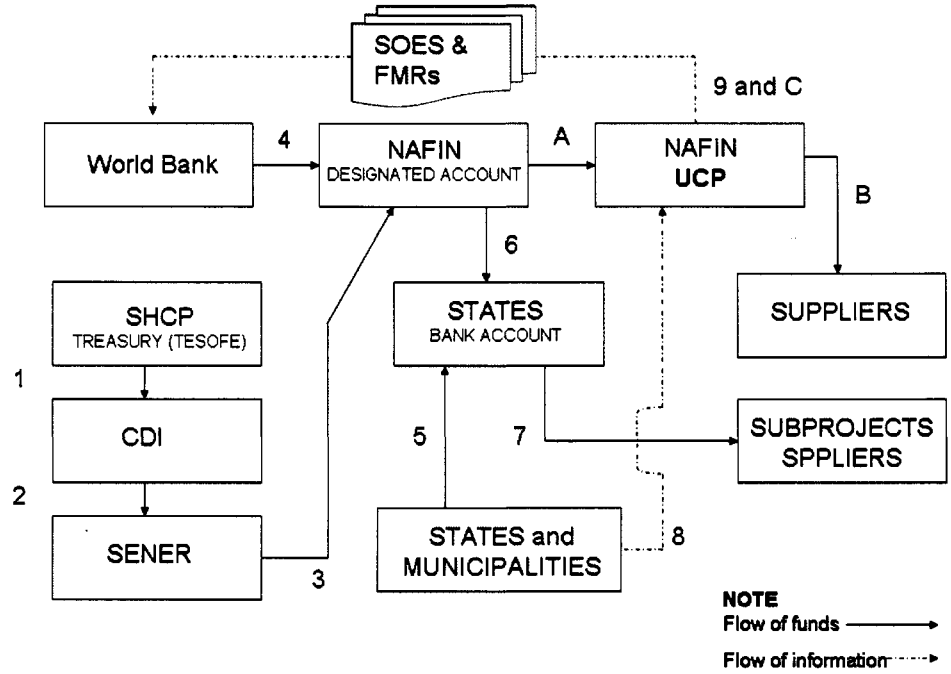
14. Through CDI's standard budget, which is known as *Presupuesto de Egresos de la Federación* (PEF), CDI will annually transfer funds to SENER. For the project, SENER would have already transferred funds to NAFIN, which would have processed payments for the national level operation and transferred funds to the participating states for the subnational level operation. The participating states also provide counterpart funding.

15. The following flowcharts illustrate (and provide details) on the flow of funds. Regarding the flow of information, all information will flow from the bottom to the top (produced in the states and SENER and submitted to NAFIN, to be processed and submitted to the Bank).

Flow of funds for Bank's Loan



Flow of funds for GEF's Grant



16. The Bank will recognize expenditures until payments have been made to the suppliers or consultants (either individuals or firms) for both national and sub-national level operations. This information will be submitted by NAFIN (UCP) to the Bank.

Accounting Policies and Procedures

17. NAFIN, SENER and the states of Guerrero, Veracruz and Oaxaca will maintain records and accounts adequate to reflect, in accordance with accounting practices congruent with International Public Sector Accounting Standards and in compliance with local requirements (national and subnational), the operations, records and accounts for the project. Administrative procedures are in place to ensure that financial transactions are made with consideration to safeguarding project assets and ensuring proper entry in the accounting & monitoring systems. According to discussions/agreements with SHCP, CDI, SENER, NAFIN and the participating states, all implementing units will be able to have in place the adjustments needed for this project (e.g., specific accounts in the chart or accounts of each state, spreadsheet to produce periodic reports, and NAFIN's arrangements for the implementation) reliable accounting policies and procedures as established in Project's Operational Manual.

18. The accounting systems (complemented with information systems) of all involved entities, currently have the capacity to record assets, liabilities and financial transactions, and to produce financial statements and reports useful to the management of the proposed projects. Actually, NAFIN has a good track record for the Bank financed projects for which currently is either (or both), the financial agent and the implementing entity. Overall, systems meet Bank's FM requirements on accounting, but the financial reports

IFRs (former FMRs) will be produced in spreadsheets, based on information and reports produced by existing systems.

19. The financial management section of the project manual provides details on accounting policies and procedures. The manual will be adopted before project effectiveness.

Information Systems

20. The information systems of all participating entities will track every project transaction. Existing systems, which are under use for the normal CDI, SENER, NAFIN and participating states' programs, are considered satisfactory to the Bank. Those systems will be complemented with spreadsheets to produce the information required for project management (and for reporting purposes). The system that NAFIN will use for this project is the same that NAFIN is currently using for similar projects e.g., the MX Community Forestry Development Project. Full description of the systems is provided in the FM section of the manual.

Staffing: Key FM Staff

21. The main duties of the staff of the implementing entities of this project will be: (i) to prepare the project budgets, financial statements and disbursement requests; (ii) to supervise internal controls and efficiency in the execution of funds; (iii) to coordinate on financial management issues, with NAFIN, CDI, SHCP, SENER, the participating states and the Bank; (v) coordinate annual project audits; and (vi) prepare and submit IFR [reports] on semi-annual basis through NAFIN (as financial agent). Initially, current staffing arrangements are acceptable to the Bank, however NAFIN (as implementing entity) will increase its staff by one FM specialist to ensure that all project's FM responsibilities are carried out in a satisfactory manner to the Bank. Similar arrangements are currently in place for the projects that are under the implementation (coordination) of NAFIN.

Internal Audit

22. SENER, NAFIN and the involved entities in the sate of Guerrero, Veracruz and Oaxaca have internal audit departments, which are responsible for internal audit reviews of all their operations/programs. Although the operations of the project will be included in the annual plans of the internal auditors, no internal auditor will be assigned specifically to the project. Each involved area makes sure that proper internal control procedures are followed, as all are subject to internal control reviews. Internal audit is complemented by reviews carried out by the executive's auditor e.g., Contraloría Estatal, legislative auditors e.g., Auditoria Superior Estatal, or external auditors. Additionally, NAFIN and the state inter-institutional committees will carry out oversight functions.

External Audit

23. The audit process and audit report will follow the Bank's audit policy. Project annual audits will be carried out in accordance with auditing standards compatible with International Standards on Auditing (ISAs), by a combination of independent auditors (private firms and governmental auditors) and under Terms of Reference acceptable to the Bank. As soon as available, but in any case not later than six months after the end of each audited year, NAFIN will furnish the audits to the Bank. The Bank will review them, evaluate their acceptability, and provide comments and recommendations (if any). The project manual, which is being updated, includes a section on financial management which provides detailed information on project audits.

24. The auditors would perform at least one interim visit per year, and will review the entire operation of the project (all sources and uses of funds) at both national and sub-national level, including all bank accounts e.g., state accounts. The audit of the Designated Account is the responsibility of NAFIN as financial agent.

The table below summarizes the audit requirements for the proposed project.

Audit report	Due dates
Project Financial Statements: NAFIN, Guerrero, Veracruz and Oaxaca.	Within the following six months after the end of the reporting period. Starting by **06/30/2008.** The period covered will be from January the 1st to December 31st which is the Mexican financial year. This audit will include all centralized and decentralized project operations and funds.
Designated Account: NAFIN.	Within the following six months after the end of the reporting period. Starting by **06/30/2008.** The period covered will be from January the 1st to December 31st which is the Mexican financial year. This audit will include all centralized and decentralized project operations and funds.

Disbursement Arrangements

25. NAFIN has a monitoring system in place that provides it with reasonable assurance that transfers made to participating states or payments made to suppliers are in line with the agreements. Disbursements would be in accordance with the advance method, with subsequent reimbursement of expenditures documented by Statements of Expenditure (SOEs). The flowcharts in the Flow of Funds section above provide further details on funds flow. NAFIN will process disbursement applications.

26. NAFIN will receive funds from the standard budget of SENER (funds corresponding to Bank's loan) and from the Bank (funds corresponding to GEF's grant). These funds will be transferred to the states of Guerrero, Oaxaca and Veracruz. At the same time the municipalities will transfer funds to the state. Each governmental level will equally provide funds for the implementation of the project as follows: (1) one third will be covered by the federal level using matching funds from the GEF's grant and Bank's

loan; (2) one third will be covered by the state level; and (3) one third will be covered by the municipalities.

Statements of expenditures

27. SOEs will be prepared by NAFIN and electronically submitted to Bank in standard forms. Documents in support of SOEs must be maintained by the concerned implementing entity at least until one year after the Bank has received the audit report for the financial year in which the last loan withdrawal was made. Such documents must be available to review by the external auditors and Bank staff at all time. The overall responsible of project supporting documents is NAFIN, with the support of SENER and the states of Guerrero, Veracruz and Oaxaca.

Designated Account (DA)

28. The project will establish in NAFIN a single account for both the GEF's grant and Bank's Loan (the Designated Account, DA) in US dollars under terms satisfactory to the Bank. This DA will have records which will allow full identification of the source of funds, movements and balances. NAFIN will be responsible for DA's management. For replenishment of the advance to the DA, NAFIN will prepare monthly (in any case, no more than quarterly) requests for reimbursement of expenditures made. Total advances to the DA at any given time would not exceed an authorized allocation of US$ 3,000,000 (10% of the total contribution of the Bank, which is US$ 15 million as a GEF's grant and US$ 15 million as a Bank's Loan). However, unless the Bank shall otherwise agree, the authorized allocation shall be limited to the amount of US$ 1,000,000 until the aggregate amount of withdrawals plus the total amount of all outstanding special commitments shall be equal to or exceed the amount of US$ 6,000,000.

Other procedures

29. The proposed project, most likely will not require other disbursement procedures, however upon request from NAFIN and subject to Bank's approval, payments may be made: (i) directly to a third party/supplier; (ii) to a procurement agent, which is not likely; or (iii) to a commercial bank for expenditures against a Bank Special Commitment covering a commercial bank's letter of credit, which is not likely either.

Retroactive Financing (expenditures).

30. The project is eligible to submit for retroactive reimbursement, documentation on expenditures totaling up to 10 percent of the Grant/Loan amount (US$ 1.5 million each), for eligible activities made not more than 12 months before the date of the grant/loan agreement.

Disbursement Table

Loan (IBRD)

Category	Amount of the Loan Allocated (expressed in USD)	Percentage of Expenditures to be financed (inclusive of Taxes)
(1) Goods, other than those financed by the GEF Trust Fund Grant	8,000	100%
(2) Consultant Services and Training, other than those financed by the GEF Trust Fund Grant	3,577,500	100%
(3) Expenditures under Service Management Contracts other than those financed by the GEF Trust Fund Grant	7,776,000	100% of OBA payments for Electrification Sub-projects
(4) Operating Costs, other than those financed by the GEF Trust Fund Grant	2,375,000	100%
(5) Unallocated	1,226,000	
(6) Front-end Fee	37,500	Amount payable pursuant to Section 2.03 of this Agreement in accordance with Section 3.01 of the General Conditions
TOTAL	15,000,000	

Grant (GEF)

Category	Amount of the Grant Allocated (expressed in USD)	Percentage of Expenditures to be financed (inclusive of Taxes)
(1) Consultant services and Training, other than those financed by the Loan	7,074,000	100%
(2) Expenditures under Service Management Contracts other than those financed by the Loan.	5,076,000	100% of OBA payments for Electrification Sub-projects
(3) Operating Costs, other than those financed by the Loan	1,500,000	100%
(4) Unallocated	1,350,000	
TOTAL	15,000,000	

Financial Reporting

31. The main FM reports will be the IFRs (former FMRs), which will be semiannually submitted by NAFIN to the Bank. The IFRs will sufficiently describe project financial operations, and will include two sections: (i) narrative; and (ii) financial information/statements. The IFRs will be complemented with separate reports (the information on physical progress will be provided in the progress reports which will be semiannually submitted, and project procurement will be provided in the procurement plan, which will cover 18 months and will be updated as needed). The initial format of the IFRs was agreed during appraisal, and final agreement was reached during negotiations. The formats have been included in the project manual (OM), in the FM section.

Operational Manual (OM) and Written Procedures

32. Project FM-related procedures have been documented in the FM section of the project OM, which defines the roles and responsibilities of the implementing entities and the financial agent.

Supervision Plan

33. Bank supervision will include field visits at least twice the first year of implementation, complementing the review of IFRs and audit reports. This FM work will be complemented by training and strengthening actions to improve institutional capacity. Based on the results of the supervision work carried out during the first year of implementation, a decision will be made to review or not transactions (SOEs), and to reduce or not the intensity of the field work.

Annex 8. Procurement Arrangements

Procurement in Mexico: Recent Developments

1. Procurement for the proposed project would be carried out in accordance with the World Bank's "Guidelines: Procurement under IBRD Loans and IDA Credits" dated May 2004; and "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" dated May 2004, 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 prequalification, estimated costs, prior review requirements, and time frame are agreed between the Borrower and the Bank in the Procurement Plan. The Procurement Plan will be updated at least annually or as required to reflect the actual project implementation needs and improvements in institutional capacity.

2. Since June, 2004 (and since January 2006, jointly with IDB), the Bank has agreed with the Government of Mexico to accept the full-fledged use of the COMPRANET as a vehicle for Bank-financed procurement for NCB and ICB pursuant to paragraphs 2.11, 2.18, 2.44, 2.45 and other parts of the Procurement Guidelines of May 2004. Recently, the Bank, IDB, and the Government through the *Secretaría de la Función Pública* (SFP) reached agreement on a harmonized Request for Proposals package, and SBDs for ICB and NCB for Goods and Works. The Bank has completed two sector studies: one at the federal level and another one at the state level to determine the acceptability of the country systems in procurement and other fiduciary areas, and to monitor and evaluate government procurement performance at the state level. The findings of the studies continue to demonstrate that Mexico has robust procurement procedures.

3. The methods to be used for the procurement of goods and services under the loan are described below with the estimated amounts, and summarized in Table A. Table B indicates thresholds to be used in the Procurement Plan and the Operational Manual for the various procurement methods.

Procurement Summary

4. The procurement arrangements include initial action in five components in three Southern states (Oaxaca, Guerrero and Veracruz) in order to benefit 50,000 houses in rural, poor villages ranging from 150 to 1,500 inhabitants: (1) technical assistance for the strengthening of strategy, policy, and regulatory frameworks; (2) procurement of small power plants in rural electrification sub-projects, including photovoltaic systems, isolated grids powered by micro hydroelectric plant, isolated grids powered by a diesel plant, wind generators, isolated grids powered by biomass generators, and battery charging stations energized by any of these options; (3) technical assistance and capacity building activities necessary to ensure the success and sustainability of the Project at different stages of implementation; (4) technical assistance to increase productive uses of electricity and improve quality of life; and (5) project management.

Procurement of Works

5. There are no isolated civil works expected under the project; except for some civil works related to small or micro hydro plants, housing and foundation work of the power generating equipment that will be part of the services provided by the contractors awarded the power generating equipment.

Procurement of Goods and Non-consulting Services

6. There is a subsidy component in the subprojects that is a financial transfer to the end beneficiaries; there are no procurement aspects in that subsidy. In other cases, the Bank and GEF financing will pay partially for the installation of the power equipment; in such cases, the state implementing units will procure the goods and services using harmonized bidding documents issued by the *Secretaría de la Función Pública (SFP)* adapted for the specialized type of supply and installation.

Employment of Consultants

7. Consultant services would be procured in accordance with "Guidelines: Selection and Employment of Consultants by World Bank Borrowers" published in May 2004 and the agreements in the procurement plan. Consultant services to be contracted under this Program include studies for tariffs and subsidies, manuals and standards, M&E, etc. The short list of consultants for contracts estimated to cost less than US$500,000 equivalent may comprise entirely national consultants, in accordance with the provisions of paragraph 2.7 of the Consultant Guidelines.

Firms

8. All contracts for firms would be procured using QCBS procedures except for small contracts for assignments of standard or routine nature and estimated to cost less than US$100,000 equivalent that would be procured using Least Cost Selection or using other procurement methods as defined in the annual procurement plan review.

Individuals

9. Specialized advisory services, including staff at the PPMT, would be provided by individual consultants selected through comparison of qualifications of at least three qualified candidates. They would be contracted in accordance with the provisions of paragraphs 5.1–5.3 of the Consultant Guidelines as defined in the annual procurement plan review.

Sub-projects

10. The subprojects will consist in the installation, operation and maintenance of isolated power systems in localities selected pursuant technical criteria as spelled out in the Operational Manual. The procurement of the goods and equipment will be carried out by IVO in Oaxaca, by *Secretaría de Desarrollo* in Veracruz and by *SOP* in Guerrero using ICB or NCB depending upon of the estimated cost of the packages. Packages estimated to cost more than US$250,000 per contract will be carried out by ICB.

Prior Review Thresholds

11. The prior review of procurement actions will be defined in the annual procurement review and will not exceed the thresholds determined by the Bank for a high risk project.

Procurement Capacity Assessment

12. SENER is beneficiary of PHRD and GEF grants for project preparation: the capacity assessment showed that it does not have the structure and organization to handle procurement. For this reason SHCP has designated NAFIN as the project executing agency in charge of resources administration and procurement.

13. NAFIN has experience and the capacity to undertake procurement responsibilities.

14. At the State level, designated agencies for undertaking procurement responsibilities exhibit an average risk. The designated agency in Oaxaca (IVO) would need to hire staff to carry out procurement responsibilities. Other designated agencies would only require certain level of capacity building (e.g., SEDESOL in Veracruz).

15. The Bank shall carry out two procurement reviews annually.

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

Expenditure Category	Procurement Method[1]				Total Cost
	ICB	NCB	Other	NBF	
1. Goods					
2. Non-consultant services, including training			2.25	0.20	
3. Consultant services and technical assistance			15.75	0.75	
4. Subprojects	10.7 (51.05)			6.54	
5. Fee			0.75		
Total	10.7		18.75		30

[1]Figures in parentheses are the amounts to be financed by the IBRD loan and the GEF grant. All costs include contingencies
[2]Includes procurement of goods, training, services, and consultants services required SENER

Procurement Plan

16. NAFIN, under the supervision of the Project Team, developed an 18 month procurement plan for project implementation which provides the basis for the procurement methods. This plan was agreed between the NAFIN and the Project Team during negotiations (September 10 and11, 2007) and is available at the Project Files (IRIS). It will also be available in the project's database and in the Bank's external website. The Procurement Plan will be updated in agreement with the Project Team annually or as required to reflect the actual project implementation needs and improvements in institutional capacity. It is expected that each participant State will carry out about 30 procurement packages during project implementation.

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

Type of Expenditures	Contract Value Threshold (US$)	Procurement Method	Contracts Subject to Prior Review (US$ millions)
1. Goods, and non-consultant services	>350,000	ICB	All
	>100,000	NCB	TBD in each review of procurement plan
	<100,000	Shopping	
2. Consultant Firms	>250,000	QCBS	All
	<100,000	LCS	TBD in each review of procurement plan
Individuals Cons.		IC	

[1]To be reviewed and confirmed in the review of the procurement plan annually

Annex 9. Economic and Financial Analysis

A. Economic Analysis

Introduction

1. This annex summarizes the results of the economic analysis for the project focusing on the costs and benefits of providing electricity to households using photovoltaic (PV) systems, which is the main focus of the project. Together with wind home systems (WHSs), which are economically and financially similar to SHS, these technologies would account for 85 percent of the total households to be served (i.e.;75% of targeted households would be served with SHSs and 10% with WHSs) . The shares of other renewable energy technologies considered in the project –biomass, microhydro, diesel-hybrid systems – are individually small. Further, their costs tend to be site specific and their benefits depend, in part, upon commercial sales of electricity. This analysis is therefore only focused on solar home systems.

2. The solution of using PV systems to supply electricity to populations in remote areas targeted by the project is, from an economic perspective, the least-cost supply option based on economic-engineering analysis performed by the Mexican Institute of Electrical Research (*Division de Energias Alternas*).[66]

Data, Assumptions and Methodology

3. The analysis uses spreadsheet modeling (file available in project files) to outline and calculate economic costs. The key assumptions and data inputs for the model are presented below. Table 9.1 presents the expected system costs based on price quotes and surveys of PV systems providers in Mexico.[67]

4. The economic analysis draws on real data regarding the expected costs of providing PV systems to households based on surveys and quotes by PV systems suppliers in Mexico. The estimates on the benefits are based on data from household surveys available and surveys conducted at the States targeted for project implementation.[68]

5. The economic benefits have two components: (i) the avoided costs for lighting and batteries (dry cells and rechargeable car-batteries) that households will not incur

[66] Source: IIE. December 2005. In-depth Analysis of Case Studies and Potential Projects for Rural Electrification in the Southern States, GVEP Report. See Appendix III on "Non Electrified Communities and Comparison of Energy Levelized Costs"

[67] Sources: FIRCO, ANES. May 2006. Estudio de Mercado de las Fuentes de las Fuentes de Energia Renovable en el Sector Agropecuario. Also different economic and technical proposal for equipment providers in Mexico were reviewed. All these documents are included in the Project's File,

[68] National Income and Expenditures Survey, ENIGH, INEGI 2005, field data from public consultations with communities (reports available in the Project Files).

when the PV systems are installed, and (ii) the consumer surplus resulting from the increased consumption at lower per unit prices.

Table 9.1: Price of Various SHS in Mexico (2006US$)

Note: All costs have been divided so as to include the dealer margin in the total price

Panel Size [Wp]		50	100	200
Solar Panel	[US$]	150	300	600
Inverter 600W	[US$]	54	54	54
Storage Battery	[US$]	61	61	123
Charge Controller	[US$]	17	17	17
Fluorescent Lamps	[US$]	40	40	40
Protection system/ Tierra Fiscal	[US$]	40	40	40
Support for module	[US$]	40	40	40
Wirings & installation accessories	[US$]	11	11	11
Total Hardware Costs	[US$]	415	565	926
Local transport and Installation	[US$]	159	159	159
Sub total	[US$]	574	724	1,085
Gross Margin	[US$]	574	724	1,085
Total Retail Cost		1,148	1,448	2,170
VAT (IVA)	[US$]	172	217	326
Total Installed Cost	[US$]	1,320	1,665	2,496

6. A recent market assessment conducted in Mexico determined that the costs of PV panels in Mexico vary between 6.90 and 8.50 US$/watt peak (before taxes).[69] These prices are much higher than in Germany, Spain, Japan and USA, where average prices are estimated in 5.45, 5.60, 5.35 and 5.20 respectively. According to the analysis the reason for the high costs is associated with sales volumes and the limitations of provision lines or logistics. The Implementation Completion and Results Report (ICR) of the FIRCO Project on the other hand, attributes the high costs of PVs in Mexico – which have tended to increase over the last three years- to the strong demand for this technology in Europe.[70]

7. The following table 9.2 presents the data used for the estimation of avoided costs. It includes alternative fuels and uses that will be replaced by the SHS.

Table 9.2: Price and Quantity of Light used in Southern Mexican rural households

Parameter	*Unit*	*Value**	*Assumption (average)*
Pdiesel	[P/Lumen-hour]	$0.058-0.089	Diesel and Petroleum cost/Lumen-hour
Ppv	[P/Lumen-hour]	$0.00017-0.00043	PV cost/lumen-hour
Qdiesel	[Klumen-hours/Year]	26 to 409	Consumption of non-electrified households
Qpv	[Klumen-hours/Year]	1,284 to 5,136	Consumption of SHS households

Source: Calculations based on National Income and Expenditure Survey, ENIGH. INEGI. 2005

*Depends on lamp model for Diesel and SHS for PV

[69] National Association Solar Energy (ANES-Mexico); May 2006. Estudio de Mercado de las Fuentes de Energia Renovable en el Sector Agropecuario. A report sponsored by FIRCO. These prices have been confirmed with various equipment suppliers in Mexico.

[70] Implementation Completion and Results Report (MULT-23251), Renewable Energy for Agriculture Project, November 31, 2006.

The key financial assumptions used for the modeling are presented in table 9.3.

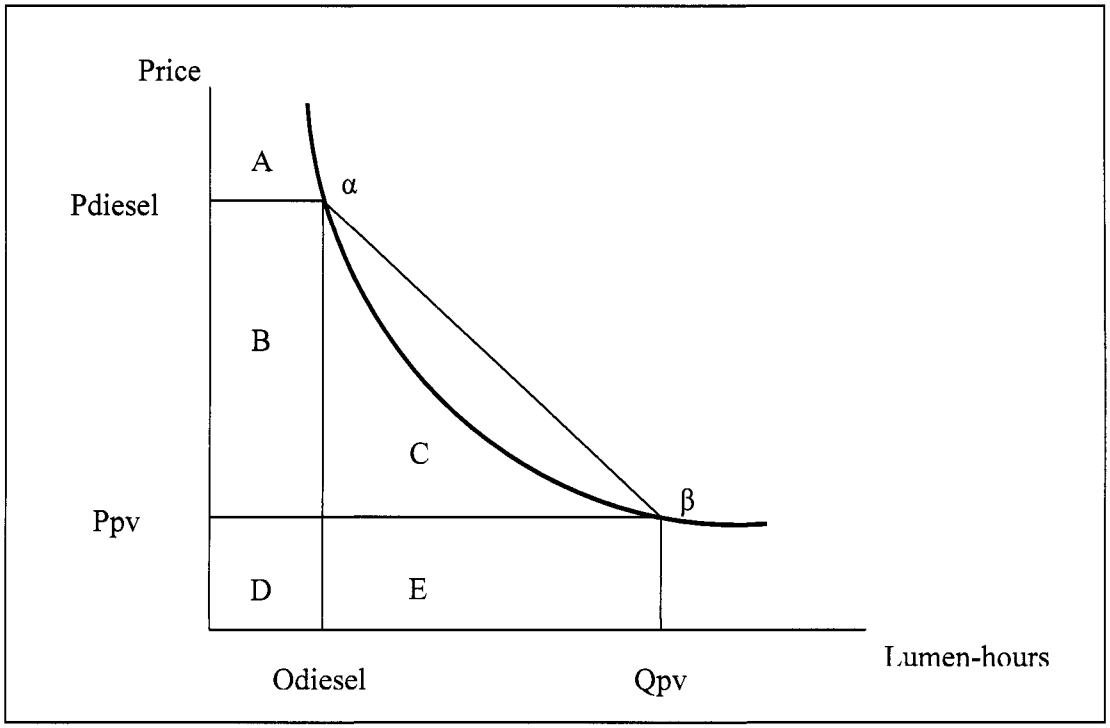
Table 9.3 Financial Assumptions		
Discount rate	[%]	12
Exchange rate	[M$/US$]	10.90
VAT (IVA)	[%]	15
Income Tax	[%]	32
Petroleum duties	[peso/liter]	0.00
Diesel duties	[peso/liter]	0.00
Transfer to dealers	[%]	35
Down payment	[%]	10%
Microfinance loan paid over a 5 year period at 35% interest rate	[%]	10

8. Table 9.4 below presents the calculated avoided costs based on the above assumptions for the *average* household targeted by the project using a 100 W panel (first three years shown only for simplicity, the analysis is carried out for the economic life of the photovoltaic panels expected to be twenty years). The ERR using avoided costs is about 15 percent.

Table 4 Economic Analysis : Avoided Costs Only

	[unit]	NPV	Year 1	Year 2	Year 3
Costs of PV system					
Down payment	[peso]	1,620	1,814		
Gvt. Mexico (including IBRD)	[peso]	11,772	13,185		
Microfinance Loan	[peso]	1,458	1,633		
GEF	[peso]	1,348	1,510		
Private Grants	[peso]	0	0		
Financial cost	[peso]	16,198	18,142		
Finance	[peso]	2,367	0	735	735
(Less) Loan repayments	[peso]	(2,367)	0	(735)	(735)
(Less) VAT	[peso]	(2,113)	(2,366)		
(Less) Income tax on margin	[peso]	(901)	(1,010)		
(Less) Transfers	[peso]	(986)	(1,104.29)		
Economic capital cost	**[peso]**	**12,198**	**13,662**	**0**	**0**
O&M costs					
Bulbs	[peso]	5,766	0	877	877
Controller	[peso]	350	0	0	0
Battery	[peso]	4,084	0	0	1,337
Financial cost to consumer	[peso]	10,199	-	877	2,214
(Less) VAT	[peso]	(1,530)	0	(132)	(332)
Economic O&M costs	[peso]	8,669	0	745	1,882
Total Economic Costs	**[peso]**	**20,867**	**13,662**	**745**	**1,882**
Benefits at avoided costs					
Petroleum Consumption	*[litres]*	*71*	*0*	*11*	*11*
Diesel Consumption	*[litres]*	*2,794*	*0*	*425*	*425*
Petroleum	[peso]	713	0	108	108
Diesel	[peso]	15,685	0	2,385	2,385
Candles	[peso]	2,872	0	437	437
Other fuels	[peso]	1,761	0	268	268
Battery and charging expenditure	[peso]	2,571	0	391	391
Dry cell expenditure	[peso]	0	0	0	0
Hurricane lamp	[peso]	153	54	0	0
Petromax lamp	[peso]	0	0	0	0
Wick, gauzes	[peso]	605	0	92	92
Total financial costs	[peso]	24,361	54	3,681	3,681
(Less) Petroleum duties	[peso]	0	0	0	0
(Less) Diesel duties	[peso]	0	0	0	0
(Less) VAT	[peso]	(1,194)	(8)	(178)	(178)
Economic Avoided Costs	**[peso]**	**23,166**	**46**	**3,503**	**3,503**
Net Economic Flows	**[peso]**	**2,299**	**(13,615)**	**2,758**	**1,621**
ERR	**[%]**		**15.07%**		

9. For the calculation of the consumer surplus the analysis estimates the consumer surplus derived from better quality and a significant increase in the quantity of lighting available through PV systems as per unit costs are reduced. This approach is laid out in the diagram below and follows the widely accepted World Bank methodology.[71]



10. The above Diagram shows the adoption of PV lighting by households using traditional lighting fuels (diesel) where the lighting demand shifts from point alpha to point beta. Current lighting fuel expenditures (D+B) represents a minimum willingness to pay (WTP) for an improved lighting source. Real current substitutable energy expenditures have been used to estimate the likely size of SHS market segments. The increase in consumer surplus from adopting a more efficient PV lighting source is represented by the additional area under the lighting demand curve (B+C). Households that change to a Solar Home System will enjoy a (minimum) increase in welfare (from lighting only) of B+C plus their revealed willingness to pay for the lighting services from the PV system (D+E). Total WTP for SHS should in reality be higher, as it would include also the non-lighting benefits.

11. The area A+B+C+D+E is the total lighting user benefit of the PV system. Area A does not count towards net benefits, as it is part of consumer surplus for users both with and without project (SHS). Lighting price and quantity points were derived for the average income households in the project sites based on available surveys. The demand curve is established assuming constant elasticity and two points are used for a fit to actual

[71] See, for instance, H. Peskin (2006) "A primer on Consumer Surplus and Demand: Common Questions and Answers", ESMAP Knowledge Exchange Series No. 5.

lighting and lighting expenditure estimates. The area under these preliminary demand curves (the definite integral from alpha to beta) yields results for the area C. A similar approach is used to estimate the consumer surplus of using PV systems to supply electricity for radios and TV. It should be noted that survey data regarding these uses are not detailed enough, so the figures presented here are likely to be on the low side of the range of actual benefits.

12. The following table 9.5 presents the spreadsheet for the total calculation of benefits including the consumer surplus part of the benefits for an average household targeted by the project. Based on electricity consumption estimates for use of lighting and other electricity devices (radio, TV, etc.) the model allocates about 43 percent of costs to lighting and the remainder to all other uses. The first 8 years are presented in the table for simplicity. The higher ERR calculated below includes consumer surplus benefits accrued not only from lighting, but also the use of radios and TVs.

Table 9.5 Cost Benefit analysis for average individual PV home system

Economic Analysis: Consumer Surplus

Timeline	[unit]	NPV	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Lighting Costs, PV system										
Allocated costs		43%								
PV costs [Financial]	[peso]	6,054	774	688	1,259	688	1,259	844	945	374
PV costs levelised	[peso]	6,054	811	811	811	811	811	811	811	811
PV lighting	[Lumen-hours]	16,887,194	0	2,557,775	2,557,775	2,557,775	2,557,775	2,557,775	2,557,775	2,557,775
P[PV]	[P/Lumen-hour]	0.00036								
area [D+E]	[peso/Year]	6,054								
Lighting Costs, Diesel/Petroleum										
Fuelcost (Petroleum + Diesel)	[peso]		0	2,493	2,493	2,493	2,493	2,493	2,493	2,493
Hurricane Lamp	[peso]		54	0	0	54	0	0	54	0
Petromax lamp	[peso]		0	0	0	0	0	0	0	0
Wick, gauzes	[peso]		0	92	92	92	92	92	92	92
Total costs	[peso]	17,156	54	2,585	2,585	2,640	2,585	2,585	2,640	2,585
Diesel lighting	[Lumen-hours]	232,852	0	35,406	35,406	35,406	35,406	35,406	35,406	35,406
P[Diesel]	[P/Lumen-hour]	0.07368								
area [B+D]	[peso/Year]	17,156								
Radio/TV: PV system										
Allocated costs		57%								
PV costs [Financial]	[peso]	8,132	1,040	924	1,691	924	1,691	1,134	1,269	503
PV costs levelised	[peso]	8,132	1,089	1,089	1,089	1,089	1,089	1,089	1,089	1,089
PV non-lighting	[M.-hours]	20,404	0	3,103	3,103	3,103	3,103	3,103	3,103	3,103
P[PV]	[PM.-hour]	0.39856								
area [D+E]	[peso/Year]	8,132								
Radio/TV: battery										
Total costs	[peso]	2,571	0	391	391	391	391	391	391	391
Battery non-lighting	[M.-hours]	6,001	0	913	913	913	913	913	913	913
P[Battery]	[PM.-hour]	0.42836								
area [B+D]	[peso/Year]	2,571								
Net economic flows										
Lighting										
B area calculation	[peso/Year]	17,073	0	2,566	2,566	2,566	2,566	2,566	2,566	2,566
C area calculation	[peso/Year]	39,689	0	6,035	6,035	6,035	6,035	6,035	6,035	6,035
D area calculation	[peso/Year]	83	0	13	13	13	13	13	13	13
E area calculation	[peso/Year]	5,971	0	908	908	908	908	908	908	908
Total benefits [B+C+D+E]	[peso/Year]	62,816	0	9,551	9,551	9,551	9,551	9,551	9,551	9,551
Total costs [D+E]	[peso/Year]	6,054	811	811	811	811	811	811	811	811
Net consumer benefits, lighting	[peso/Year]	56,762	(811)	8,741	8,741	8,741	8,741	8,741	8,741	8,741
TV/Radio										
B area calculation	[peso/Year]	179	0	27	27	27	27	27	27	27
C area calculation	[peso/Year]	169	0	26	26	26	26	26	26	26
D area calculation	[peso/Year]	2,392	0	364	364	364	364	364	364	364
E area calculation	[peso/Year]	5,740	0	873	873	873	873	873	873	873
Total benefits [B+C+D+E]	[peso/Year]	8,480	0	1,289	1,289	1,289	1,289	1,289	1,289	1,289
Total costs [D+E]	[peso/Year]	8,132	1,040	924	1,691	924	1,691	1,134	1,269	503
Net consumer benefits, TV/Radio	[peso/Year]	348	(1,040)	365	(401)	365	(401)	156	20	787
Total consumer surplus	[peso/Year]	57,110	(1,850)	9,106	8,340	9,106	8,340	8,897	8,761	9,528
Economic cost adjustment	[peso/Year]	(0)	(13,662)	1,855	1,855	1,855	1,855	1,855	1,855	1,855
(Less) Net Gvt. Subsidies	[peso/Year]	(8,131)	(9,107)							
(Less) GEF subsidies	[peso/Year]	(1,348)	(1,510)							
(Plus) FI surplus	[peso/Year]	618	693							
(Plus) Dealers surplus	[peso/Year]	986	1,104							
Net economic flows	[peso/Year]	49,235	(24,332)	10,961	10,194	10,961	10,194	10,751	10,616	11,383
	[ERR]		44%							

13. Finally, the analysis concludes by combining the individual system benefits presented above with the expected number of annual systems installations for the project as a whole. The results are presented in table 9.6 below and include an economic net present value of about 805 million pesos and an economic rate of return of about 40 percent.

14. Table 9.6: Economic Cost-Benefit analysis for solar home systems project component

		Costs			lenefits		
					'artial Benefits		
Year	Installed Systems	Initial Capital Expenditures	Replacement costs	Total Costs	Avoided Lighting costs	Gain in Lighting Benefit from PV	Total Net Benefits
							(18,032,508
					16,173,878	43,045,118	(33,948,960
			(21,574,244)	(237,428,016)	41,217,302	109,695,623	(86,515,091
			(34,682,646)	(381,688,077)	66,260,727	176,346,128	(139,081,222
			(47,791,048)	(525,948,137)	91,304,151	242,996,633	(191,647,353
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
			(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
20	35,000	0	(47,791,048)	(47,791,048)	91,304,151	242,996,633	286,509,736
NPV		34,976,885	(257,423,909)	(985,073,226)	489,009,872	1,301,449,624	805,386,270

Discount Rate	12%	EIRR	40%
Net Present Value	805,386,270		
Economic Internal Rate of Return	40%		

Conclusions

15. Based on the economic analysis, the solar homes systems (SHS) component of the project shows high economic returns. Under relatively conservative assumptions, the economic rate of return (ERR) for the total SHS component is about 40 percent, with an economic net present value of about 805 million pesos, reflecting a significant improvement in the quality of lighting and battery services using PV systems in households. The economic returns of the SHS component are robust, and risks are minor.

16. Such high benefits are consistent with those estimated in other countries for similar projects (e.g., 30 percent ERR as estimated by the ICRs for a similar project component in India, and 43 percent for the SHS component of the Sri Lanka Energy

Services Delivery Project, while a similar analysis for the Bolivia Decentralized Infrastructure for Rural Transformation project yielded about 30 percent). These benefits reflect the high willingness to pay and considerable net consumer surplus from improved levels of lighting service.

17. It should be also noted that the calculated household ERR does not include the broad range of important, additional direct and indirect benefits from rural electrification. These additional benefits include, among others, the following:[72] increases in consumer surplus from information and communication technologies (TV, radio and cell phones where signal exists); avoidance of burn injuries and fires; benefit to families with higher levels of educational possibilities; time savings for household chores; benefits of earning higher levels of family income as the availability of good quality lighting extends the potentially productive hours of people; health benefits (through decreased indoor kerosene and diesel use which cause indoor pollution and burns) and improves service in health stations (emergency lights; vaccines); social benefits to the community (street light increasing safety and allowing women to participate in community life at night); multiplier effects on local and national level from replication of the successful pilot sites; and synergy effects from bundling services.

18. As noted above, all these additional benefits have not been counted towards total net benefits and would come on top of the conservative ERR and NPV results used for the Project economic analysis. The benefits that will be generated by the project stem from households, micro-enterprises and social uses 'stepping up the energy ladder' by substituting electricity for traditional energy (improving service quality and unit costs). Rural users currently mainly use kerosene, diesel, and batteries for lighting and radio/TVs, plus diesel generators in few cases (all assumptions based on data from household surveys).

19. The Project will achieve a significant improvement to the current situation regarding energy quality, energy cost, service reliability, and sustainability. SHS allow for a level of service that is far superior to existing solutions to basic needs in non-electrified households (e.g., lighting, radio, TV). A large majority of rural households are low-intensity consumers, using less than 10 kWh per month. This level of service is consistent with the power available from SHS, when used in conjunction with compact fluorescent lamps (CFLs).

B. Comparison between on-grid and off-grid costs, prices and subsidy

20. The following table compares the difference between on and off-grid costs, prices and subsidies:

[72] This section based on the World Bank's Bolivia Decentralized Infrastructure for Rural Transformation project where a more comprehensive list and additional references of such benefits are available

Table 9.6 Tariff Comparison on and off-grid solutions (4)				
		On-Grid (1)	**Off-Grid (SHSs) (2)**	**Off-Grid (SHSs) (3)**
Unit Cost	US cents / kWh	81.8 (5)	64.96	64.96
Unit Price	US cents / kWh	44	34.58	30.7
Unit Subsidy	US cents / kWh	37.8	30.38	34.26

(2) Source: World Bank (2002), Mexico Expenditure Review, see Table 1.2 in Annex 1
(3) Considers a 100W system, a subsidy of 80 percent over the capital cost of the SHSs, no subsidy is expected in O&M
(4) Considers a 100W system, a subsidy of 90 percent over the capital cost of the SHSs, no subsidy is expected in O&M
(5) Lowest residential decile (10 percent poorest)
(6) Considers grid extensions with positive economic NPVs

21. The Project will therefore provide rural communities with an electricity tariff that is lower than the grid-connected tariff, also with a lower subsidy.

C. Financial Analysis

22. Given that the Project is supporting the implementation of a social program led by the government which subsidizes to a large extent the provision of a basic infrastructure service for poor rural communities, the analysis in only focused on the economic costs and social benefits associated to the service. In this case, there is no need to assess the "profitability" of the program and conduct a financial analysis.

Annex 10. Safeguard Policy Issues

Environmental

1. The project aims at increasing electricity services and promoting social and economic development in the rural areas of the poorest states of Mexico. It will promote the use of renewable, small scale energy sources. The negative environmental impacts of the project will be minimal given the scale of the subprojects. Most likely, the project will have positive environmental impacts, both in terms of local and global pollutants.

- global environmental impacts are likely to be reduced due to the comparatively low CO_2 emissions from the technologies applied;

- local environmental impacts are likely to be reduced due to the fact that the proposed technologies have low or even zero health-threatening local pollutants (indoor pollution being a major health risk in the communities concerned); reduce the risk of fires inside the household, among other benefits.

2. The positive impact both in terms of reduced emissions (both global and local pollutants) and reduced impacts on health due to indoor pollution will vary and can only be determined once specific subprojects are defined.

3. The implementation of the project will be guided by an operational manual which will include a detailed environmental framework and a set of guidelines to ensure that the installation of different sub-projects as well as their operation, maintenance and end-of-life activities, comply with both, the Mexican environmental legal and regulatory frameworks and the Bank's safeguards.

4. The environmental framework and set of guidelines (or manual) include the following sections: (i) current situation of the electricity sector in Mexico, (ii) summary of the environmental, institutional, and legal framework to carry out environmental assessments in Mexico, (iii) screening criteria and procedures for ensuring compliance with World Bank Safeguard Policies for small renewable energy projects, (iv) outline of the main environmental and social issues that would have to be discussed in EA reports, and (v) outline of the procedures for review and clearance of safeguard policies. This manual has been discussed and agreed with the Government.

Key environmental impacts and proposed mitigation mechanisms

5. As discussed above, the project will promote the use of renewable, small scale energy sources in remote areas of the Southern States of Mexico. The technologies considered are predominantly photovoltaic and wind home systems (85 percent of households targeted under the program). Other types of systems may also be contemplated, including pico and micro hydros (3-5 percent of targeted households), and, whenever advisable, other types of small scale systems based on biomass, diesel, or diesel-RET hybrid systems.

6. The negative environmental impacts from the technologies under consideration are expected to be local and minimal, and will be controlled through the implementation of appropriate measures to prevent and mitigate impacts. Below is a detailed description of each of these systems and their expected environmental impacts is included after the table. This is followed by a table (Table 10-1) containing a summary of the potential environmental impacts and appropriate mitigation measures to be applied for each of the technologies considered in the project.

7. These measures are detailed further in the Project's operational manual, which presents the project's environmental management framework, to ensure that both the national environmental regulatory framework and the Bank's safeguard policies are observed. The environmental management framework of the project also has addressed the institutional environmental management responsibilities and capacities, and has set forth enhancement provisions as needed to ensure that participating institutions have the capacity to address any environmental impacts associated with the project.

Typology of Projects

a. Photovoltaic systems

8. For the most part, photovoltaic (PV) systems will range from 50W to 210W DC. These systems are typically used to provide lighting, power a radio or a television set, and charge a cellular phone.

9. The primary article of commerce in the PV market is the PV module. PV modules can last more than 25 years with no routine maintenance required, but periodic inspection is advised to identify damages to the module (glass, backskin, or frame). Though these modules can operate effectively without ever being washed, removal of dirt from the front glass can however increase output.

10. The components added to the module constitute the "balance of system" or BOS. Balance of system components can be classified into four categories:

a. **Batteries.** Store electricity to provide energy on demand at night or on overcast days.
b. **Inverters.** Are required to convert the DC power produced by the PV module into AC power.
c. **Controllers.** Manage the energy storage to the battery and deliver power to the load.
d. **Structure.** Required to mount or install the PV modules and other components.

11. Not all systems will require all these components. For example in systems where no AC load is present an inverter is not required. For on-grid systems, the utility grid acts as the storage medium and batteries are not required. Batteries are typically not required for PV water pumping systems, where a water reservoir "buffers" short-term demand and

supply differences. Batteries are typically required for single-home systems such as the ones included in this project.

12. The main environmental issue related to PV systems is the disposal of batteries. Guidelines to dispose of batteries are established in the Mexican law and described in the project's environmental manual. Within the scope of the project, battery maintenance and disposal will be made by the supplier. It is therefore the responsibility of the supplier to dispose correctly of the battery. Supervision of the supplier will be provided by SEMARNAT.

b. Wind generators

13. The major components of modern wind energy systems typically consist of the following: Rotor, with 2 or 3 blades, which converts the energy in the wind into mechanical energy onto the rotor shaft; Gearbox to match the slowly turning rotor shaft to the electric generator; tall tower which supports the rotor high above the ground to capture the higher wind speeds; Solid foundation to prevent the wind turbine from blowing over in high winds and/or icing conditions; and Control system to start and stop the wind turbine and to monitor proper operation of the machinery. Finally, batteries, inverters and controllers are required depending on the application.

14. Wind turbine technology has reached a mature status during the past 15 years as a result of international commercial competition, mass production and continuing technical success in research and development (R&D). The earlier concerns that wind turbines were expensive and unreliable have largely been allayed. Wind energy project costs have declined and wind turbine technical availability is now consistently above 97 percent. Modern wind energy systems operate automatically.

15. Essentially, the same environmental considerations as those for PV systems are in order when discussing wind generators—the main environmental concern is related to the disposal of batteries. A secondary environmental problem associated with small wind turbines is the killing of birds. While this is an important issue with large turbines, reports of residential-scale wind turbines killing birds are very rare given the small size of the blades. Finally, any intervention under this project will not allow for significant land clearing (land clearing should not be needed due to the size of the turbines that will be used).

c. Diesel generators

16. A diesel generator is the combination of a diesel engine with an electrical generator to generate electric energy. Diesel generators are used in places without connection to the power grid or as emergency power-supply if the grid fails. Small portable diesel generators range from about 1kVA to 10kVA, while the larger industrial generators can range from 8kVA - 30kVA for homes.

17. The main environmental impact from diesel generators is associated to fuel spills. In order to control any negative impacts from a diesel oil spill, the generator should be located in an area in which any potential spills can be contained (for example a room with adequate ventilation). The floor of the area will be made or covered by an impermeable surface. Details on suggested materials for the impermeable surface and the guide for disposing material impregnated by diesel oil are included in the project's environmental manual.

d. Biomass generators

18. Biomass generators transform organic matter (agricultural and industrial residues, waste, wood, bagasse) into heat or electric energy. The main methods available to convert biomass into useful energy are (i) direct combustion, (ii) anaerobic digestion, (iii) fermentation, (iv) pyrolisis, and (iv) gasification. Direct combustion is the method with the greatest level of environmental problems because, first, the search for biological matter (i.e., wood) may affect natural ecosystems through deforestation, and second, the combustion of organic residues can release certain toxic elements such as dioxins and furans or heavy metals. The remaining methods have negligible small environmental impacts.

19. The Project targets only small scale biomass gasifiers. The same environmental considerations apply for biomass generators as for diesel based systems. Typical environmental problems for small biomass generators include production of bottom ash, dust generation and emissions to air and water. These issues can be dealt with by installing filters to prevent emissions and by the adequate disposal of bottom ash.

e. *Pico and Micro-hydro systems*

20. Pico Hydro Systems currently provide basic energy services for lighting, radio, television, and the operation of small appliances to millions of rural households and cottage industries that have no access to electricity grids. The pico hydro unit capacities range from 100 to 500W. The micro-hydro considered in the Project is expected to be in the range 50-200 kW.

21. The smaller units are used by individual households, while the larger systems are used for productive activities and for multi-household supply.

22. maintenance costs, especially for bearing replacement - annual cost almost equals the initial cost of a pico hydro unit; (b) inconvenience of having to walk to the stream possibly several times a day to remove debris from the impeller chamber; and (c) need to be within 500-1000 meters from a stream.

23. Hydro systems do not create any pollution when they are operating, and generally offer highly reliable power. They also have very low running or maintenance costs, and they can be operated and maintained by trained local staff. Hydro systems generally have

a long project life. Equipment such as turbines can last 20–30 years, while concrete civil works can last 100 years. This is often not reflected in the economic analysis of small hydropower projects, where costs are usually calculated over a shorter period of time. This is important for hydro projects, as their initial capital costs tend to be comparatively high because of the need for civil engineering works.

24. Environmental impacts of pico and micro-hydro vary by location, but are mainly associated to the construction of the canal to divert the water from the river and the construction of the housing for the generator. Care must be taken when selecting the location of the generator in order to minimize the impacts of the construction (deforestation/land clearing, noise, dust, and generation of solid waste). The project's environmental manual describes the impacts associated with the construction of a small scale hydro station, as well as mitigation options.

Table 10.1
Potential Environmental Impacts Associated with Technologies Applied in the Project and Suggested Mitigation Measures

Type of Generation Project	Potential Environmental Impacts	Level	Mitigation Measure
Photovoltaic systems (stand alone systems)	- Disposal of batteries	- Minimum	- Adequate collection and disposal of batteries.
Wind Generators (stand alone systems)	- Land clearing	- Minimum	- Low-impact forms of land-clearing (e.g., paying attention to erosion risks)
	- Disposal of batteries	- Minimum	- Adequate collection and disposal of batteries.
Diesel Generators	- Oils spills	- Minimum	- System containing potential diesel spillage – using e.g., mini-dikes or impermeable membranes and construction materials
PVs-Diesel Hybrids	- Disposal of batteries	- Minimum	- Adequate collection and disposal.
	- Oil spills	- Minimum	- System containing potential diesel spillage – using e.g., mini-dikes or impermeable membranes o materials.
PVs-Wind Hybrids	- Land clearing	- Minimum	- Low-impact forms of land-clearing (e.g., paying attention to erosion risks)
	- Disposal of batteries	- Minimum	- Adequate collection and disposal of batteries.

Table 10.1 Potential Environmental Impacts Associated with Technologies Applied in the Project and Suggested Mitigation Measures			
Type of Generation Project	**Potential Environmental Impacts**	**Level**	**Mitigation Measure**
Wind-Diesel Hybrids	- Land clearing	- Minimum	- Adapt wind installation functioning to presence of birds (e.g., reduced during major migration period).
	- Oils spills	- Minimum	- System containing potential diesel spillage – using e.g., minidikes or impermeable membranes

f. Social, Economic and Productive Activities

25. The project will also support the development of a limited number of productive and social activities as described in Annex 4. Although the type and nature of these activities will be determined during project implementation, it is expected that the will be of small scale and that any potential environmental impacts derived from them will be of also easy to prevent and/or mitigate.

26. The environmental framework and manual prepared for the projects includes a set of measures and guidelines to ensure that these activities comply with the national environmental law and Bank's safeguards. No social, economic and/or productive activity will be supported by the project if the associated impacts are not minimal or within the parameters of a Category B project.

Environmental Assessment

27. As explained in Annexes 4 and 6, sub-projects will be selected during implementation randomly from a data base of pre-selected communities, based on specific eligibility criteria. For this reason, the EA of the project will take the form of an Environmental Management Framework, which will set the rules and necessary conditions to comply with both, the national environmental law –and regulatory framework- and the Bank's safeguard policies.

28. The environmental management framework of the project will include the institutional environmental management responsibilities and capacities, and set forth enhancement provisions as needed to ensure that participating institutions have the capacity to address any environmental impacts associated with the project.

29. This framework will be included as part of the Project's Operational Manual, and will therefore have a legal status.

30. The Project will only support sub-projects whose potential environmental impacts are minimal in within the parameters of a Category B project.

Social Assessment

Introduction

31. During project preparation a Social Assessment was conducted which included: (a) a review of the legal and institutional framework affecting IP in the Southern States, (b) review of baseline information focused on demographic, social, political, legal and custom/cultural characteristics of the targeted IP beneficiaries, (c) a consultation with the targeted IP beneficiaries to assess potential social impacts and identify prevention and mitigation measures. Several official sources were used to conduct the context analysis.[73]

Analysis of the Social Context

32. Although they are rich in natural resources, the four southern states (SS) of Chiapas, Guerrero, Oaxaca and Veracruz, lag behind national averages in virtually every indicator of social development. Their ratings in industrialization, productivity, exports, gross national product and electrification are also the lowest in Mexico. In the fields of investment and economic growth, the level of both public and private investment is extremely low. The outcome has been an extensive emigration over harvest seasons to different agricultural regions of the country and the United States.

33. Furthermore the poverty pattern in the SS is complicated by the geographic isolation that in part explains the economic exclusion of the poor living in their regions. Small human settlements are spread throughout their mountain range territory. The pattern of population distribution is characterized by two opposed phenomena: rural dispersion and urban concentration. About 60 percent of the urban population of the four states lives in towns of fewer than 50,000 people, compared to 30 percent across the country as a whole. Approximately 8.2 million people of the SS live in small localities with less than 2,500 inhabitants and 3.8 million lives in cities that have fewer than 500 residents.

34. These particular population distribution has complicated the delivery of public services which in turn result in higher transportation costs to distribute products to either local or national markets; it also makes alternative social interventions more costly, for instance, communities in the SS have been bypassed in small electrification projects.

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[73] Indigenous Profiles. www.ciesasitsmo.edu.mx (as of June, 2005); The World Bank (1999): Indigenous Peoples Profile (Green Cover), Mexico; The World Bank (2003): SSDS Policy Note Summary and Indigenous Policy Notes, Washington, D.C; The World Bank (2004): The U.S.-Mexico Remittance Corridor. Lessons on shifting from informal to formal transfer systems. Working Paper 47, Washington, D.C. 2004. Mesoamerica Biological Corridor, Manual for Sustainable Community Participation, Tania Carrasco and Shawn Mcdonough, Trust Fund BNPP, World Bank, Mexico, D.F, 2005.

Ethnic and Linguistic Diversity

35. In Mexico, there are 6.04 million indigenous language speakers over the age of five[74] and growing at 2.2 percent per year during the period 1970 and 2000, as compared to an average national growth rate of 1.5 percent. They form 62 different ethnic groups. The density of indigenous people in the national territory is 3.1 per km2. The SS have the highest concentration of indigenous peoples in Mexico, with at least 2.9 million, 40 percent residents of these states being indigenous. In other words, 4 out of 10 people are indigenous. The high incidence of poverty in the specific case of indigenous groups also emerges from an array of political, economic and cultural determinants that combine to exclude them from opportunities that could move them out of poverty. Most of the indigenous communities live the process of clearing the deciduous forest and rainforest, which makes them face a hostile environment. In general terms, it can be said that they are the main victims of the confrontation between modernization processes in the framework of natural resources pushed to their limit by economic inefficiencies. One of the outcomes is that the youngest generation has no land or job options and their only alternative is to migrate to the US in most of cases.

36. The evaluation showed that a diverse number of indigenous peoples live in the target states of the project, representing 28 ethno-linguistic groups (see Table 10.2 below). This cultural and linguistic richness has, however, contributed to the marginalization of many these groups as well, at least in mono-linguistic groups (i.e., groups that speak only their language and little or no Spanish). The use of Spanish, evidently a crucial tool for interaction with the world outside the community, varies between communities and is more widespread among men.

[74] Figures are based upon linguistic criteria. It would be 10.0 million if housing occupants of household where the head or household or spouse is an indigenous language speaker, and indigenous language speakers over the age of 5 are included.

Table 10.2 Total indigenous population in the SS

Population	Chiapas	Guerrero	Oaxaca	Veracruz	Total SS
Total population	3,920,892	3,079,649	3,438,765	6,908,975	17,348,281
Indigenous speakers	809,592	367,110	1,120,312	633,372	2,930,386
Ethinc Groups	Tseltales, Tsoltsiles, Mames, Lacandones, Choles, Tojolabales	Nahua, Mixtecos, Tlapanecos, Amuzgo, Zapotecos, Popolucas, Mazahua	Chinantecos, Mazatecos, Zoques, Zapotecos, Huaves, Mixe, Mixteco, Tiqui, Chatinos, Cuicatecos, Chontales, Amuzgos, Chochos, Chatino, Ixcateco, Popoloca	Nahua, Tepehua, Totonaca, Husteco, Popoluca, Tepehua, Otomi	

Source: INEGI (2000).

37. The high incidence of poverty in the specific case of indigenous groups also emerges from an array of political, economic and cultural determinants that combine to exclude them from opportunities that could move them out of poverty. Most of the indigenous communities live the process of clearing the deciduous forest and rainforest, which makes them face a hostile environment. In general terms, it can be said that they are the main victims of the confrontation between modernization processes in the framework of natural resources pushed to their limit by economic inefficiencies. One of the outcomes is that the youngest generation has no land or job options and their only alternative is to migrate to the US in most of cases.

Gender Issues

38. As a result of lack of access to bilingual education, the percentage of monolingual population is higher amongst woman (60.5 percent), and is growing. This becomes a constraint to access better living standards as Spanish learning is closely correlated with improvements in access to health, food, education and also to housing. There are 19 municipalities in Chiapas with a monolingual female population of 113,619; 7 municipalities in Guerrero with 35,058 monolingual females; in Oaxaca 16 municipalities with 19,389 such females; and in Veracruz with 3 municipalities including a total of 10,074 monolingual females.

39. In general, women remain in the community or even family context, which means that on average their level of Spanish is lower. However, the degree to which this is true varies among communities, and indeed due to a strong outflux of male community members (who tend to seek work elsewhere), this has somewhat diminished in recent times by increasingly forcing women to interact with the outside world, including for

business purposes. The resulting incomes are somewhat reducing the gender gap in health and nutrition.

Additional Baseline Data

40. The social assessment established that population in project target areas are largely indigenous. The SS were populated by many distinct indigenous groups when the Spaniards arrived in Mexico. Chiapas was generally peopled by *Tzeltal* and *Tzotzil* speaking descendants of the Mayan civilization. Guerrero's indigenous groups include the *Nahuas* and *Tlapanec*; the Nahuas are also found in Veracruz as well as *Totonacs*. Indigenous communities in Oaxaca seem to have had more ethnic and linguistic diversity than Chiapas and Guerrero. While the two largest groups were, and still are, the *Mixtec* and the *Zapotec*, the indigenous population in Oaxaca can be broken down into a dozen of linguistic groups.

41. As a result of lack of access to bilingual education, the percentage of monolingual population is higher amongst woman (60.5 percent), and is growing. This becomes a constraint to access better living standards as Spanish learning is closely correlated with improvements in access to health, food, education and also to housing. Most of the indigenous people and poor farmers in the SS practice agriculture ranging from subsistence to low-cost alternatives for sale, complemented by the collection of forest products, small livestock, collection of wild plants and insects, hunting-gathering, and fishing. In some cases, they manage to sell the surplus or hand-made artisan work in local markets if paved roads and rural market intermediaries allow for transportation, bulk purchase, and trade of their products.

Environmental Characterization

42. Across the SS, vegetation, animal life and water resources are used in traditional ways – which are unfortunately low value added activities with poor significant economic returns. Agriculture employs less than 39 percent of the work force in the SS; it is no surprise that on average productivity is so low. Agriculture in the four SS is severely hampered by the pattern of land ownership, which favors very small land holdings. The expansion of low cost livestock production practices and poor double purpose cattle production by local producers destined for domestic or export market, is a low-return, inefficient, and non-sustainable industry, and further encourages deforestation. The federal government estimates that 92 percent of the soil in Guerrero is degraded, in Oaxaca 83 percent, and Chiapas 76 percent.

43. One of the impacts of living in the remote areas of the SS is the lack of electricity that would facilitate increases in their productive activities while also addressing the issue of ecological sustainability. By providing them with small electrification/renewable energy as a force for economic and cultural survival, it seems that the largest potential lies still remain unexplored using the natural wealth, particularly water, forest and rainforest, and taking into account their sustainable use as a source of long-term income.

44. The key challenge would be to build capacity so as to promote and generalize practice adoption and adaptation.

Table 10.3 Municipalities without electrification in SS

	Chiapas	Guerrero	Oaxaca	Veracruz	Total SS
Municipalities	31	69	81	81	262
Population	154,443	39,624	38,473	58,421	290,961
Indigenous speakers	66,710	63,947	24,431	16,983	172,071

Source: INEGI (2000).

45. Considering the total number of dispersed municipalities with no electrification, roughly 70 percent of them are populated by indigenous people living in localities with more than 50 inhabitants. It is estimated that in the course of project span 50,037 households will benefit from renewable energy technologies (RETs). The latter figure includes hybrid systems (diesel/RETs), but where considered appropriate it will also support limited fossil/fuel based sub-projects (e.g., diesel based); 37,839 households will profit from PV/SHS, 11,674 households will be covered by Wind/Biomass, and 525 households will benefit from Mini/Hydro systems.

The State of Chiapas

46. The state of Chiapas is characterized by multiple microclimates, ranging from mountain to coastline. These different climates meaning diverse habitats support a wide variety of animal wildlife. It is also a very rich state in terms of biodiversity (one of the few important rainforest areas in the country) and natural water sources – it is the generator of a high percentage of Mexico's electricity through hydropower. In the state there are 30 plants generating electricity with an installed capacity of 3,928.48 megawatts/hour. The water storage capacity is 36,868 million m3 to be used for electricity generation in 80 percent.

47. The municipalities of Chiapas are atomized 119 municipalities (including 8 autonomous councils due to the split of some municipalities) in nearly 19,500 localities. All but 44 percent of population lives in rural localities (those where more than 50 percent of the population lives in localities of 2,500 inhabitants or less), and almost a third part is living in localities with less than 500 inhabitants. According to data (INEGI, 2000), as much as 88 percent of dwellings are electrified. Chiapas will be part of the project from the second year of operation due to both the end of the government's elected period in office and the devastation produced recently by Hurricanes Wilma and Stan. Government authorities will have to update the housing census because nowadays many localities lack electricity service and it is estimated that an important figure disappeared.

48. With respect to land property, virtually 95 percent of the sociall properties are *ejidos*, three quarters of which are divided into parcels, either in forest of rainforest areas. In addition, half of the *ejidos'* title holders speak indigenous language. It is worth noting that in practically all *ejidos* agriculture is practiced, and at the same time in 70 percent of properties livestock activity is also practiced. The original indigenous population learnt to produce under multiple crop conditions to avoid soil erosion. Local agriculture is aimed at subsistence, although range beef cattle farming is commonly practiced in most part of the state thus competing with protected natural areas.

49. Within the 3.9 millions of Chiapas inhabitants a quarter of the population is indigenous with a total of 809,592 people, and the density of indigenous language speakers is 11/km2. However, compared to Oaxaca, it ranks in second place. Out of a total of 3.4 million people over the age of five, the *Tzotzil* language is spoken by 291,550 indigenous speakers over the age of five. 9 percent of the population does not speak Spanish at all. The second and third important indigenous languages are *Tzeltal* and *Chol* (spoken by 278,577 and 140,806, respectively). The most commonly spoken languages are also *Zoque, Tojolabal, Kajobal, Mame, Zapotec* and *Chuj,* in descending order.

50. As a result of lack of access to bilingual education, in Chiapas the percentage of monolingual population is higher amongst woman (63.1 percent). This feature becomes a constraint to access better living standards when Spanish learning is closely correlated with improvements in access to public services and housing, as it was explained before (*supra*).

51. Priorities of the state-level budget are similar to the situation found in Oaxaca. They are aimed to education (38.4 percent), health (17.2 percent), infrastructure (12.9 percent), social development and housing (12.1 percent), and only 9 percent for agriculture. Only 0.5 percent of public investment is aimed to indigenous people as a specific state program.

The State of Guerrero

52. The state of Guerrero can be described as fairly dried and sunny territory with high mountains, scarce valleys, and mostly poor soil supporting tropical jungle. Although the climate is mostly dry, the different altitude conditions allow for the development of varied seasonal crops. As a tradition, maize is largely cultivated on hillsides with poor soil conditions and range beef cattle farming is as well a common practice in the state. Another important feature is the pre-Hispanic slash-and-burn agricultural system. Silver mining has been carried out for centuries. It is worth noting that the coastline of Guerrero has several famous tourist destinations.

53. Unlike the other Southern States, there are 80 municipalities atomized within its territory and with a total of 7,719 localities. Nearly 45 percent of population live in rural localities (those where more than 50 percent of the population lives in localities with 2,500 inhabitants or less), and almost 1 out of 5 people are living in localities with less than 500 inhabitants.

54. Approximately, 26 percent of the population was practicing agriculture, 20 percent secondary activities, and half of the population devoted to tertiary activities. About land property, more than 8 out of 10 social properties are *ejidos*, of which virtually all are dedicated to agriculture, and livestock activity can be found at the same time in 86 percent of properties. Fifteen percent of the *ejidos'* title holders speak indigenous language. Also, it is worth noting that in 40 percent of the social properties artisan, extraction and fishing stands as important activities.

55. Within the 3 millions of Guerrero inhabitants, 14 percent of the population is indigenous (367,110 inhabitants) and the density of indigenous language speakers is 5.8/km2. The *Náhuatl* language is spoken by 136,681 people over the age of five. The second and third important indigenous languages are *Mixtec* and *Tlapanec,* spoken by 103,152 and 90,443, respectively). Approximately 5 percent of the population does not speak Spanish at all. The most commonly spoken language is also *Amuzgo*

56. As a result of lack of access to bilingual education, the percentage of monolingual population is higher amongst woman (60.5 percent), and is growing. As in the case of the previous two characterized SS, this feature becomes a constraint to access better living standards in Guerrero.

The State of Oaxaca

57. The state of Oaxaca is similar to the state of Guerrero in terms of climate and topographical conditions. The two states also share a common border. Likewise both states have rich coastlines. However, the soil is probably richer than in Guerrero because of valleys that allow for more diversified crops like in the case of sugar cane. The indigenous culture in Oaxaca is acknowledged for being poly-chromatic. This is based on the different ethnic groups that inhabit the state, all of them speaking different languages, and practicing different customs and traditions. Oaxaca is mostly a tourist-oriented state with places of interest from the mountains down to its coastline. Chiapas and Oaxaca also share a common border.

58. The state is divided into 509 municipalities, with 10,500 localities in total. As much as 45 percent of population lives in rural localities (those where more than 50 percent of the population lives in localities with 2,500 inhabitants or less), and a quarter lives in localities with less than 500 inhabitants.

59. Approximately, 41 percent of the population lives off agriculture, 19 percent off secondary activities, and nearly 38 percent to tertiary activities. In the case of land property, one half of the social land tenure in the state is *ejidos*, while the other half is part of the so-called communal land. Unlike the latter, 6 out of 10 *ejidos* are divided into land holdings. In almost all *ejidos* agriculture is practiced and at the same time in 65 percent of properties livestock is also practiced. Roughly almost one half of the *ejidos'* title holders speak indigenous language.

60. Within the 3 .4 millions of Oaxaca inhabitants more than 37 percent in Oaxaca is indigenous, and the density of indigenous language speakers is 1.7/km2. The growth rate of indigenous between 1995 and 2000 was 1.7 percent, while at the national level that rate was 2.0 percent. More than 1.12 million people over 5 years speak indigenous languages or dialects. 7 percent of the population does not speak Spanish at all.

61. The *Zapotec* language is spoken by 377,936,000 indigenous language speakers over the age of five. The second and third important indigenous languages are *Mixtec* and *Mazatec* (spoken by 244,029 and 174,352, respectively). The most commonly spoken languages are also *Mixe, Chinantec* and *Chatino. Zapotec* refers to a native people, and their language family consisting of more than 15 languages, as well as their historic culture and traditions. The *Zapotec* people are centered in Oaxaca. The *Zapotec* name means 'People of the Clouds' and *Mixtec* means 'People of the Rain'.

62. As a result of problems/lack of access to bilingual education, the percentage of monolingual population amongst woman is 60 of speakers, and is growing. As in the other SS, in Oaxaca this situation becomes also a constraint to access better living standards as Spanish learning is closely correlated with improvements in access to public services and housing.

63. It is worth noting that Oaxaca is unique in the country in the sense that the state's legal system recognizes the authority of indigenous government and authorizes municipalities to govern themselves through the customary system of consensus, rather than the system of election of authorities by majority vote. Roughly more than 400 municipalities are governed under traditional customary forms of government. These forms of government include a hierarchy of civil and religious institutions specific to indigenous communities.

The State of Veracruz

64. A number of rivers and streams irrigate the territory including areas with outstanding soil conditions for crops and grassland. At the same time, the state has energy reserves such as oil which are exploited in the ocean, and extraction and oil-related activities in-land. It can be said that Veracruz is the richest of the 4 poor southern states. The state is an important producer of coffee, tobacco, maize, sugar cane, beef and dairy livestock. Some areas of the state have grasslands exploited for extensive dual (beef and diary) purpose cattle farming. This activity has resulted in impoverishment of areas needed for environmental preservation.

65. The state of Veracruz is divided into 210 municipalities, with a total of 22,032 localities. Approximately, 41 percent of the population live in rural localities (those where more than 50 percent of the population live in localities of 2,500 inhabitants or less), but 20 percent live in localities with less than 500 inhabitant.

66. Roughly, 3.73 percent of the population was practicing agriculture in year 2000. With respect to land property, virtually all the social properties in the state are *ejidos*, of

which 8.8 out of 10 are divided into land holdings; in 96 percent of them agriculture is practiced, and at the same time in 78 percent of plots there is also livestock activity. A fifth part of the *ejidos*' title holders speak indigenous languages.

67. Within the 6. 9 millions of Veracruz inhabitants el 10 percent is indigenous, and the density of indigenous language speakers is 8.7/km2. Only 2 percent of population does not speak Spanish. *Náhuatl* is spoken by almost 338,324 indigenous language speakers over the age of five. The second and third most important languages are *Totonac* and *Huastec* (spoken by 119,957 and 51,625, respectively). The most commonly spoken languages are also *Popoluc* and *Zapotec.*

68. As a result of lack of access to bilingual education, the percentage of monolingual population is higher on the side of woman (65.6 percent) and is growing. As it has been mentioned repeatedly before, this situation becomes a constraint to access better living standards as Spanish learning is closely correlated with improvements in access to public services and housing.

Community Organization: Main Features

69. The target communities – indigenous or non-indigenous – are far from homogenous. Indeed, they are different in numerous ways, including with respect to their ethno-linguistic groupings; their internal organizations, their degree of geographic concentration or dispersion; their physical environment (and, accordingly, the natural resources they use); or by their governance structures.

70. Nonetheless, there are also some similarities, such as the assembly-based community decision-making. Decisions thus taken tend to have strong validity with community members – indeed, there are usually sanctions provided for those community members who do not. The most important decisions are usually taken on festive days – when most community members, including those working outside the community, are present. Community-level decisions are represented at the municipal level by a community member chosen for this purpose.

Legal Framework on Indigenous Peoples

71. The Constitutional basis that sets the basic right of indigenous peoples in Mexico and from which the validity of secondary protective regulations is derived on individual guarantees, are articles 2 and 27. In the former case, it guarantees to indigenous peoples: (i) to decide their internal ways of both living together, and social, economic, political and cultural organization, (ii) to preserve and improve their habitat as well as the integrity of their lands, (iii) to encourage the regional development of indigenous areas so as to strengthen their local economies and improve living conditions by means of government coordinated activities, (iv) to consult them on program and project development earmarked for them, and (v) promote the participation of various organizations and indigenous communities in the formulation, carrying-through, management, evaluation

and follow-up of the programs and projects at the community and municipal planning level.

72. In the paragraph nine of Article 27 of the Constitution, dealing with the capacity to acquire ownership of lands and waters in the country's territory, the clause VII states that the legal existence of indigenous settlements is acknowledged and may be organized according to two schemes with direct consequences on land tenure: communal and *ejidal*. Both the communal and *ejidal* settlement will have a General Assembly as a type of organization – the Supreme Agency. It will also have a Commissariat as a body of representation, which is an organization similar to that of any civil or mercantile society. Each scheme will be given the ability to own lands but is given different treatment. The essential difference is that, although in both schemes they can organize to transmit the use of their land, only in the *ejido* system can transmit ownership of their lands.

73. Based on the aforementioned Article 2 of the Constitution and with the purpose of complying with the objectives of promotion established therein, in 2001 the Indigenous Commission Development (CDI) was created as a decentralized agency of the Federal Government. The purpose of this institution is to promote the protection, defense and development, of indigenous peoples, through programs aimed at dealing with the basic needs if indigenous communities at economic, legal, cultural and social levels, as well as to support the organizational processes of indigenous peoples so that they can deal directly with different authorities in the public, social and private sectors. Currently, the CDI has set up a network of regional offices to specifically deal with indigenous issues.

74. In addition, at the international level, among other related activities, the Mexican Government has ratified the Convention 169 of the International Labor Organization (ILO) with respect to the right of indigenous peoples.

Regulation of Land Tenure and Rural Development

75. History proves that agrarian conflicts among communities rise according to cycles, and largely are the result of structural economic, social and political imbalances. They provoke a negative impact in rural development particularly in those areas inhabited by small indigenous producers. Conflicts are due to either individual of collective boundaries, lack of land tenure security, and access to natural resources. There are records of more than 2,000 conflicts and precisely a large proportion of them arose in the SS, which can be broken down as agrarian (55 percent), dispute on natural resources (21 percent), public (17 percent), religious (5 percent), and confrontation (2 percent).

76. Rural areas where the project will be implemented are not exempt from those kinds of conflicts, particularly in Oaxaca and Chiapas where communities keep dispute alive. The main problems impeding a sustainable development are among others, insufficient basic infrastructure for production and trade activities, few suitable technology to potential conditions, little capacity for organizing, weak self-management processes, low impact training, and short planning for micro-regional development.

77. As it was mentioned above (*supra*), there are different types of land tenure, (i) communal or agrarian land, (ii) *ejido* operating according to the communal/agrarian organization in terms of decision-making, and (iii) *ejido* operating formally according the Agrarian Law enacted in 1917. Thus, given the complexities of land tenure in project intervention areas, both an *ad hoc* participation strategy and a dispute resolution mechanism will be implemented throughout project span. Communities will be given culturally suitable information allowing for their decision-making to participate in the project with the help of indigenous translators given the high rate of mono-lingual speaking women living in the four SS.

II. Preparation Activities

78. During the project preparation stage, an ex ante assessment of the overall situation in the four states was completed, with full detail of the most important social, economic, ethnic, land property and natural resources features from official Mexican databases, World Bank policy notes, and other relevant information sources.75 Different methodologies for gathering information were used as: (i) field visits to different communities in the four SS, (ii) workshops held with NGOss, government authorities at the federal, state and municipal levels, and also private firms, and (iii) meetings and surveys before the selection of sub-projects for the first year of implementation. In communities selected pre-consultations were organized so as to know their perception on off-grid RETs. It is worth noting that positive expressions of interest about the consumption and use of fuel/alternative energy sources were shown.

Initial Consultations with participant Stakeholders

79. During the preparation phase, the following workshops were organized:

- Workshop in Jalapa City, Veracruz. Participants were representatives from federal agencies as CDI, FIRCO, CFE, SENER and WB team. From states: Coplades, Sedesol, Finance, Rural Development, private sector, NGO's and the Academia. The purpose was to provide technical information about RETs and to discuss diverse institutional models for.

- Workshop in Tequesquitengo City, Morelos. Participants were representatives from states, NGO's, private sector, academia, and the WB team. The aim was to brief them on project progress, the state-of-the-art on solar panels technology, the importance of NGO's participation to support local actors and to

[75] Indigenous Profiles. www.ciesasitsmo.edu.mx (as of June, 2005); The World Bank (1999): Indigenous Peoples Profile (Green Cover), Mexico; The World Bank (2003): SSDS Policy Note Summary and Indigenous Policy Notes, Washington, D.C; The World Bank (2004): The U.S.-Mexico Remittance Corridor. Lessons on shifting from informal to formal transfer systems. Working Paper 47, Washington, D.C. 2004. Mesoamerica Biological Corridor, Manual for Sustainable Community Participation, Tania Carrasco and Shawn Mcdonough, Trud Found BNPP, World Bank, Mexico, D.F, 2005.

comply with both Mexican and WB safeguards on social and indigenous issues, and to obtain new inputs for project preparation.

- Workshop in Mexico City. Participants were representatives from private sector, SENER y CRE. The aim was to brief them on project objectives and activities funded with donations from trust funds targeted to different fields of development, and to gauge their interest to participate in the sub-component or Rural Electrification. This workshop proved to be most helpful to dialogue, involve and encourage the private sector in a joint effort not only to support the goals of the proposed public program but also to avoid dispersed investments.

- Workshop in Cuernavaca City. Participants invited were representatives from states, SENER, IIE, CDI, CFE, CRE, SEDESOL, FIRCO, and USAID. The objective was to assess criteria for the selection of both localities and sub-projects, and to discuss lessons learned from previous rural electrification programs.

- Field visits were organized to follow-up agreements made in Cuernavaca City about the pre-consultation to communities selected for the first year of project implementation.

- Several assessments were completed to record running experiences in the use of RETs in different regions in Mexico. In addition, specific studies on the targeted areas for project implementation were completed to assess the social and technical feasibility of regions selected by state governments.

Consultations on Service Delivery Models

80. Finally, a considerable part of the project preparation activities centered around the question of which service delivery arrangements would offer the opportunity to provide quality electricity service in off grid situations in rural Mexico in the context of this project.

81. The challenges of service provision in off grid situations are complicated by the potential variety of technologies available, each with their own set of features, by the potential variety of potential "actors" or service providers and by factors of distance and accessibility.

82. The potential service delivery models that fall in two categories:

1. Those applying to home systems such as PV and wind, where the technology is simpler and the training terms for local personnel may be correspondingly shorter;

2. Those that apply to systems where a mini-grid is needed, such as mini-hydro, biomass, diesel hybrids and diesel based, where the technology tends to be more

complex, a community organization must perform the commercial functions, and training terms will be longer.

Validation of Service Delivery Models with Renewable Energy Technology and Service Providers

83. In order to validate the service delivery models, a relevant questionnaire was prepared. Representatives from 15 private companies whose names and coordinates were provided by SENER were interviewed. Most of these companies (93 percent) specialized in photovoltaic energy, while some (33 percent) reported also having some experience in wind systems; one of them was a wind project developer. They had been operating in the RET field for an average of 7.9 years, but the range was wide (1 to 25 years) and their average sales for 2005 were a little under US 1.0 million. Interviewed companies included:

1. CONERGY México
2. APLITEC Energy
3. CONDUMEX
4. Fuerza Eólica
5. FISION
6 OVONICS
7. SolarTronic
8. ARIAN
9. CRYPLANT
10. ECOS
11. ITZAES
12. SCHOTT Mexicana
13. IAESA
14. ALCAN Energía Solar
15. SEA

84. In essence, all of the companies expressed a positive opinion of the service deliver models suggested by the WB, and many suggested changes, improvements and refinements. All of them expressed interest in participating in a bidding process organized by the IESREM along the lines described in the service delivery model chapter. This is the main finding of the validation exercise.

85. On average, companies stated that they would be able to install 221 PV systems per month each. When extrapolated to a yearly figure their average was 3,364 systems. Multiplied by 15 (the number of interviewed and interested companies), these figures yield 3,315 monthly and 50,460 yearly systems respectively. According to these numbers, the 15 companies interviewed would seem to have no problem providing for the entire needs of the IESREM Program. However, a tendency to overestimate capacity is a part of usual business "game playing" and while seemingly sufficient these numbers should not be taken as written in stone. Furthermore, some companies commented on the current shortage of PV panels and, on average, only 28 percent of PV systems' components are said to be of Mexican origin. One company reported producing PV panels locally.

86. On the whole, these providers seemed capable of meeting the requirements of the IESREM Program. Evidently, this in no way precludes the need for a promotional

campaign, a certification and a prequalification process in order to secure the participation of as many qualified service and technology providers as possible.

Validation of Service Delivery Models with Community Representatives

87. Rural communities without electricity were selected by State authorities in consultation with municipal presidents in Guerrero, Oaxaca and Veracruz. These communities were visited in order to better get to know community selection practices and validate photovoltaic service packages as well as service delivery models.

88. State representatives from Guerrero, Oaxaca and Veracruz also endorse the service delivery models. When presented with their institutional requirements, they proposed solutions that varied in every state. Their proposals have been taken into consideration during the design of the institutional structure for project execution and implementation.

III. Summary of Public Consultation with targeted Communities

Background

89. Between May and June 2006, the Mexican Energy Ministry, together with its counterpart institutions at the state and municipal level in which the Project will be implemented, carried out a consultation process. This consultation process analyzed, in the relevant communities, the economic, environmental, social and cultural impact that the project may have. During this consultation process, a number of workshops were carried out with the help of renewable energy experts, NGOs, development agencies to inform about the project and exchange views about renewable-based rural energy access. This process was carried out in keeping with national legislation regarding social development, which recognizes the participation of all stakeholders concerned in the formulation, execution and evaluation of programs and projects (Ley de Desarrollo Social, www.sedesol.gob.mx/acciones/leydesarrollosocial.htm, Ley de Derechos y Cultura Indígena, Comisión para el Desarrollo de los Pueblos Indígenas).

90. As part of this process, an inter-institutional coordination process was carried out, focused on the regional and local institutions: COPLADE of Guerrero and Oaxaca, and the Ministry of Regional Development of Veracruz (SEDERE). Key institutional partners at the national level were the Ministry for Social Development (SEDESOL), the Commission for Indigenous People Development (CDI), Fideicomiso de Riesgo Compartido (FIRCO), and the Federal Energy Commission. During this process, a number of workshops were carried out with the participation of renewable energy experts, NGOs, and development agencies like USAID. The main purpose was to inform about the project objectives and exchange knowledge about renewable energy

applications in rural areas. These workshops and meetings were a process of learning, orientation and improvement for the management of the project.[76]

91. At the same time, the economic, social and cultural conditions in the implementation regions were analyzed, bearing in mind that many of these communities harbor indigenous cultures and are highly marginalized. Information used included the 'Indigenous Profiles' established with the help of the World Bank and to be found on the website of the Center for Research in Social Anthropology (CIESAS); and information by the National Institute for Statistics in Geography and Informatics (INEGI).

92. A number of visits were also carried out to the communities that will benefit from the project during its first year. Moreover, a number of regional consultation workshops informed the communities of the project objectives, and sought their opinions/expectations. These consultation workshops were underpinned by specifically-designed didactic material, taking into account relevant cultural aspects. Several visits to currently operating relevant small-scale renewable energy units (usually with relevant applications in agriculture) also took place for demonstration purposes.

Table 10.4 Regional Consultation Workshops, 2006

State	Town which in Consultation Took place	Communities That attended	Ethnic Groups	No of workshops	Number of Participants
Oaxaca	Ixtayutla Zezontepec Ixhuatan	Tetlate Cachimbo	Zapotecos Huaves	3	125
Veracruz	Tehuipango Soteapan	Zongolica Tehuipango Mixtla Acultzingo Rafael Delgado San Martín	Náhuatl Popoluca	2	79
Guerrero	Tlapa Tecpan de Galena	Atlixta Cochoapan Acatepec Metlatonoc	Mixteco Náhuatl	7	115
3	7	20	8		319

Methodology

Key principles of the consultation process

93. ***Attention to particularities indigenous cultures:*** *Given that the project target area has a strong presence of indigenous communities,* the consultation was adapted to

[76] See Social Assessment: Integrated Energy Services for Small Localities of Rural Mexico" in the states of Veracruz, Oaxaca, Guerrero y Chiapas, World Bank, Mexico, 2006

be appropriate to the indigenous cultures. In the workshops, interpreters into indigenous languages were used, and local institutions and governments acted as facilitators.

94. ***Flexibility***: the logistics of the workshops were adapted to the particular conditions of each region, for example through choosing the communities and workshop location so as to facilitate participation, or through taking transport of community representatives to the workshop location into account. Ample time was given in the development of relevant participation methods and materials, not least in order to allow participating NGOs to profit from these in their own work with the communities.

95. ***Continuity***: the consultations were carried out simultaneously and similarly in all three states and all 7 regions. As a result, according to the NGOs which organized the consultations, the average rate of attendance by each community was about 75 percent.[77]

96. ***Respect for established customs:*** to provide for a climate of trust among the participants, pre-consultations were carried out in the community assemblies, with the relevant authorities present. The project representatives then stayed for one and a half days with the communities, making every effort that the project was well understood and reflected upon by the community. In most cases, it was these community assemblies who then chose representatives at the consultations.

97. ***Gender- and generation balance***: During all consultations, every effort was made to ensure a gender- and generational balance among the participants. The presence of women was particularly important, given that it is hoped that activities carried out by the women in the target communities are hoped to be among the main activities to benefit from electrification.

98. ***Didactic material*** was developed specifically for the project so that the communities elected for the first years could learn about renewable energy. The material was also designed to teach about sustainable use of natural resources. This didactic material included:

- Facilitators helping participants evaluate their consumption in e.g., candles, batteries, or fuel;
- Appropriate visual aides with basic information on renewable energies (including a video);
- Small models of each of the relevant small-scale renewable energy systems;

Scope of the Consultation Process

99. The Scope of the consultation process was the following:

[77] See World Bank / SENER (2006): Mexico rural electrification project: final report on regional consultation workshops.

In a first step, information was provided to all stakeholders on the nature of the project areas and their socioeconomic, cultural and environmental characteristics; institutional analysis, including the respective roles of field staff, NGOs, suppliers at various stages of the project, and participation of all actors in the project.

100. Next, didactic material was developed specifically for the project so that the communities elected for the first years could learn about renewable energy. The material was also designed to teach about sustainable use of natural resources. This didactic material and exercises included:

- facilitators helping participants evaluate their consumption in e.g., candles, batteries, or fuel;
- appropriate visual aides with basic information on renewable energies (including a video);
- small models of each of the relevant small-scale renewable energy systems;

101. Finally, the 'consultation' was carried out with various stakeholders about the impact of the project and their management. This occurred through presentation of videos to all stakeholders, indicating the implications of adopting renewable energy technologies in the communities, and a discussion of the concerns of the community members present.

General Lessons Learned about Indigenous Peoples Consultation

- There is empirical evidence that information received is not shared and widely disseminated to community members. One potential implication is that future consultation might consider going beyond inviting local authorities and leaders to inviting other community members.
- Consultations requiring project ownership must be undertaken within the community context where their actors live – not cities or hotels.
- Information to be provided to indigenous participants must be visual and didactic (without oversimplifying). Support from local indigenous translators is still an effective method.

Reactions and concerns by the participants

102. The general reaction by the communities to the Project was positive. Solar PV created the greatest interest – since solar radiation, unlike wind and water, in many communities is sufficient for the application of this technology. Broadly, community representatives or members present at the consultation expressed an inclination to participate in the project, and put the decision about participation to their local assemblies.

103. Participation by women was generally low. An exception was Oaxaca, where the rate of women among participants was approximately one quarter – the likely reason being that this consultation was held in a community itself. – Most women expressed interest in having solar panels installed in their house, since it would facilitate some household tasks, provide an opportunity for additional income, and give them an opportunity to improve the nutritive health of their families. They asked for provisions to be made for capacity-building on productive uses tailored to their daily tasks (e.g., learning to sew with the help of sewing machines).

Perceived Key Concerns and Risk Issues Arising from the Consultations; and Responses Provided

104. The extensive consultation efforts were based on the awareness that, while the project presents great opportunities for the communities concerned (notably energy for basic household uses basic service provision such as education and health, and for productive uses in the small business context), risks remain. Thus, in the following the key concerns and risks are outlined, and what is being done to address them.

105. ***Concern / Risk 1:*** The lack of confidence by local communities in renewable energy technology on which access provision is based in this project. This lack of confidence is mostly based on negative prior experience with photovoltaics.
Response: The key to addressing this concern / risk is provision of information. Indeed, when presented with details about off-grid renewable energy technologies (including demonstrations), many participants recognized that this could be an access option not far at all in quality from grid connection.

106. Another key aspect in this context was to help communities calculate the expenses they currently incur in meeting their most basic energy needs, through using batteries, diesel, carbon etc. Calculations per family per week of an average of 283.00 to 371 pesos per family per week led for many participants to astounding results, strengthening the case for off-grid renewable energy access.

107. ***Concern / Risk 2:*** Communities were concerned that off-grid access now would prevent them from gaining grid access in the foreseeable future.
Response: Given their remote nature, the grid would be highly unlikely to reach any of the communities concerned within the next ten years. The communities were informed both about this fact and that getting renewable energy access now would be highly unlikely to reduce their chances for future grid access. The communities were also informed that the program worked in coordination with grid-extension initiatives programmed by other government entities.

108. ***Concern / Risk 3:*** Equipment degradation due to internal conflicts, poor follow-up for responsible use of the equipment, or poor capacity-building for equipment

maintenance. Such risk of conflict would evidently not only endanger the functioning of the project, but would pose a challenge to the integrity of the community per se.
Responses: Key to addressing this concern is training on responsible use / capacity building, and adequate selection of people doing the maintenance. The solar equipment providers will have to include in their team NGO representatives with relevant experience who can help the communities in use and maintenance of the equipment. In addition, the community was informed that local technicians or extension agents would be available for repair, maintenance, billing and tariff collection.

109. ***Concern / Risk 4:*** Differential access to project benefits between community members.
Response: Communities were informed that the Project benefits will be provided to all community members, irrespective of whether they are indigenous or not. It is each household that takes the decision of whether it will or will not participate in the project. Consultation and information meetings with community members and local authorities will help each household and individual to give informed and free consent and to reach community consensus.

110 ***Concern / Risk 5:*** Traditional rights or entitlements; conflicting demands on the same resources.
Response: The Project does not involve or affect common property sources. The relevant small-scale energy systems are set up and operated on individual / private holdings and in or next to public buildings like schools of hospitals.

111. ***Concern / Risk 6:*** Positions of expected winners and losers.
Response: There are no likely conflicts between winners and losers, given that the project is delivered to all those private households (in the relevant communities) who wish to participate, and to community services (schools, hospitals) that are accessible to all.

The Conflict Analysis Framework (CAF)

Several of the concerns / risks mentioned above (notably numbers 4-6) could potentially lead to inter- or intra-community conflicts.

Hence, the use of a Conflict Analysis Framework will support both the country and regional efforts to assess and orientate latent conflicts towards to dialogue. Over the first year of project operation, the CAF will be undertaken in the four states so as to design a dispute resolution mechanism involving different modalities such as local conflict management (through communal assemblies, in which such conflicts are usually resolved in the communities concerned). Such conflict resolution processes are to be supported by external third parties support as are justice administrators at the federal, state and municipal levels. Finally, monitoring mechanisms of the agreements made under the project will attempt to avoid and address grievances before they escalate into conflict.

112. ***Concern / Risk 7:*** Degree of participation / 'voice' of communities in project-relevant governance questions

Response: One of the principle tenets of the project is that all community members have a voice in the relevant governance decisions. From the design stages onwards, local families and representatives will be involved, and will be supported by experienced NGOs, with interpreters where necessary.

113. ***Concern / Risk 8:*** Monitoring of Social Impacts.
Response: Given that the social component is central to the Project objectives, the implementing agencies need to provide qualitative follow-up of all activities by the providers and / or NGOs, so that any lessons can be incorporated subsequently. At the end of the third year, an evaluation will check the social impact in the communities that have been served by the project against a control group of communities. For details on planned impact evaluation assessments in the context of this project, see Annex 6 and 17 respectively.

114. ***Concern / Risk 9:*** A final concern / risk that is real despite not having been raised frequently during the consultations is the failure of the relevant agreements – i.e., because agreements between providers and beneficiaries are unclear; providers do not honor agreements; or because NGOs provide weak follow-up in monitoring agreements.
Response: Monitoring is the key aspect to containing this risk, and impact monitoring and evaluation will therefore be integrated in the project. Please see Annexes 6 and 17 of the PAD for more details.

IV. Strategy for the implementation of sub-projects at the community level

115. To ensure a successful implementation of the sub-projects in the communities, we have to bear in mind the abovementioned diversity of the target communities. Their key relevant characteristics in this context are that the target communities are small and dispersed. Moreover, neither their relations – notably with respect to efficient flows of information – with the relevant outside authorities nor their own organization is currently likely to be apt for the implementation of the sub-projects. Thus, NGO support will be warranted through (a) assist the communities in the various steps of the sub-projects; (b) consult the community assembly (*Asamblea Comunitaria*) before project implementation, to obtain its approval; (c) ensure that the opinions and decisions of the project beneficiaries / community members will be taken into account in the implementation of the subprojects; (d) inform the assembly regularly about the progress of the subprojects; and (e) follow-up and monitor relevant capacity-building efforts, bearing in mind aspects relating to cultural sensitivity and making use of interpreters as warranted.

V Community Participation and Monitoring Roles

116. The recognition of indigenous communities' rights is central to this Project. Hence the community assembly is given a central role (including that of key interlocutor for outside authorities) in decision-making. The precise nature of participation by the communities may differ – e.g., a community with a particularly strong internal

organization may decide to form sub-committees that will follow closely precise aspects of the sub-projects.

117. Responsibilities of the communities:

- The community names the monitoring commission.
- The community endorses the start of implementation of the works, and commits to respecting the (pre-established) conditions necessary to successfully carry out the project.
- The community also acts as a monitoring / control mechanism during the implementation of the sub-projects.
- The community participates in necessary adjustments / modifications of the sub-projects, where appropriate.
- Finally, the community will formally take over the sub-projects and run them henceforth.
- For the maintenance stage, communities will assume various degrees of responsibility (e.g., payment of operation & maintenance expenses, attending workshops to learn best practice in equipment maintenance, etc.)

VI. Benefits to the Community

118. The subprojects will be firmly implanted in the community, and care will be taken to make the community as a whole benefit from them. Generally, some benefits will be immediate (e.g., through electricity in schools or health centers); others, however, will take time to manifest themselves (e.g., improved incomes through a greater array of productive activities). It should also be borne in mind that some of the benefits can only be reaped in a long learning and adaptation process.

Table 10.5 Participant Stakeholders

ACTORES		BENEFICIOS
Pueblos y comunidades indígenas	Comunidad	Aumenta el valor de las propiedades individuales Desarrollan capital social Se crean circuitos micro regionales (producción-consumo) Reducen la brecha de desigualdad con el resto del país
	Autoridades municipales	Pueden satisfacer las demandas de servicios básicos Favorecen empleos temporales
	Organizaciones comunitarias	Desarrollan capacidades para la vigilancia o mantenimiento Experiencia en la gestión de recursos Oportunidades económicas
	Individuos	Acceden a servicios Desarrollan habilidades básicas de electricidad y mantenimiento Se abaratan productos, tienen acceso a nuevas mercancías Mejoran sus condiciones de vida
Autoridades de Gobierno	Gobierno federal	Se cumplen objetivos de desarrollo social Se cumplen ofrecimientos políticos Se mejora la gobernabilidad Aumenta la participación con los gobiernos estatales Mayores vínculos con los pueblos indígenas
	Gobierno Estatal	Satisface demandas sociales Cumple compromisos políticos Atrae recursos federales al estado Puede realizar otras acciones complementarias para el desarrollo
	Gobierno municipal	Atienden demanda de rezago Resultados de gobierno crecen significativamente Desarrollan capacidades locales
ONGs	Locales y nacionales	Ganan espacios de negociación Se abren espacios para acompañamiento Avanzan en sus reivindicaciones por los Pueblos Indígenas

VII. Institutional Capacity for Attending Indigenous Peoples Affairs

119. Project implementation includes partnership between the Ministry of Energy (SENER) and the Indigenous People Development Commission (CDI). SENER and CDI have signed a formal agreement (*convenio de cooperacion*) which defines the respective roles of CDI and SENER.

120. As explained in Annex 6, CDI will participate with various roles at the Federal and State levels, as a member of the Project Advisory Committee (PAC) for instance, but mainly as a member of the Technical Supervision and Monitoring Group (TSMG) at the State level, from which it will directly support the project ensuring that public consultations and the social action plan are well implemented. Indeed, CDI has State offices across the country and solid network of social specialists attending and participating in the planning affairs and decision making at the municipal and community levels.

121. In addition, the Ministry of Social Development (SEDESOL), with organizational characteristics similar to CDI (i.e., planning offices at the State level, a network of extension agents which reach municipal and community stakeholders) will also support the project, complementing the actions of CDI as a member of the TSMG (see Annex 6 for a detailed description of project institutional and implementation arrangements).

Annex 11. Project Preparation and Supervision

Bank staff and consultants who worked in this Project included:

Gabriela Elizondo	TTL, Sr. Energy Specialist
Todd Johnson	TTL (appraisal, negotiation), Sr. Energy Specialist
Ernie Terrado	Sr. Rural Energy Specialist, Consultant
Eduardo Villagran	Sr. Rural Energy Specialist
Demetrios Papathanasiou	Sr. Economist, Consultant
Efraim Jimenez	Lead Procurement Specialist
Gabriel Penaloza	Procurement Specialist
Juan Carlos Alvarez	Legal Counsel
Tania Carrasco	Social Specialist
Victor Ordonez	Sr. Financial Management Specialist
Benjamin Santa Maria	Institutional Specialist, Consultant
Ann Hjetland	Sr. Project Sustainability Specialist
Hernan Gonzalez	Environmental Specialist, Consultant
Alberto Didoni	Micro-Finance Specialist, Consultant
Michael Jarvis	Social Corporate Initiatives Specialist
Gabriela de la Garza	Junior Professional Associate
Susana Sanchez	Impact Evaluation LAC Coordinator
Christian Borja-Vega	Poverty and Impact Evaluation Specialist
Georg Caspary	Consultant, Safeguards Support
Fowzia Hassan	Operations Analyst
Zayra Romo Mercado	Junior Professional Associate
Karina Kashiwamoto	Language Program Assistant
Fernanda Pacheco	Language Program Assistant

Annex 12. Documents in the Project File

I. Bank Staff Assessments

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IIE. December 2005. In-depth Analysis of Case Studies and Potential Projects for Rural Electrification in the Southern States, GVEP Report. See Appendix III on "Non Electrified Communities and Comparison of Energy Levelized Costs"

National Income and Expenditures Survey, ENIGH, INEGI 2005, field data from public consultations with communities (reports available in the Project Files).

Comisión Federal de Electricidad (CFE), Subdirección de Distribución, Programa de Electrificación Rural: data from period January 2001-September 2005.

III. List of Technical Documents

A. Earlier project documents prepared for the project.

Project Appraisal Document (PAD) – Decision Meeting (12 December 2006).

Project Information Document (PID) - Concept Stage (9 December 2005).

Integrated Safeguards Data Sheet (ISDS) - Concept Stage (30 November 2005).

Project Concept Note (8 August 2004).

B. Project Consultant Reports.

Integrated Energy Services for Small Localities of Rural Mexico: Development of Regional Capabilities at the State, Municipal and Community Levels in Interaction with the Private Sector. Report by Eduardo Villagran, 2006.

Intermediate Technology Consultants (2005): Institutional Structure for the Development of Rural Electrification Projects: GVEP Project for Rural Electrification in Southern Mexico. November 2005.

Romero, Arturo (2005): GVEP Rural Electrification with Renewable Energy in Mexico. July 2005.

C. World Bank documents on rural electrification efforts in other LAC countries.

Honduras Rural Infrastructure / Electrification Component: Project Appraisal Document (07 March 2005).

Bolivia - Decentralized Electricity for Universal Access: Project Information Document (31 October 2006).

D. Technical World Bank documents (or documents authored by World Bank staff) on rural electrification.

ESMAP (2005): Meeting the Challenges of Rural Electrification in Developing Nations: The Experience of Successful Programs. The World Bank.

Cabraal A., Cosgrove-Davis M, Schaeffer (1996): Best Practices for Photovoltaic Household Electrification Programs: Lessons from Experiences in Selected Countries. The World Bank, Washington.

Reiche Killian (2006): Bolivia Rural Access: Tendering Ouput-Based Subsidies for Energy and ICT. Working Paper, the World Bank.

E. Other relevant documents.

Hernandez, Fausto (2004): Analisis de Aportaciones Federales para Infraestructura.

Cayeros, Diaz; Castaneda, Silva (2004): Descentralización a Escala Municipal en Mexico: la Inversion en Infraestructura Social. Comisión Economica para America Latina, Santiago.

IIE / Instituto de Investigaciones Electricas (2005): In-depth Analysis of Case Studies and Potential Projects for Rural Electrification in the Southern Mexican States: GVEP Report.

Annex 13: Statement of Loans and Credits

			Original Amount in US$ Millions						Difference between expected and actual disbursements	
Project ID	FY	Purpose	IBRD	IDA	SF	GEF	Cancel.	Undisb.	Orig.	Frm. Rev'd
P101342	2008	MX Affordable Housing DPL III	200.51	0.00	0.00	0.00	0.00	200.51	0.00	0.00
P080104	2007	MX - Wind Umbrella	0.00	0.00	0.00	0.00	0.00	19.07	0.00	0.00
P066426	2007	MX Hybrid Solar Thermal Integrated Cycle	0.00	0.00	0.00	49.35	0.05	49.35	0.00	0.00
P087038	2006	MX Environmental Services Project	45.00	0.00	0.00	0.00	0.00	41.00	9.33	0.00
P085593	2006	MX (APL I) Tertiary Educ Student Ass	180.00	0.00	0.00	0.00	0.00	170.79	71.89	0.00
P082656	2006	MX Transport Corridors	0.00	0.00	0.00	0.00	0.00	2.02	0.00	0.00
P077717	2006	MX GEF-Large-scale Renewable Energy Dev.	0.00	0.00	0.00	25.35	0.00	25.00	1.67	0.00
P088728	2006	MX (APL1) School-Based Management Prog	240.00	0.00	0.00	0.00	0.00	113.58	-4.75	0.00
P088732	2006	MX Access to Land for Young Farmers	100.00	0.00	0.00	0.00	0.75	52.57	10.15	0.00
P089171	2006	MX GEF Environmental Services Project	0.00	0.00	0.00	15.00	0.26	13.20	4.47	0.00
P091695	2006	MX Modernization Water & Sanit Sector TA	25.00	0.00	0.00	0.00	0.19	23.69	14.55	0.00
P074755	2005	MX State Judicial Modernization Project	30.00	0.00	0.00	0.00	0.00	30.00	19.00	0.00
P088080	2005	MX Housing & Urban Technical Assistance	7.77	0.00	0.00	0.00	4.89	1.61	5.54	0.00
P089865	2005	MX-(APL1) Innov. for Competitiveness	250.00	0.00	0.00	0.00	0.00	148.18	3.01	0.00
P087152	2004	MX (CRL1)Savings & Rurl Finance(BANSEFI)	75.50	0.00	0.00	0.00	0.38	32.15	-10.94	0.00
P080149	2004	MX Decentralized Infrastructure Developm	108.00	0.00	0.00	0.00	0.00	46.88	22.88	0.00
P035752	2004	MX Irrigation & Drainage Modernization	303.03	0.00	0.00	0.00	0.00	7.57	-79.46	0.00
P035751	2004	MX Community Forestry II (PROCYMAF II)	21.30	0.00	0.00	0.00	0.00	10.63	7.80	0.00
P070108	2003	MX Savings & Credit Sector Strengthening	64.60	0.00	0.00	0.00	0.00	6.09	6.09	0.00
P059161	2003	GEF MX-Climate Measures in Transport	0.00	0.00	0.00	5.80	0.00	0.80	5.80	0.00
P077602	2002	MX Tax Admin Institutional Development	52.00	0.00	0.00	0.00	0.00	0.17	0.17	0.00
P065988	2002	GEF MX Consolidat.Prot Areas (SINAP II)	0.00	0.00	0.00	16.10	0.00	2.46	18.31	0.00
P066321	2001	MX: III BASIC HEALTH CARE PROJECT	350.00	0.00	0.00	0.00	0.00	153.61	153.61	13.55
P060908	2001	GEF MX-MESO AMERICAN CORRIDOR	0.00	0.00	0.00	14.84	0.00	7.56	14.38	13.51
		Total:	2,052.71	0.00	0.00	126.44	6.52	1,158.49	273.50	27.06

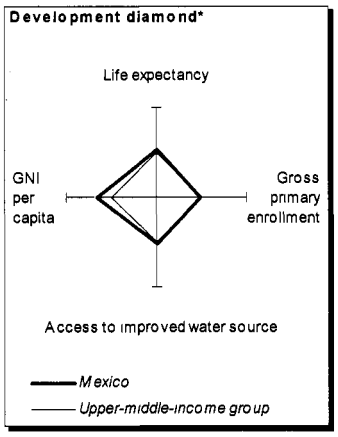
MEXICO
STATEMENT OF IFC's
Held and Disbursed Portfolio in Millions of US Dollars

		Committed				Disbursed			
		IFC				IFC			
FY Approval	Company	Loan	Equity	Quasi	Partic.	Loan	Equity	Quasi	Partic.
1998	Ayvi	2.14	0.00	0.00	0.00	2.14	0.00	0.00	0.00
	BBVA-Bancomer	6.63	0.00	0.00	0.00	6.63	0.00	0.00	0.00
2006	Banco del Bajio	0.00	45.00	0.00	0.00	0.00	0.00	0.00	0.00
1995	Baring MexFnd	0.00	0.29	0.00	0.00	0.00	0.29	0.00	0.00
1999	Baring MexFnd	0.00	1.41	0.00	0.00	0.00	1.41	0.00	0.00
1998	CIMA Puebla	3.25	0.00	0.00	0.00	3.25	0.00	0.00	0.00
2005	CMPDH	14.50	0.00	0.00	0.00	14.50	0.00	0.00	0.00
2006	Carlyle Mexico	0.00	20.00	0.00	0.00	0.00	8.44	0.00	0.00
	Chiapas-Propalma	0.00	0.97	0.00	0.00	0.00	0.97	0.00	0.00
2001	Compartamos	0.00	0.66	0.00	0.00	0.00	0.66	0.00	0.00
2004	Compartamos	15.58	0.00	0.00	0.00	15.58	0.00	0.00	0.00
2002	Coppel	25.71	0.00	0.00	0.00	25.71	0.00	0.00	0.00
1999	Corsa	2.79	3.00	0.00	0.00	2.79	3.00	0.00	0.00
2005	Credito y Casa	21.25	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2004	DTM	17.04	0.00	0.00	0.00	17.04	0.00	0.00	0.00
2001	Ecomex	4.00	0.00	0.24	0.00	2.00	0.00	0.24	0.00
2000	Educacion	3.54	0.00	0.00	0.00	3.54	0.00	0.00	0.00
2005	FINEM	15.12	0.67	0.00	0.00	4.86	0.67	0.00	0.00
1998	Forja Monterrey	3.71	3.00	0.00	3.71	3.71	3.00	0.00	3.71
2001	GFNorte	95.63	0.00	0.00	0.00	45.63	0.00	0.00	0.00
1996	GIBSA	5.41	0.00	0.00	18.19	5.41	0.00	0.00	18.19
2000	GIRSA	22.50	0.00	0.00	30.00	22.50	0.00	0.00	30.00
2005	GMAC Financiera	120.67	0.00	0.00	0.00	32.52	0.00	0.00	0.00
1998	Grupo Calidra	4.00	6.00	0.00	0.00	4.00	6.00	0.00	0.00
2004	Grupo Calidra	20.89	0.00	0.00	0.00	20.15	0.00	0.00	0.00
1989	Grupo FEMSA	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.00
1996	Grupo Posadas	1.60	0.71	0.00	0.00	0.00	0.71	0.00	0.00
1999	Grupo Posadas	0.00	0.00	10.00	0.00	0.00	0.00	10.00	0.00
1998	Grupo Sanfandila	4.09	0.00	0.00	1.33	4.09	0.00	0.00	1.33
2005	Grupo Sanfandila	0.00	0.00	0.00	6.49	0.00	0.00	0.00	0.00
	Grupo Su Casita	0.00	7.08	0.00	0.00	0.00	7.08	0.00	0.00
2006	Grupo Su Casita	0.00	7.68	0.00	0.00	0.00	7.68	0.00	0.00
	Infologix BVI	3.50	0.00	0.00	0.00	3.50	0.00	0.00	0.00
2000	Innopack	0.00	12.81	0.00	0.00	0.00	12.81	0.00	0.00
	Interoyal	0.00	0.01	0.00	0.00	0.00	0.01	0.00	0.00
2005	La Bene	5.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2003	Lomas de Real	47.46	0.00	20.00	95.22	46.18	0.00	20.00	95.22
1998	Merida III	24.86	0.00	0.00	52.30	24.86	0.00	0.00	52.30
2003	Mexmal	0.00	0.00	0.80	0.00	0.00	0.00	0.80	0.00
1995	Mexplus Puertos	0.00	0.55	0.00	0.00	0.00	0.55	0.00	0.00
1999	Mexplus Puertos	0.00	0.25	0.00	0.00	0.00	0.25	0.00	0.00
2003	Occidental Mex	24.90	0.00	0.00	33.20	24.90	0.00	0.00	33.20
	Occihol	0.00	9.99	0.00	0.00	0.00	9.99	0.00	0.00
2003	POLOMEX S.A.	4.94	0.00	0.00	0.00	4.94	0.00	0.00	0.00
2000	Pan American	0.00	0.92	0.00	0.00	0.00	0.92	0.00	0.00
2002	Puertas Finas	8.94	0.00	0.00	0.00	8.94	0.00	0.00	0.00
2000	Rio Bravo	44.10	0.00	0.00	48.26	44.10	0.00	0.00	48.26
2004	SSA Mexico	44.50	0.00	0.00	0.00	44.50	0.00	0.00	0.00
2000	Saltillo S.A.	31.16	0.00	0.00	34.89	31.16	0.00	0.00	34.89
2000	Servicios	5.92	0.65	0.00	5.07	5.92	0.65	0.00	5.07
2004	Su Casita	16.49	0.00	0.00	0.00	16.49	0.00	0.00	0.00
2005	Su Casita	50.68	0.00	0.00	0.00	50.68	0.00	0.00	0.00
2006	Su Casita	71.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00
1997	TMA	1.06	0.00	3.29	3.68	1.06	0.00	3.29	3.68
2005	UNITEC	30.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2003	Valle Hermoso	50.68	0.00	20.00	103.49	50.10	0.00	20.00	103.49
2006	Vuela	40.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	ZN Mexico II	0.00	7.07	0.00	0.00	0.00	5.51	0.00	0.00
1998	ZN Mxc Eqty Fund	0.00	1.69	0.00	0.00	0.00	1.69	0.00	0.00
	Total portfolio:	915.96	130.43	54.33	435.83	593.38	72.31	54.33	429.34

		Approvals Pending Commitment			
FY Approval	Company	Loan	Equity	Quasi	Partic.
2006	Bajio	0.08	0.00	0.00	0.00
2001	Ecomex	0.00	0.00	0.00	0.00
2003	Mexmal	0.00	0.00	0.01	0.00
2005	Coppel II	0.01	0.00	0.01	0.00
2000	Educacion	0.00	0.00	0.00	0.00
2006	Metro-WHL	0.05	0.00	0.00	0.00
2001	GFNorte-CL	0.00	0.00	0.00	0.10
2006	BANSEFI AFORE	0.00	0.00	0.00	0.00
2006	Protego Sofol	0.00	0.00	0.00	0.00
2005	Credito y Casa	0.02	0.00	0.00	0.00
2006	Mexico MBS CEF	0.03	0.00	0.00	0.00
2005	Pan American 2	0.00	0.00	0.00	0.00
1998	Cima Hermosillo	0.00	0.00	0.01	0.00
2007	Nexxus III Fund	0.00	0.02	0.00	0.00
2006	Compartamos III	0.05	0.00	0.00	0.00
2006	Irapuato-Piedad	0.01	0.00	0.00	0.00
2006	Su Casita WHL II	0.17	0.00	0.00	0.00
	Total pending commitment:	0.42	0.02	0.03	0.10

Annex 14: Country at a Glance

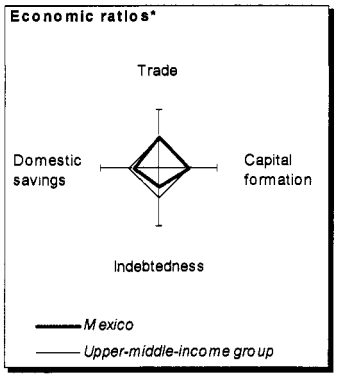
POVERTY and SOCIAL	Mexico	Latin America & Carib.	Upper-middle-income
2006			
Population, mid-year *(millions)*	104.2	556	810
GNI per capita *(Atlas method, US$)*	7,830	4,767	5,913
GNI *(Atlas method, US$ billions)*	816.1	2,650	4,790
Average annual growth, 2000-06			
Population *(%)*	1.0	1.3	0.8
Labor force *(%)*	1.4	2.1	1.3
Most recent estimate (latest year available, 2000-06)			
Poverty *(% of population below national poverty line)*	18	..	..
Urban population *(% of total population)*	76	78	75
Life expectancy at birth *(years)*	75	73	70
Infant mortality *(per 1,000 live births)*	22	26	26
Child malnutrition *(% of children under 5)*	..	..	..
Access to an improved water source *(% of population)*	97	91	93
Literacy *(% of population age 15+)*	92	90	93
Gross primary enrollment *(% of school-age population)*	109	118	112
Male	110	120	106
Female	108	116	104



KEY ECONOMIC RATIOS and LONG-TERM TRENDS

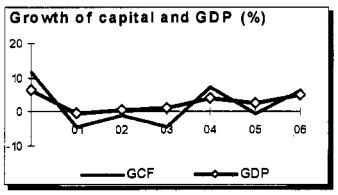
	1986	1996	2005	2006
GDP *(US$ billions)*	129.4	332.9	767.7	839.2
Gross capital formation/GDP	18.5	23.2	21.8	22.0
Exports of goods and services/GDP	17.3	32.1	30.0	31.9
Gross domestic savings/GDP	22.4	25.3	20.3	20.7
Gross national savings/GDP	17.9	22.5	21.2	21.9
Current account balance/GDP	-1.1	-0.8	-0.6	-0.2
Interest payments/GDP	5.9	2.4	1.3	..
Total debt/GDP	77.9	46.9	21.8	..
Total debt service/exports	43.7	35.2	17.2	..
Present value of debt/GDP	..	..	23.3	..
Present value of debt/exports	..	..	69.8	..

	1986-96	1996-06	2005	2006	2006-10
(average annual growth)					
GDP	2.8	3.1	2.8	4.8	3.6
GDP per capita	0.9	1.9	1.8	3.6	1.9
Exports of goods and services	9.6	7.1	7.1	11.1	5.6

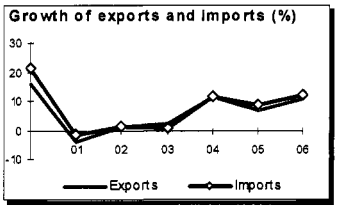


STRUCTURE of the ECONOMY

	1986	1996	2005	2006
(% of GDP)				
Agriculture	10.3	6.3	3.8	3.9
Industry	34.9	28.4	26.0	26.7
Manufacturing	24.8	21.5	17.8	18.0
Services	54.8	65.4	70.2	69.4
Household final consumption expenditure	68.5	65.1	68.2	67.6
General gov't final consumption expenditure	9.1	9.6	11.5	11.7
Imports of goods and services	13.4	30.0	31.5	33.2



	1986-96	1996-06	2005	2006
(average annual growth)				
Agriculture	1.3	1.8	-2.1	4.8
Industry	3.2	2.5	1.7	5.0
Manufacturing	3.5	2.3	1.4	4.7
Services	2.7	3.5	3.6	4.7
Household final consumption expenditure	3.0	5.0	4.6	5.1
General gov't final consumption expenditure	2.2	1.2	0.4	6.0
Gross capital formation	4.3	3.5	-0.6	6.6
Imports of goods and services	14.1	8.9	8.6	12.2



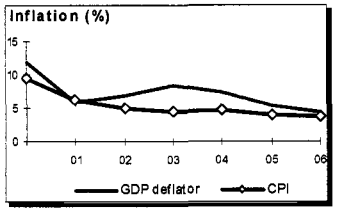
Note: 2006 data are preliminary estimates.

This table was produced from the Development Economics LDB database.

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

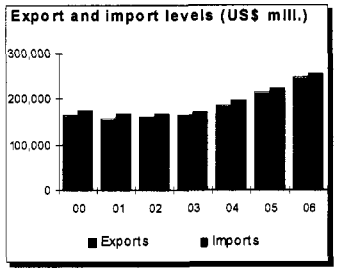
PRICES and GOVERNMENT FINANCE

	1986	1996	2005	2006
Domestic prices				
(% change)				
Consumer prices	86.2	34.4	4.0	3.6
Implicit GDP deflator	73.6	30.7	5.5	4.5
Government finance				
(% of GDP, includes current grants)				
Current revenue	31.6	23.0	23.3	24.7
Current budget balance	-8.6	3.5	3.1	3.6
Overall surplus/deficit	-13.5	-0.1	-0.1	0.1



TRADE

	1986	1996	2005	2006
(US$ millions)				
Total exports (fob)	21,804	96,000	214,233	250,292
Oil	6,307	11,654	31,891	39,124
Agriculture	2,098	3,592	6,008	6,986
Manufactures	12,888	80,305	175,166	202,865
Total imports (cif)	16,784	89,469	221,820	256,131
Food	..	..	..	..
Fuel and energy	..	..	..	..
Capital goods	2,954	10,922	26,216	30,525
Export price index *(2000=100)*	75	96	127	136
Import price index *(2000=100)*	76	98	114	117
Terms of trade *(2000=100)*	99	98	112	116



Annex 15. Incremental Cost Analysis

Broad Development Goals of Rural Electrification

1. Mexico has already achieved an electrification coverage of 96.6 percent of households, serving approximately all but about 3.5 million of the 106 million population. Electrifying the remaining unserved households is challenging, since the majority of them are found in small, remote, isolated communities. Further, the unelectrified population is expected to increase by 20 percent through population growth over the next decade, while the new connections rate has been declining every year since 1995. About 60 percent of those with no electricity are indigenous people that are among the poorest in Mexico, whose communities also lack other basic services such as water supply, access to health centers, telecommunications and education. The Government is looking for new mechanisms that would extend electrification services to these difficult areas, in an economically and environmentally sustainable manner.

Baseline Scenario

2. Since the 1970s, there have been many attempts by the Government, bilateral organizations, private NGOs and academic and research agencies to apply renewable energy technologies (RET) for rural electrification in Mexico. They include a variety of technologies and system sizes, ranging from individual solar home systems to multi-kilowatt systems powering minigrids.[78] The largest efforts were embedded in social development programs, such as *Pronasol* and *Progresa* in the 1980s and 90s. While a wealth of useful technical data and operational experience has been gathered, recent surveys by CFE and others showed that all of these efforts were unsustainable. The reasons were that except for the large government programs, most were small, "one-off", research-oriented projects driven mainly by the availability of funding. All efforts had ill-defined or no mechanisms for cost-recovery and long-term technical maintenance. But perhaps the major reason for unsustainability and fragmentation of efforts so far was the serious lack of institutional capacity and coordination for electrification projects by those responsible for their implementation: the energy agencies, the social development agencies and the municipalities. In 1996, decisions for electrification works was transferred by law from CFE to the municipalities that, in turn, would rely for infrastructure funding from the social fund Ramo 33. This well-intentioned arrangement has not worked well in practice and, particularly for remote areas of extreme poverty, increased the complexity of implementing decentralized electrification projects using renewable energy. A recent analysis of the use of Ramo 33 funds indicated that only 1.3 percent was used for electrification initiatives, the majority of which went for grid-extension projects for urban and peri-urban areas. There is today no formal national plan for offgrid rural electrification with RET, reflecting the lack capacity and appreciation by

[78] Many RETs for purposes other than rural electrification have also been introduced, such as solar water pumps for a World Bank/FIRCO agricultural project. More recently, large grid-connected wind and solar thermal power have been proposed for GEF co-financing.

3. Government decision makers and energy planners in the feasibility of RETs as an economic option for that purpose.

4. The business-as-usual scenario for rural electrification in Mexico thus implies continued line extension and isolated diesel system projects in the Government's program. The cost of grid extension to the remaining unserved areas of Mexico is already approaching $2,700 per connection, a figure 3-6 times more costly than typical connections in the rest of Latin America, virtually guaranteeing that remote and very poor communities, such as those in the Southern States of Oaxaca, Vera Cruz, Guerrero, Chiapas and Puebla, will not be electrified in the foreseeable future. There will be continued use of inefficient and inadequate lighting systems in these unserved areas, limited hours for health and educational services, and absence of opportunities to initiate economically productive local activities. Environmentally, the continued heavy use of kerosene and other traditional fuels for lighting in homes will result in indoor pollution and higher incidence of respiratory diseases. The populations will continue to be disadvantaged and unable to break out of the vicious cycle of poverty because they lack basic services and information available to those in less-remote areas.

The GEF Alternative

5. The GEF Alternative is intended to introduce, when they are least cost, decentralized power supply options, particularly those based on RETs, into social infrastructure plans for remote rural areas of Mexico, starting with selected unelectrified communities in Oaxaca, Vera Cruz, Guerrero, Chiapas and Puebla. The focus will be on energy solutions that provide basic lighting services and power for non-agricultural productive and social activities suitable for extremely poor small communities. Assistance to the Government through the Project would include: (a) development of legal and regulatory framework, policies and strategies that would enable effective implementation of integrated energy solutions to the target communities; (b) capacity building of state/municipal entities and community stakeholders on planning and implementation of electrification models that use RETs; (c) financing of pilot microgrid and PV projects that demonstrate innovative and sustainable operation, and (d) development of a replication and scaling-up strategy to apply the piloted models to similar communities nationwide.

6. The GEF Alternative will result in a reduction of overall public funding for rural electrification, higher electrification coverage in offgrid areas within a reasonable time frame, general improvement of the quality of life in the unserved communities, and the reduction of GHG emissions.

Global Environmental Objective

7. The project's global environmental objective is to achieve greenhouse gas (GHG) reductions through the reduction of policy, information, institutional capacity and financing barriers that currently hinder renewable energy technology (RET) dissemination and market development internationally (GEF Operational Program No. 6).

8. While the absolute magnitude of GHG reduction would not be high in the context of a rural electrification project where least cost considerations limit the type and number of RETs that could be practically applied, the methodologies developed for reducing market barriers to the use of RETs in offgrid electrification through innovative private sector and community based approaches could provide an important contribution to efforts of this nature in other countries of the region and elsewhere.

Scope of the Analysis

9. The analysis compares the cost of investments and magnitude of GHG emissions associated with carrying out the business-as-usual approach to rural electrification (almost exclusively line extension and the use of isolated diesel systems) as opposed to implementing the GEF alternative plan (line extension where clearly least cost plus decentralized systems, particularly RETs, for remote rural communities) for the project duration of about 5 years. For isolated micro-grids powered by hydro, biomass or other renewables the comparator technology is a diesel system of equivalent capacity. For individual SHS, small wind home systems (WHS) and batteries charged in centralized PV stations for dispersed households where the main use is for lighting, the comparator is kerosene lamps. For larger stand-alone PV systems for public or productive applications, the assumed baseline comparator is a small gasoline engine. These and other information enable the estimation of the GEF "incremental costs" based on lifecycle cost comparisons. The amount of GHG emissions mitigated is then calculated on a per year basis, as well as the total amount mitigated over the life of the principal RETs (assumed to be 20 years on the average).

10. Building and other supporting activities that must be carried out to reduce market barriers to the deployment of RETs are also considered in the analysis. Finally, the analysis considers that the domestic and global benefits of the project are not only physical and environmental, but also programmatic, i.e., they extend beyond the brief project duration and beyond national boundaries. There are vital domestic benefits that accrue to the country's future situation, in the form of capacity built and markets developed. The international community likewise would benefit from the experience generated by the Project in terms of the added demand for RETs and the reduction of perceived risks of investments in these environmentally-benign technologies globally.

Incremental Cost Estimates

A. Investments

11. The Project will finance RET investments in remote and very poor communities in the Southern States of Oaxaca, Vera Cruz, Guerrero, Chiapas and Puebla that are unlikely to be reached by the grid in at least 5 years. The Project will focus on communities with 20 to 200 households. The RET investments will complement grid-extension efforts by the Government. They will enhance quality of life in these marginalized areas through provision of higher quality lighting services and power for socially and economically beneficial activities.

12. The choice of specific RETs for domestic, institutional or productive applications in each site will be determined by economic least cost comparison with alternatives. Where end users are concentrated and can be served by minigrids, and where opportunities for productive applications exist, decentralized power systems feeding into a small distribution network are likely to be the least cost solution. If local renewable energy resources are available near the load center, appropriate RETs will be considered. Where end users are dispersed and the main use of power is mainly for domestic lighting, individual systems, such as SHS and WHS, will be promoted.

1. *Stand Alone Systems*

a) PV Systems. This category comprises both individual PV systems for household use (solar home systems or SHS) and larger capacity PV systems for productive and institutional uses. A preparatory study by the Mexico Institute of Electrical Research (IIE) showed that PV is likely to be the least cost option for up to 75 percent of the target households. A total of 34,000 households, productive and institutional users, with average capacity of 100 Watts peak for each installation, are targeted over the 5-year project duration. On the investment side, GEF intervention is sought to reduce barriers related to the still much higher cost of PV technology compared to traditional lighting practice. To estimate this technology-specific incremental cost, the lifecycle costs were compared between the cost of a 100W SHS and the cost of using traditional fuels (kerosene, candles, dry cell batteries, ocote, etc.) for lighting and minimal entertainment purposes (radio, B&W TV) over a 15 year period.[79] The results show incremental cost figures that exceed $20 per peak Watt but depend strongly on the type of service and assumed baseline conditions (see Annex 9). To keep within the magnitude of incremental cost grants awarded by GEF to recent projects and for administrative simplicity, a single across-the-board GEF grant amount of $1.5 per peak Watt is requested that would gradually decline to $0.68 per peak Watt in Year 5 (see later discussion of this topic). The total would be about $3.6 million for a target of 3,400 kW of stand-alone PV installations. The requested grant per peak Watt is less than the $1.8-$2 per peak Watt provided by GEF to recent Bank/GEF projects in Asia and Latin America.

b) Solar Battery Charging Systems (SBCS). SBCS represents a less expensive alternative for the poorest households who are unable to acquire their own full SHS. Their cost is only in the battery acquisition and the fees for periodic charging. In many parts of Mexico, battery charging (from grid-based or diesel-fueled chargers) is already practiced, with people using public transport to charge their batteries in distant towns. SBCS allow stations to be located close to the points of demand, thereby decreasing health and safety hazards substantially compared to the current

[79] Several large capacity PV systems for productive and institutional applications will also be installed by the Project. For such systems which could average 300 Wp or more, the more appropriate cost comparator would be a small gasoline engine. However, in terms of quantity and total wattage, the residential systems predominate. For simplicity therefore, the incremental cost comparison was made with the domestic traditional fuel usage situation.

practice. GEF intervention on SBCS will help remove barriers to its wider use in the off-grid electrification program. The barriers include a complete lack of familiarity with the SBCS technology, application, characteristics, performance and economics on the part of both rural potential beneficiaries and government planners. There is consequently low willingness to test this solution and finance/pay for it. The project will finance the installation of a total of 200 SBCS stations to be managed by the local communities themselves. While capital expenditures may be fully subsidized, all O & M costs, including battery replacements, will be borne by the communities, to ensure sustainability of the operation.

13. The capital and operating costs of SBCS installations vary with the station capacity and charging layout, solar insolation at the site and the type of batteries used. Each of the 1 to 2.5 kW station planned to be installed by the Project is estimated to cost about $20,000. A 1 kW SBCS could serve about 40-50 customers. For incremental cost estimation, an SBCS station may be simply considered as equivalent to several individual SHS combined into one installation. The GEF grant requested is therefore $1.5 per peak Watt initially or a total of $550,000.

a) Wind Home Systems (WHS). A WHS is a compact wind turbine system that can deliver an amount of energy per month comparable to a large SHS, depending on the average wind speed. Like the SHS, a battery is needed to store the intermittent energy generated. A typical commercial (e.g., Southwest Windpower Air-X) WHS rated 400W at 12.5 m/s wind would cost about $500-$600 and thus could be more cost-effective than an equivalent SHS. Some parts of the target States, such as communities in Oaxaca, have exceptionally high average wind speeds making some of them suitable for consideration for wind home systems (WHS) in addition to SHS. The relatively higher power rating is based on a constant wind speed that is hardly attained in practice. The commercial system mentioned above, for example, is quoted as capable of delivering 38 kWh per month at 12 mph. A figure of about 15 kWh is more likely, making it comparable to the energy delivered by a 100Wp PV system at 4 hrs per day. The total cost of the WHS, including battery, lamps, mounting, wiring, installation, etc. is about $1,400 which is comparable to a 100Wp SHS. For these reasons, the requested GEF incremental cost grant for the above-described WHS capacity is made equivalent to that for PV, with the same schedule of decline over the 5 year life of the Project. This comes out to a total of $$830,000 for the 7,500 units planned to be disseminated. This would the largest number of WHS to be installed for actual use in any project, so far, and would be consistent with GEF's current emphasis on technology diversification.

2. Minigrid Systems

a) Microhydro Power (MHP). MHPs will be supported in sites that have hydro resources and have potential for productive applications. Best practice for social organization and financial intermediation will be promoted. Communities will be organized to operate and maintain the power plants and the identified productive use. From a technical viewpoint, the proposed MHPs will also enable collection of data of

actual operating characteristics, validity of pre-project resource assessment methodologies, maintenance requirements and costs, and other information useful to similar projects contemplated elsewhere and valuable to GEF's decision-making process regarding support for other future MHPs. Up to 25 MHPs averaging 50 kW each are planned to be installed, or a total capacity of 1,250 kW. The average investment cost for each plant is expected to be in the order of $5,500 per Watt installed for the conditions in the target areas. Based on experience with many MHP installations elsewhere, they are economically least cost compared to grid-extension or isolated diesel systems because of their typical remote location. For this reason, no GEF grant related to technology cost is sought. However, other serious market barriers or MHPs in Mexico exist and GEF support for activities to reduce these barriers will be sought.

b) Small-Scale Biomass Power. Some communities in the 5 Southern States have access to significant amounts of biomass fuels, in the form of agricultural, forestry and agro-processing residues. It is planned to finance up to 20 biomass gasifiers for power production of about 6 kW average capacity each, sufficient for the needs of a small community of about 20-30 households. Similar systems have been recently field tested by NREL and found to have significant potential for rural applications. The purpose of their inclusion in the Project is to assist in advancing the practical development of this little-used but quite well-known technology. At the scale mentioned, the capital cost is expected to be in the range of $6,000 per kW. Comparing lifecycle costs with an equivalent diesel system results in an economic incremental cost of at least $600 per kW. The total requested hardware-related GEF grant for this component is therefore $720,000.

c) Diesel/RET/Battery Hybrids. Diesel based systems and diesel hybrids are the fall back option when little or no renewable energy alternatives are available at the site. The feasibility of the hybrid option will be first to be explored in such a case. The intermittent RET contribution will save diesel fuel even as the diesel component assures continuous power output. This is especially important for certain productive or institutional applications. The RET component may be wind or PV, although diesel/wind hybrids have been more frequently used due to the much higher cost of PV. At the 100 kW scale (hybrid capacity with about 50 percent RET), the capital cost is expected to be in the range of $3,500 per kW. Simple lifecycle cost comparison with equivalent-sized diesel system again results in an economic incremental cost of at least $600 per kW. This is in line with the level of GEF grants provided to support pure RET or diesel/RET hybrids in recent Bank/GEF projects. The total requested investment-related GEF grant for this component is therefore $530,000.

Summary

14. Table 1 summarizes the RET-based offgrid rural electrification investments to be financed by the Project, totaling some $66.3 millions. The hardware-related GEF grants for incremental costs totals $5.6 millions.

Table 15.1. Incremental Costs of Renewable Energy Investments

Technology	No. of Units	No. of Households	Average Capacity	Total kW	Installed Cost per Unit, US$	Indicative Investment Cost, US$ millions	Unit Incremental Cost, US$	Total Incremental Cost***, US$
Stand alone								
PV/SHS	34,000	34,000	100 Wp	3,400	1,200	40.80	1.5 /Wp	3.64
Wind Home Systems (WHS)*	7,500	7,500	100 Wp	750	1,400	10.50	1.5 /Wp	0.85
SBCS	200	2,000	2. 5 kW	500	18,000	4.50	1.5 /Wp	0.55
Minigrids								
MHP	25	2,500	50	1,250	5,500	6.88	n/a	n/a
Biomass	20	500	6	126	6,000	0.72	600	0.07
Diesel/RETHybrids**	15	3,500	60	876	3,300	2.89	600	0.53
Totals	37,635	45,500		5,280		66.32		5.64

* *Individual WHS are assumed to have equivalent capacity as 100 Wp SHS.*

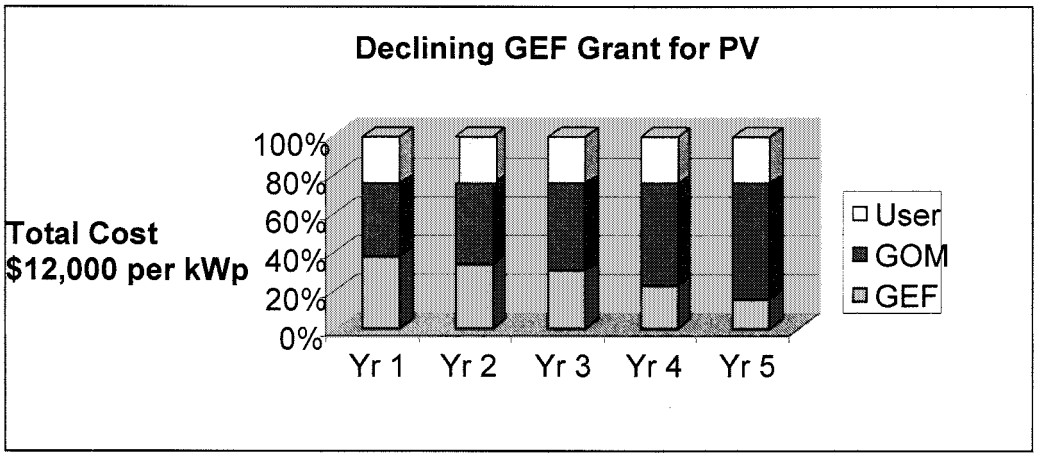
** *Hybrid capacity assumed to be 70 percent diesel, 30 percent RET . RET is likely to be wind;*

*** *Total incremental costs for PV, WHS and SBCS are calculated on declining basis.*

Phase-out strategy for GEF grant

15. The present Project is of 5 years duration and is focused on some of the poorest States of Mexico. Substantial government subsidies are needed whatever technology is used. The relatively small GEF grant contribution requested for hardware-related incremental cost is not the key factor, as it is in most other Bank/GEF projects, to making the systems affordable to users and spurring market growth. The major barrier to wider use of PV in this case is not the high upfront cost to users but the present lack of confidence by government decision makers and planners on the role of PV as an economic option for rural electrification. GEF co-financing of the investment cost would provide the level of comfort needed by the GOM to commit to the program. As the Project successfully demonstrates the role of PV and the practicality of the dissemination mechanism, the confidence of Government is expected to increase and the level of GEF grant could be reduced. Project sustainability is assured because the Government has the capability, through existing social funds such as *Ramo33*, to shoulder the full subsidy requirements for as long as necessary.

16. To estimate total GEF grant requirements, it is assumed that, on average, capital cost of PV is $12,000 per peak kW in Year 1, declining by about 20 percent at the end of Year 5, as a result of market growth, volume procurement and improved efficiencies. In Year 1, a GEF grant of $1,500 per peak kW would be provided. The user pays 30 percent of the unit cost while the balance is borne by the Government. The GEF grant will be gradually reduced such that only about $0.6 per peak Watt will be provided during Year 5. In Year 6, no GEF grant will be provided; Government subsidies will bear all costs beyond the assumed average user contribution. The following figure depicts the changing cost contributions by GEF, the Government and the users.



B. Technical Assistance to reduce market barriers to RETs

17. The tables below list the market barrier reduction activities for RETs considered essential to the successful implementation of the project. Compared to incremental cost financing for hardware, GEF intervention in the Project through grant financing of technical assistance activities will not only be important to the effective implementation of the RET-based subcomponents but will have deeper and longer-term impacts, as they address crucial gaps in policy and capacity of the sector. Many of the RET-related activities are inextricably linked with activities that deal with the baseline plan but need incremental cost financing. For example, while a general tariff and subsidy scheme must be developed for normal implementation of the Government's rural electrification program, the use of RETs requires special attention because technologies such as individual solar home systems deliver a different type of service than a diesel minigrid connection or a grid extension connection. In this case, the project loan will finance the baseline work; the additional cost of the special study dealing with RETs will be financed with a GEF grant.

- Technical assistance co-financed by GEF to Project Component I: Policy, Regulation and Strategy will support activities that contribute to strengthen the strategy, policy and regulatory frameworks under which off-grid rural electrification projects operate. The market reduction activities focused on RETs include: development of incentives and financing mechanisms for off-grid electrification projects baded on RETs, and development of regulatory measures, standards and manuals to ensure minimum quality levels in RET technical installations and service delivery practices.

- Technical assistance financed by GEF to the Project Component 2: Rural Electrification Subprojects will enable extensive consultations in the field with the subject communities to ensure full social acceptance of the subprojects.

- TA activities co-financed by GEF to the Project Component 3: Technical Assistance for Rural Electrification will strengthen the capacity of Federal, State, Municipal and Community stakeholders to identify, plan, prioritize, and implement sound offgrid RET sub-projects in cooperation with electricity service providers, the private sector, decentralized government institutions such as the CFE and when appropriate, NGOs and the academia.

- Technical assistance co-financed by GEF to the Project Component 4: Increasing Productive Uses of Electricity will build capacity in the communities that been provided with access to electricity and train them to utilize the service for productive purposes, focusing on the possibilities electricity offers for the creation and expansion of micro businesses. Specialized assistance on development of economic applications and micro business that utilize RETs will be provided.

- Finally, technical assistance co-financed by GEF to the Project Component 5: Project Management will support overall management of the Project including capacity building and operational support of implementation units at the Federal (FIU) and State levels (SIUs).

18. The TA activities and their estimated baseline costs and GEF requested co financing are listed in Table 15.2.

Table 15.2. Incremental Costs of Technical Assistance Activities

	COMPONENT	US$Million		
		Baseline	GEF	Total
I. Policy, Regulation and Strategy				
1.1	1.1.1 Review Off-Grid Electricity Tariff and Subsidy Schemes	0.05		0.05
	1.1.2.Design policy, legal and/or regulatory frame (as required)	0.40	0.40	0.80
1.2	1.2.1 Review Ownership Rights and Schemes	0.05		0.05
	1.2.2 Design policy, legal and/or regulatory frame (as required)	0.40	0.40	0.80
1.3	Design Conflict Resolution Mechanism (All Levels)	0.15		0.15
1.4	Design incentives to promote renewable source based off-grid projects	0.20	0.05	0.25
1.5	Develop technical specifications, manuals and standards RETS	1.00	0.50	1.50
1.6	Develop methodological guidelines/tools social consultation	0.50		0.50
	TOTAL	2.75	**1.35**	**4.10**
II. Social Consultations at Rural Electrification Subprojects Sites				
2.7	Social Consultations (Municipalities + Communities)	0.00	0.13	0.13
	TOTAL	**0.00**	**0.13**	**0.13**
III. Technical Assistance for Rural Electrification				
3.1	Computer hardware and software/modeling tools planning stage	0.01		0.01
3.2	Measurement, data collection on renewable energy resources	0.60	1.00	1.60
3.3	Capacity building to FIU and SIUs to support all project stages	1.30	0.70	2.00
3.4	Design and implementation communication strategy, information campaign, social consultation (including didactic materials)	0.50	0.50	1.00
3.5	Pre-feasibility, Feasibility, Engineering of Selected Subprojects	0.75	0.50	1.25
3.6	Design model bidding packages, incentives, service delivery models	0.30	0.30	0.60
3.7	Permanent training to community extension agents	1.00	0.50	1.50
3.8	Impact Evaluation (surveys / analysis)	0.75	0.50	1.25
3.9	Monitoring Activities (technical / social / environmental)	1.50	0.75	2.25
3.10	Technical, Social and Environmental Oversight	0.62	0.39	1.00
	TOTAL	7.33	**5.14**	**12.45**
IV. Technical Assistance to Increase Social and Economic/Productive Uses of Electricity				
4.1	Capacity building social and productive activities / micro-businesses	0.25	1.25	1.50
4.2	Financing of social activities (consumptive with development effect)	1.00		1.00
4.3	Investments in Micro-Businesses (entrepreneurial activities)	3.50		3.50
	TOTAL	4.75	**1.25**	**6.00**
V. Project Management Five Year Period				
5.1	Federal Level: Management, Procurement, Financial, Technical	1.38	0.85	2.23
5.2	State Level: Management, Procurement, Financial, Technical	2.75	0.20	2.95
5.4	Legal, Fiduciary Management including Fee for Administration of Project Account	1.89	0.45	2.34
	TOTAL	6.02	**1.50**	**7.52**
	GRAND TOTALS ALL COMPONENTS	**20.85**	**9.36**	**30.19**

Incremental Cost Matrix

19. Table 2 below summarizes the preliminary results of the above analysis in a matrix that shows the costs, domestic benefits and global benefits associated with the baseline course of action and the proposed alternative course of actions. The increments are then calculated.

Table 2:
Incremental Cost Matrix

	Baseline	Alternative	Increment
Domestic Benefits			
a) physical	New line extensions to concentrated users over 5 years under Project. Continued use of kerosene and other fossil-fuels for lighting and other domestic applications by offgrid populations.	Offgrid connections with microgrids powered by microhydro, biomass and diesel/RET systems plus SHS, WHS and SBCS to total of 46,000 users.	Up to 46,000 offgrid users provided basic electricity service
b) programmatic	Government's rural electrification program focused on line extensions and fossil-fuel based generation	New national strategy incorporating offgrid electrification with high decentralized and renewables component	Reduction of perceived risks in renewables-based offgrid electrification projects
	Minimal local capacity to develop renewables-based projects for offgrid electrification	Participation by GOM agencies, community organizations and private sector in planning, design and execution of offgrid renewables-based electrification projects	Up to 300 GOM staff at various levels, up to 1,000 private sector persons and up to 5,000 community residents trained/experienced in renewables-based offgrid electrification
Global Benefits			
a) environmental	5 million tones of CO2 over 20 years from diesel and kerosene use	Zero tones of CO2 over 20 years	5 million tones CO2 abated over 20 years
b) programmatic	Limited international experience in SHS and microgrids for offgrid electrification High perceived risks by Govt/investors/communities in above systems	About 5.3 MW additional PV, MHP, WHS , biomass, diesel/wind hybrids and other RETs installed and providing demonstration effect/combining impact with similar demo plants globally	More Govt programs/private investors in similar countries in Central America and elsewhere willing to consider renewables-based options for rural electrification Incremental addition to global knowledge on community-based and private sector-led offgrid operations

	Baseline	Alternative	Increment
Costs (M$) a) Investment: Capital Costs	$ 61,650,000 (Cost of grid-extension and fossil fuels-based systems assumed installed instead of RETs+ continued use of traditional lighting fuels)	$ 67,290,000 (Cost of RET installations)	$ 5,640,000
b)Technical Assistance	$ 20,850,000	$ 30,190,000	$ 9,360,000
Total	$ 82,500,000	$ 97,480,000	$15,000,000

Notes:

20. The 5 million tones CO2 abated by installations in the GEF alternative was estimated over 20 years, the average lifetime of most of the installations. The baseline generation avoided by the construction of microhydro, biomass gasifiers and diesel/RET hybrids in the Project is assumed to be diesel. Hybrids were assumed to be 70 percent diesel and 30 percent RET on average. For SHS, WHS and SBCS, the avoided emissions were assumed to be due to kerosene use in lamps for lighting for 100 percent of households and 25 percent of institutional applications. For the rest of institutional applications and all productive uses of PV, the avoided emissions were assumed to be from small gasoline engines. Technical figures on carbon content of diesel and kerosene, specific fuel consumption and carbon dioxide emissions per kWh of operation are all based on standard data.

UNIVERSITY OF CALIFORNIA, BERKELEY

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ENERGY AND RESOURCES GROUP
310 BARROWS HALL
UNIVERSITY OF CALIFORNIA
BERKELEY, CA 94720-3050
WWW: *http://socrates.berkeley.edu/~rael*
TEL (510) 642-1139
FAX (510) 642-1085
CO-DIRECTOR, BERKELEY INSTITUTE OF THE ENVIRONMENT

DANIEL M. KAMMEN
CLASS OF 1935 DISTINGUISHED CHAIR IN ENERGY
PROFESSOR IN THE ENERGY AND RESOURCES GROUP
PROFESSOR OF PUBLIC POLICY
PROFESSOR OF NUCLEAR ENGINEERING
DIRECTOR
RENEWABLE AND APPROPRIATE ENERGY LAB (RAEL)
EMAIL: kammen@berkeley.edu

December 1, 2005

To: Gabriela Elizondo Azuela, Senior Energy Specialist
Finance, Private Sector and Infrastructure, LAC
The World Bank, Room I5-064
Email: gazuela@worldbank.org

Re: Review of Integrated Energy Services Project

Overall:

This project takes a focused approach to many of the key energy issues facing rural communities by focusing equally on the domestic issues of lighting and household energy services, as well as on the energy and electricity infrastructure for local businesses and commercial ventures.

The project is well designed with an excellent management team, and a very solid list of key performance indicators and should be funded.

In fact, the PCD is *very* well prepared and informative, and the project team has done a very good job with the cost analysis (Annex 9) where they are clear and sensible in the carbon abatement costs. In fact, if anything, the team has been highly conservative in forecasting benefits, and detailed in costs.

Major Comments:

[Pages 8, 11, 46] More detail is needed on the selection of the entities to undertake the electrification subprojects. In many ways this is a critical operational aspect of the project, and a vital indicator of how transparent the project will be in its operation.

Project Team Response 1:

For service delivery A (solar and wind home systems):

a) Equipment provision, O&M, training and transfer contracts are bid out to a potential list of 180 private service suppliers existing in the FIRCO data base; bids are evaluated and awarded according to least subsidy requirements. Boundaries for training terms and tariffs, as well as training and transfer conditions, are established in the bidding documents. Part of the investment cost is paid in trenches or as a balloon payment upon successful system transfer.

b) Under the aegis of the Project, private supplier makes arrangements with local individuals and organizations for billing and collection; private supplier operates and maintains systems for a period of time, during which it conducts training of local operations and maintenance personnel for eventual system take over. Private supplier puts in place a mechanism for providing spare parts such as fuses, controllers and batteries as well as complementary appliances such as inverters.

c) Program implements ways of testing the effectiveness of training and the readiness of local organizations for system take over. Upon successful system transfer, the Program releases remaining investment payments to service provider.

d) Program establishes a formal relationship with an established public service provider such as CFE to provide backstopping to local based rural electric service organizations. Complementarily, The Project extends the life of the program to the long term (20 years) to continue to support backstopping activities.

In service delivery B (centralized systems with mini-grids, mini-hydros, etc.):

a) Program conducts studies to determine potential number of customers both residential and productive uses, demand levels, customer dispersion, willingness to pay, mini-grid design including service drop and house-wiring provisions as well as potential for local participation.

b) Program works and makes arrangements with local individuals and organizations to provide for metering, billing and collection. Communities may be organized in cooperatives, associations, PPPs or other forms. Before contracts go out to bid, an organization will be in place to be able to handle the commercial functions from the start and with the help and training from both the private supplier and the Program itself.

c) Equipment provision, mini-grid installation, O&M, training and transfer contracts are bid out to potential equipment and service providers. The Program will actively seek to develop suppliers' market through presentations, promoting links between different organizations and inviting international suppliers. Bids will be evaluated and awarded using least subsidy requirements. Maximum investment

subsidy will be 33 percent under this component. Private supplier operates and maintains systems for a period of time, during which it conducts training of local operations and maintenance personnel for eventual system take over. This period of time may be longer than in the case of PV and wind systems; private co-investors must have the opportunity for capital recovery and profit. The possibility exists that some co-investors remain as partners with the community for the life of the project.

d) Program implements ways of testing the effectiveness of training and the readiness of local organizations for system complete or partial take over. Partial take over may involve the mini-grid only, or the conversion of capital subsidy components into community shares, or additional community share purchases. While the proposed financial engineering provides for greater private involvement in the long term, the projects will tend to be small and this may in turn encourage and facilitate community take over.

e) Program establishes links between micro-hydro operators and other long term backstopping and technical support instances to shore up projects' sustainability.

The IESRM will do everything possible to ensure transparency in the process of selection and will ensure the participation of highly qualified entities.

Companies participating in the bidding will have to be certified and registered in the FIRCO data-base (at least initially). The majority of companies registered in the FIRCO database today are only equipment suppliers, however about 25 percent of them also offer after-sale services. The Project will also attract international companies.

In addition, it is not clear why the groups to be engaged for this work need necessarily be [established] electricity service providers. In an effort to broaden the reach of the project, this would seem a natural place to combine goals [ii] and [iii] and to provide training and technical assistance to evolve groups to be able to provide these functions. This issue is reflected in the "Rejection of off-grid electrification solutions by rural indigenous communities" [page 16, entry in table].

Project Team Response 2:

The Project will be open to the participation of local entities, rural cooperatives and other types of stakeholders such as NGOs and strategic partnerships (e.g., equipment provider with NGO such as in "La Florida del Sur" case study described in Annex I of the PAD). The ESRM Project will indeed provide training and technical assistance to groups that have evolved and are capable of providing the service efficiently.

As described in the PAD, project sustainability will be ensured through: a) the continuous strengthening of an institutional network integrated with government and non-government agents, focused on the planning, prioritization and implementation of rural

electrification projects in coordination with other key government programs, and b) the provision of service delivery models and market mechanisms designed to promote synergies between "external" (e.g., ESCOs, equipment suppliers, public utility, NGOs) and "internal" service providers (e.g., community organizations, local cooperatives, individuals, private companies) consistent with their real capabilities and nature.

The Ministry of Energy (SENER) has done a very large amount of work to justify and properly analyze how to cost-effectively use renewable energy options in rural settings. This material does not appear to have made it into Annex 9 [page 91ff] and the least-cost assessment. This should be corrected.

Project Team Response 3:

The task team will correct this and integrate all data available in the economic and financial analysis.

[Page 20: Annex 1] What planning metrics, or tools, will be used to determine how funds will be allocated for off-grid electrification of remote homes? This is often a key, and very contentious decision/allocation issue, and the more clarity on it up front the better. Tools much as HOMER and ViPoR exist for this purpose (both of these are provided by NREL, the National Renewable Energy Laboratory, www.nrel.gov].

Project Team Response 4:

The State Implementation Units (SIUs) of the four targeted States have already participated in several workshops to learn how to use the HOMER. In particular, NREL (Jeannie Renne) has played a very active role in Mexico, specially promoting the use of HOMER.

The Project will place special emphasis in the capacity building of SIUs to ensure a transparent and solid planning and project selection process. In fact, an important share of GEF resources is allocated to capacity building and technical assistance components.

[Page 39] 50,000 systems over 5 years seems a low target.

Project Team Response 5:

Perhaps the number of households seems low; however the number of communities is expected to be high as the Project targets communities of 20-100 households. This is already a great challenge, as communities are small, isolated and disperse. The Project on the other hand will seek to continue after the end of the five year period, when replication is expected to start.

[Page 46] There seems to be a fairly major flaw in the implementation model for some of the subsidies. Item (i) indicates that the subsidy, up to 90 percent of the initial investment cost, will be paid directly to the supplier. I would caution strongly against this. To prevent corruption and claims of large numbers of installations, *and* to pass subsidies on as much as possible to consumers, it would seem to make *much* more sense to send some significant component of the funds to the end-users. Or, as has been tell-tested in Nepal, make the payments to suppliers contingent upon successful operation of the systems over time. This does take more administration, but systems are consistently better installed and maintained if suppliers get, for example, 50 percent of the subsidy up front, but the remainder is only paid out as a function of demonstrated and successful system usage.

Project Team Response 6:

As explained in Annex IV of the PAD, service delivery model A –or that applying to solar and wind home systems- is based on the following premises:

a) Equipment provision, O&M, training and transfer contracts are bid out to a potential list of 180 private service suppliers existing in the FIRCO data base; bids are evaluated and awarded according to least subsidy requirements. Boundaries for training terms and tariffs, as well as training and transfer conditions, are established in the bidding documents. **Part of the investment cost is paid in trenches or as a balloon payment upon successful system transfer.**

b) Under the aegis of the Project, private supplier makes arrangements with local individuals and organizations for billing and collection; private supplier operates and maintains systems for a period of time, during which it conducts training of local operations and maintenance personnel for eventual system take over. Private supplier puts in place a mechanism for providing spare parts such as fuses, controllers and batteries as well as complementary appliances such as inverters.

c) Program implements ways of testing the effectiveness of training and the readiness of local organizations for system take over. Upon successful system transfer, the Program releases remaining investment payments to service provider.

d) Program establishes a formal relationship with an established public service provider such as CFE to provide backstopping to local based rural electric service organizations. Complementarily, The Project extends the life of the program to the long term (20 years) to continue to support backstopping activities.

Indeed, the Projects intend to make the payments to suppliers contingent upon successful operation of the systems over time. The Project will examine ways of passing the subsidies –or a portion of the subsidies- directly to the end-users to reduce lack of

transparency of the possibility of corruption. **The Project team will pay special attention to this important aspect of the Project design.**

Through this service delivery model, the Program intends to provide four different types of subsidies:

i. Direct up-front output-based subsidies of up to 90 percent on the initial investment costs, paid to the supplier on the basis of actual installations. **Here we will clarify that the intention is to make payments contingent upon successful installation operation of the systems over time**. These installations will achieve full coverage in the chosen communities and attempt to serve the needs of all potential productive uses. Those residential customers unable to pay the tariff will obtain access through community payment arrangements, cross subsidies or direct subsidies, through mechanisms to be determined.[80]

ii. Output based service quality subsidies, paid to the supplier against installation and service performance targets. Bidders will "package" their incremental operations, maintenance costs into their investment calculations and mechanisms will be put in place to ensure the provision and quality of these services. In addition, as stated above, a portion of investment cost payments will be deferred for up to three years, to be paid in trenches or as a balloon payment at the time of system transfer.

iii. Output based market development service subsidies, paid to the supplier against training of local technicians, programmed visits, users training and other. A portion of these subsidies will be disbursed through the Program's account over the long term (20 years) to support backstopping activities.

iv. A subsidy window open for the duration of Program to provide for system expansion through increased demand and additional customers in communities electrified under Program. Applicants will have to submit several competitive bids from qualified suppliers. Subsidy conditions will be at least equivalent to those granted to the first batch of users in Year 1 of the relevant community.

Minor Comments:

The electricity access indicators that the project will use are an important innovation, and I applaud their explicit inclusion. A paper describing several such indicators is attached, with the reference:

> Arne Jacobson, Anita D. Milman & Daniel M. Kammen (2004), "Letting the (Energy) Gini Out of the Bottle: Lorentz Curves of Cumulative Electricity Consumption and Gini Coefficients as Metrics of Energy Distribution and Equity" *Energy Policy*33 (2005) 1825-1832.

[80] Detailed studies for optimizing the nature and provenance of these subsidies are underway.

Project Team Response 7:

The Project team will review the paper and consider additional ideas and recommendations for Project performance indicators.

Page 13] Will the advisory committee, or the project monitoring committee, be purely Mexican in composition, or will there be an international component (as I would recommend)?

Project Team Response 8:

It is expected that the Project Advisory Committee (PAC) will include the participation of the World Bank, as appropriate. Also, international consultants will be hired to assess the impacts of the Project and analyze ways to adjust the design and/or implementation. Indeed, the Project thought as an adaptable approach.

The Project team will however further reflect on this recommendation, as it is seems to be extremely important to have an independent international voice in the PAC during project implementation and beyond,

[Page 23] Additional clarification on the 'white flags' is needed.

Project Team Response 9:

The **Micro-Regions Strategy** is a poverty reduction national strategy that promotes inter-institutional coordination and the participation of Federal, State and Municipal entities for the co-financing of works and social infrastructure (through annual legal agreements). The strategy is focused on the development of community centers or *development poles* with the potential to serve a number of disperse communities (micro-region). The Micro-Regions Strategy finances a number of "white flags" per micro-region every year.

The Program defines "white flags" as any work –of any scale- that includes the installation of water supply systems, sewage systems, roads, schools, housing improvent - concrete-based floors-, electrification, hospitals and other.

The Program counts the number of "white flags"every year, as targets and milestones to the program.

Page 24 – 26] How does the Mexican national law treat the joint use of electricity for homes and businesses that are linked and co-located (as are many rural enterprises)? This would seem to be a critical issue in the provision of rural energy services, *and* the evolution of rural entrepreneurs.

Project Team Response 10:

This is a frequent practice in Mexico. There are plenty of families with "*talleres*" and micro-business in their homes. When these home-businesses are connected to the grid, the Federal Electricity Commission (CFE) installs two meters, one for the house and the other for the "*taller*" or micro-business. This is perfectly legal. This practice can also be translated to rural areas, especially when the systems have micro-grids operated by the CFE.

The Electricity Law is also explicit in that rural consumers installing systems of less than 1 MW can be productive cooperatives or enterprises (under the self-supply scheme). This also includes public-private partnerships.

The Project team will pay special attention to all legal details regarding this issue.

[Page 29] Useful to mention remittances (which are important), but it does not anything is done with this information. (Michoacan province, for example, is estimated to be a locus of more local income from remittances than from local industries.)

Project Team Response 11:

We agree, this is not well explained in the PAD. The project team will further develop this argument and link the importance of remittances to the economic capacity of communities to embark in new productive activities and micro-businesses. In particular, the Southern States are major recipients of remittances and new banking systems are being developed to reach remote communities (e.g., cash-machines). However, there is still a lack of education among rural families on how to invest (as opposed to spend) part of the received remittance. The example provided in Box "Home Town Associations, the Program 3x1" seeks to illustrate the success of a program where "hometown associations" play a major role and families living in US actually invest in community projects, productive activities and micro-business when the appropriate incentives are in place.

Component 4 of the Project intends to support remittance recipients through technical assistance to increase the number of energy intensive community projects and investments with high developmental impact (i.e., leverage and maximize the productive impact of remittances).

[Page 33ff] Has the FIRCO network been able to aggregate sufficiently to be in a position to act a bulk purchases to get lower materials costs for local installers? If not, they appear to be ideally positioned to take on this responsibility. In many settings that service has been found to reduce rural home-based energy installation businesses.

Project Team Response 12:

Yes, absolutely. The Project will strongly rely on the FIRCO network of equipment and service providers in order to reap economies of scale. It is important to mention however that the costs of photovoltaics in Mexico are still higher than the average in Latin America. This is because despite the FIRCO initiative, the market for PVs has not grown significantly and there are few –if any- equipment manufacturers or assembly facilities supplying parts and accessories in Mexico. One of the important outcomes expected from the Project is the lowering of PV costs and the development of a strong market for equipment and service provision based on different types of renewable energy technologies.

[Page 44] The build, operate, train and transfer contracts do not explicitly indicate that members of successful, early sage communities, would be offered contracts to provide training in later communities. This should be a hallmark of the 'local empowerment' component of the project.

Project Team Response 13:

The Project will definitely encourage the participation of local extension agents that have had experience with previous successful sub-projects in their communities. This is extremely important as "local empowerment" is at the heart of rural development, sustainability and replication.

The Project team will pay special attention to this key aspect.

[Page 52] It is unclear why one would want to encourage the diesel/hybrid systems, especially without any follow-plan to evolve these to be solar powered.

Project Team Response 14:

As explained in the PAD, diesel/RET/battery hybrids –where the RET component would be either wind or PV- may be practical options where local renewable energy resources are non-existent or are not particularly abundant and where an isolated diesel system may be the only way to electrify the area. In such case, it may still be possible and economic to complement the diesel system with a synchronized RET system, operating in a "fuel saving mode". This would be particularly useful in situations where continuous power is needed (e.g., for fish or milk refrigeration). Wind is the more commonly used RET for a hybrid because of its relatively lower costs compared to PV.

Annex 17. Impact Evaluation

Introduction

1. Program monitoring provides ongoing information on the direction and the magnitude of change in outputs or outcomes of the project. Monitoring is then critical to know whether the project is moving in the right direction. Program monitoring, however, is not a tool that provides information to determine if the observed changes in specific outcome indicators are the direct consequence of the intervention. The main purpose of an impact evaluation study is to provide convincing and reliable evidence that the changes in the outcome indicators are *attributed* exclusively to intervention and not to other factors.

2. In order to be able to establish *causality*, the impact evaluation of a project must elaborate a credible "counterfactual" that describes what would have happened had the project never taken place. For example, in the case of the impact evaluation of the rural electrification project the counterfactual consists of what participants would have experienced had their localities not participated in the rural electrification project. The provision of electricity to poor households gives them access to better lighting which makes it possible to gainfully utilize the latter part of the day, resulting in a positive effect on education and employment compared to a counterfactual that was not intervened.

3. The central problem in the evaluation of any program is the fact that households participating in the program cannot be simultaneously observed in the alternative state of no treatment. A household is either electrified or not, and cannot be observed in both states at the same time. At a first glance, one has to resort to statistical methods to address this problem (e.g., see Heckman, LaLonde and Smith, 1999). But when the impact evaluation is planned prospectively, the process of selecting the unit of analysis fitted into the design can be understood and randomized methods to select counterfactuals may provide enormous advantages to infer causal linkages.

The Evaluation Framework

4. The idea to evaluate a program lies on constructing a suitable counterfactual outcome in the untreated state conditional on receiving treatment. If T=1, the state that denotes participation, then the treatment parameter can be express as:

$$TT = E[Y_1 - Y_0|T = 1] = E[Y_1|T = 1] - E[Y_0|T = 1]$$

5. The equation above shows the counterfactual that is impossible to estimate. We can observe, however, the average outcome in the untreated states conditional on similar characteristics:

$$TT = E[Y_1 - Y_0|X, T = 1] = E[Y_1|X, T = 1] - E[Y_0|X, T = 0]$$

Since in the equation above,

$$E[Y_0|X, T = 0] \neq E[Y_0|T = 1]$$

6. The evaluation problem arises when finding an accurate estimate that makes both elements of the equation above to be closer. Formally, "randomization provides a mechanism to derive probabilistic properties of estimates without making further assumptions."(Rubin, p 693) Randomized trials of participants in the intervention may also be useful for incorporating causal effects. Holland (1985) reminds to us that randomized trials for participation can be a powerful aid in investigating causal relations. Randomly assigning individuals or communities into treatment and control groups, solves the evaluation problem by using information from communities or households in the control group to construct an estimate of what participants would have experienced had they not participated in the project. Therefore, impact evaluation with randomized participation criteria focus attention on impacts across persons with certain similar features.

Proposed Types of Evaluating Methods

7. Randomized or experimental designs assign randomly localities or households into treatment and control groups. Randomized or experimental designs use information from individuals or households in the control group to construct an estimate of what participants would have experienced had they not participated in the program. The advantage offered by a randomized design is that the random assignment of treatment, or its timing, generates a control group that is statistically equivalent to the treatment group in both observables and unobservable variables. Thus randomized designs generate the ideal counterfactual term for a rigorous and credible impact evaluation.

8. In an experimental design, the project team in coordination with the state authorities could randomly select the order or the year (2007 through 2010) in which localities could be electrified. Such a design could be relatively easily applicable to the larger group of localities (75 percent of the targeted households) identified as likely candidates for electrification with PV-SHS. In each year the localities electrified with PV-SHS would be the treatment population while the localities waiting to be electrified would be the control population or comparison group. Consider, for example, the state of Oaxaca. An estimated total of 7,560 households in Oaxaca will be electrified with PV-SHS between 2007 and 2011. Provided that the year of coverage of these localities is determined through a random process, some 1,400 households can be electrified with PV-SHS in 2007. These households would be considered as the treatment group while the rest eligible households waiting to be electrified in 2008 (other 1,400) could be considered as the control or comparison group for 2007.

9. A rigorous and credible impact evaluation could then be designed along the following lines: (1) select a random sample of households from the treatment group (the households to be electrified in 2007) and from the control group (the households to be

electrified in 2010); (2) implement a baseline survey of this sample of households prior to the electrification in 2007. One of the main criteria for selecting an eligible community deals with the community's economic disposition to maintain the infrastructure and enhance long-term sustainability. A market assessment is planned to be implemented to gather willingness to pay and other relevant socio-economic conditions of the communities. The impact evaluation could take advantage of the market assessment survey to generate a baseline that would enhance the credibility of the evaluation. (3) Depending on the available budget for the impact valuation (including survey costs) contact one or more follow-up surveys (e.g., in 2008 or 2009) to determine the impact of the PV-SHS on the households that were electrified in 2007. The follow-up survey (or surveys) in combination with the baseline survey can be used to construct the "difference-in-differences" estimator for evaluating the project's impact, which nets out of the estimated impact of the project any differences between the treatment and control localities that might have existed prior to the start of the project.

10. The same general experimental design is also possible to be implemented in the evaluation of the impact of electrification on the smaller group of localities (25 percent of the targeted households) identified as likely candidates for electrification with non-PV-SHS. As long as the order or the year in which localities get electrified is determined exogenously (randomly) localities that are identified as suitable for electrification by Small Scale Wind Generators/Wind based Hybrids/Wind Based Mini-grids and similar Biomass projects (20 percent of the targeted households) or Micro-Hydro/Hydro-Based Mini-Grid (5 percent of the targeted households) in later years (2007-2010) can serve as a comparison group for the localities that are electrified with resource-dependent (non-PV-SHS) systems at the start of the project in 2007.

11. *Quasi-experimental* (or nonrandomized) designs, on the other hand, construct a comparison group (usually after a program has been implemented) that matches statistically the treatment and control groups on the basis of only observable characteristics. Quasi-experimental methods attempt to control for the potential role of unobserved selection bias, through assumptions and statistical techniques. As a result the credibility of the impacts obtained through quasi-experimental designs is limited by the extent to which the influence of selection bias and other unobservable factors accounts for program participation, and the degree in which assumptions are weak or strong.

12. systems but not for non-PV systems. One of the main criteria for selecting an eligible community deals with the community's economic disposition to maintain the infrastructure and enhance long-term sustainability. An *Encouragement Design* (see Duflo and Saez 2003) randomly selects a group of localities to receive extra encouragement or help/information to join or fulfill the eligibility requirements. These requirements meet their economic disposition to maintain project sustainability. Provided that the encouragement significantly increases the rate of participation in the electrification project but does not change the nature of the project, then the indicator variable of whether a locality received encouragement or not can serve as an instrument to identify the impact of the project. This can be an effective way to evaluate non-PV systems using a *Quasi-experimental* framework.

13. The principal advantage of this design is its use of random selection, which controls for any unobserved background factors, without requiring that a control group be involuntarily excluded from the project. Potential disadvantages of this variant of a quasi-experimental design include: (a) it may be difficult to design a method of encouragement that significantly increases participation without affecting design or implementation of the project; (b) since the project is decentralized, each state might implement the encouragement differently: (c) since about 1,500 new households will enter the project in each year, it may be difficult to achieve the sample size needed to obtain significant results; (d) observers may question why some but not all the localities receive encouragement to join the project.

14. The main disadvantage of evaluating non-PV systems is that there are few localities and households that would be included. The challenge to be met is in the selection of the sample for the impact evaluation. The evaluation sample needs to be sufficiently large and diverse to include localities that can be electrified with non-PV-SHS systems. Given the additional requirements for a locality to be considered as eligible for Micro-Hydro/Hydro-Based Mini-Grid (e.g., the presence of a sufficiently large water fall is required for the installation of Micro-Hydro plants) it is likely that communities that are candidates for non PV-SHS systems may need to be over-sampled.

Identification of the Universe of Eligible Communities for Intervention

15. Several factors define the universe of eligible communities to be intervened. The main factors correspond to exogenous conditions such as community size, distance to the grid and the capability of implementing solar energy sources. There are other important factors such as the willingness to pay of communities to enable sustainability of the systems. Randomization allows to balance exogenous and self-selection attributes between the treatment and control groups so that both groups are comparable. The only difference between the treatment and control groups should concentrate on the intervention.

16. Table 1 shows the main attributes of communities that are considered in eligibility for intervention. Since randomization can take place for evaluating the PV component of the project, the project can be organized to provide an equal chance of intervention to communities in a given period, while allowing phases of implementation needed for effective implementation. Randomization would then be the most effective way to ensure a fair system of selection of communities to intervention while providing a robust framework for impact evaluation.

17. For impact evaluation to be design prospectively, the first step is to know with precision the conditions for the eligible communities and then list the number of localities with their characteristics.

Table 1. Factors that Determine the Universe of Localities Eligible for Project Intervention

Geographic/social	Economic	Technology	Planning	Public Consultation
Localities only in the southern states involved in the project	Income/welfare stratification of localities// Marginalization level	Identification of areas with potential of implementing renewable energy	Public Programs available	Social Organization and Political Aspects (Social Capital)
Localities with less than 2,500 and more than 50 inhabitants	Electric consumption per inhabitant	Type A: Mini-centrals (Any type of technology) Characterized by supplying relatively large (>500 & <2500) rural communities	Localities that will not receive CFE or CDI electrification in the following 5 to 10 years are eligible for the pilot	Perception of participants about renewable energy (Public acceptance)
Distance to grid network of CFE	Productive capabilities	Type B: Hybrid (even diesel-hydro or any other hybrid) for small communities with productive capabilities	Cost-Benefit of Electrification (voltage use and cost of installation)	Willingness to pay for sustainability (Economic Acceptance)
Population density	Costs per device implemented	Type C: Photo-Voltaic for nuclear or extended family centers (small >50 & <100)	Municipal Budget	
		Type D: Other technologies that are more cost-effective than the previous three	Technical Feasibility of the intervention	

Data Sources for Eligible Communities for Intervention: Guerrero, Oaxaca and Veracruz

18. To estimate accurately the number of localities that lack of electrification in Mexico is a complicated process. Initially, CENSUS data was used in order to inspect the potential universe of localities that could have been eligible to be intervened. CENSUS data has the advantage that it includes the list of all localities available within the Mexican Republic and its States. However, CENSUS data presents shortcomings in the sense that it only captures information on households and not localities. So for instance, one may know the proportion of households electrified in one locality, but we cannot fully assert if the locality is indeed electrified and if that electricity is provided by the grid. Additionally, CENSUS data goes back to the year 2000 and many localities could have being intervened with grid extension or other projects of renewable energy. However, an additional CENSUS sample for 2005 is available to verify changes in localities and updated characteristics of communities and households.

19. The use different sources of information can be meaningful to verify the accuracy of our list of eligible localities. To do so, we combined three main different sources to

CENSUS locality lists. The first source included the list derived from a research undertaken by the Institute for Electrical Research (IIE) where field trips to non-electrified localities were done and the data was gathered through Geo-referenced estimation. The problem with this data is that in includes only technical information on the costs of energy, yet this data is useful for our project and the list of localities it provides is accurate and updated.

20. The second source of information belongs to the Federal Commission on Electricity. The data was provided to the World Bank to increase the accuracy of our available data. This source includes all the recently electrified localities so we can drop-out the localities that have already been intervened by CFE and that according to IIE or CENSUS data they were not electrified.

21. The last source of information was provided by state and/or local officials. This data ended up being extremely relevant since sometimes the local leaders/government have better knowledge of the most updated electrification status of localities. The use of this data increased the accuracy of the eligible localities and provided more information useful to control when randomization takes place.

22. The State of Guerrero has 75 municipalities with a total of 7,719 localities. From the total number of localities 3,554 have 50 to 2,500 inhabitants. According to our database 24 percent (850) of the total localities between 50 and 2,500 inhabitants were not electrified in 2000. By using additional information to verify the accuracy of the number of localities, around 760 localities are eligible in 2005. The median and average number of households per locality is 19 and 28, respectively. The number of eligible localities and households is sufficient to randomly select treatment and control groups with a viable statistical power.

23. The State of Oaxaca has 572 municipalities with 9,826 communities. Using data from the CENSUS 2000, local government data, and from CFE & IIE data 1,234 communities were identified. The use of the CENSUS 2005 sample reduced marginally the number of eligible communities to 1,192 because of the creation of new municipalities. 97 percent of the communities have "very high" levels of marginalization. This indicates that eligible localities are in most need of infrastructure. The median and average number of households per eligible community is 24.5 and 42, respectively. The number of eligible communities and households are enough to randomize in the various stages of implementation.

24. The State of Veracruz has 212 municipalities, with around 22,032 communities, out of which 7,624 are rural communities with a population between 50 and 2,500 inhabitants. From our first estimate of localities using CENSUS data and through the verification of localities where schools have no electricity we end up having 1,768 eligible localities. The new estimates of localities using more accurate sources showed that we have 1,698 localities between 50 and 2,500 inhabitants eligible for the project. The error incurred in this estimation was about 4.2 percent (passing from 1,768 to 1,698 communities) and thus the increase in the accuracy through the use CFE & IIE

information was worthy. Using additional CENSUS sample data of 2005 the final universe of communities for Veracruz was 1,656. The median and average number of households per locality is 26 and 39, respectively. From the total number of households within these eligible localities, around 7 to 8 thousand will be selected for intervention during the life of the project, which allows having a reasonable number of communities and households for impact evaluation.

25. From all criteria considered to eligibility of intervention, Table 2 shows how in terms of targeting the communities with less infrastructure endowments and less education are indeed considered to be eligible. The step of targeting the intervention accurately is very important within the design of impact evaluation.

Table 2. Project Targeting: Characteristics of Eligible vs Non eligible Communities

	Eligible				Rest of Localities			
	Guerrero	*Oaxaca*	*Veracruz*	*Total*	*Guerrero*	*Oaxaca*	*Veracruz*	*Total*
Avg. Years of Schooling	3.54	3.51	4.03	3.76	4.19	4.71	4.83	4.66
Male	3.76	3.92	4.22	4.02	4.38	5.06	4.98	4.88
Female	3.33	3.12	3.83	3.49	4.00	4.39	4.67	4.44
% Female Pop.	0.50	0.51	0.49	0.50	0.50	0.52	0.50	0.50
% Pop 0 to 4 years old	0.15	0.13	0.11	0.13	0.13	0.10	0.10	0.11
% Pop 5 years and older	0.84	0.87	0.88	0.87	0.87	0.89	0.90	0.89
% Pop 12 to 14 years old	0.09	0.09	0.08	0.09	0.08	0.08	0.07	0.08
% Pop over 15 years old	0.52	0.58	0.62	0.59	0.59	0.64	0.67	0.64
% Pop over 65 years old	0.05	0.06	0.06	0.06	0.07	0.09	0.08	0.08
% Pop without insurance	0.95	0.94	0.89	0.92	0.92	0.88	0.76	0.83
% Pop with Popular insurance	0.04	0.03	0.08	0.06	0.04	0.04	0.16	0.10
% Pop speak indigenous lang.	0.35	0.71	0.25	0.42	0.21	0.39	0.13	0.23
% Households with indigenous	0.37	0.78	0.31	0.48	0.23	0.48	0.18	0.29
% Households with female head	0.17	0.17	0.15	0.16	0.19	0.21	0.17	0.19
% Households with only 1 room	0.38	0.36	0.38	0.37	0.20	0.12	0.15	0.15
% Households without drinking water	0.79	0.76	0.84	0.80	0.71	0.51	0.63	0.61
% Households without sewage	0.87	0.83	0.65	0.75	0.70	0.64	0.45	0.56

Source: Conteo de Población y Vivienda, 2005. INEGI.

Steps Taken to Ensure Data Availability and Outcome Indicators for Impact Evaluation

26. In the first year of project implementation, government and Bank supervision activities will focus in determining the following 6 points:

1. Agree on the preferred design, the localities where the evaluation will focus, the sample size, and the unit of observation (locality, household, or both). This includes the mechanisms of information provided to communities on the time, place and rules of the random assignment for the intervention in the various phases with the coordination of State Governments and local officials.

2. If the encouragement design is to be used, possibly pilot test several types of encouragement to determine which has the largest effect on increasing the probability that households/localities join or fulfill the eligibility requirements of the project

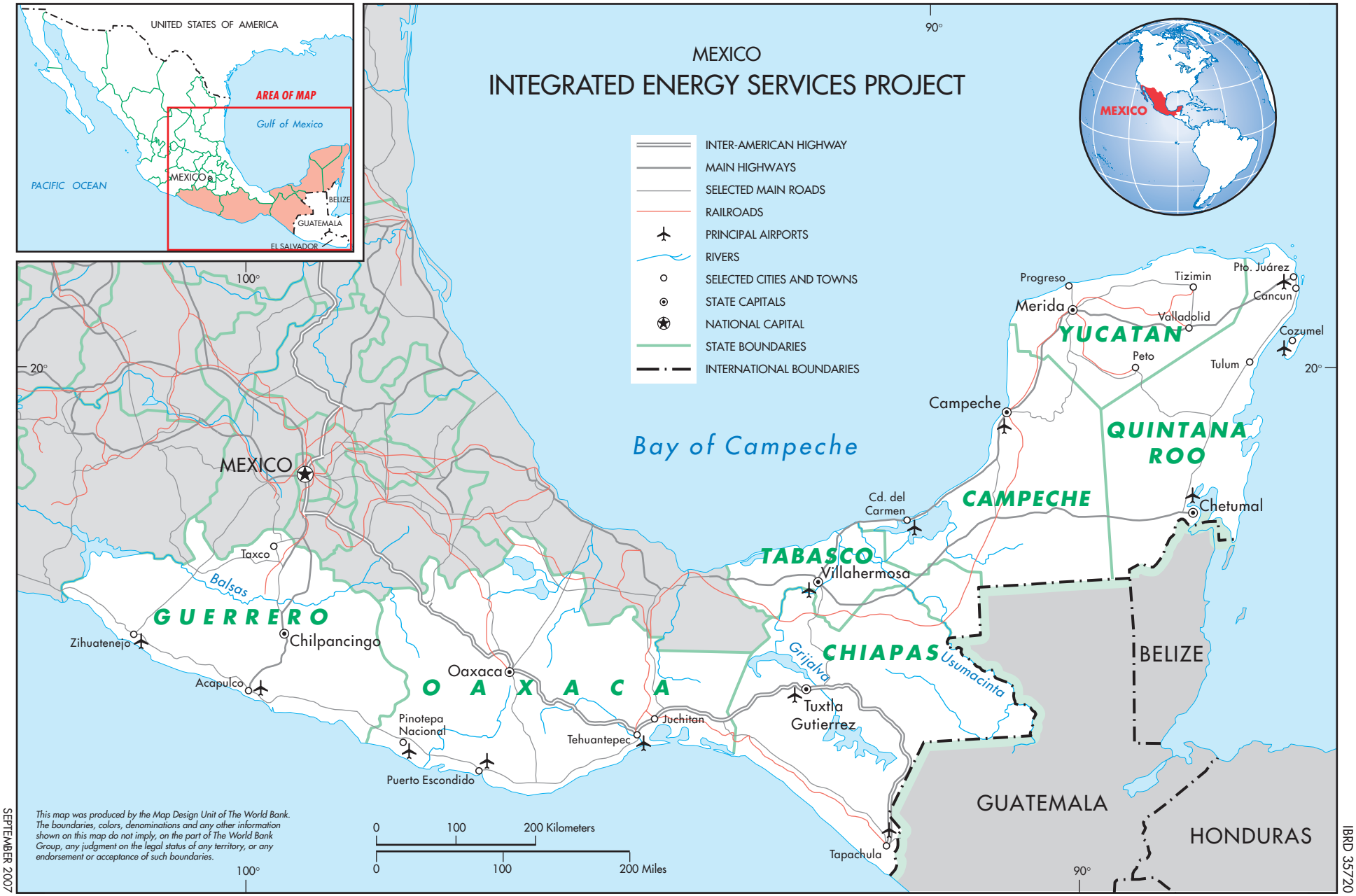
3. Agree on exactly which indicators will be used to evaluate program impact (including environmental impacts and perceptions of institutions)

4. Determine which indicators will be measured through qualitative and through quantitative methods

5. Design and contract out a baseline survey. A market assessment is planned to be implemented to gather willingness to pay and other relevant socio-economic conditions of the communities. The impact evaluation will take advantage of the market assessment survey to generate a baseline that would enhance the credibility of the evaluation.

6. Determine the timing of the follow-up surveys for the impact evaluation

MAP SECTION


MEXICO
INTEGRATED ENERGY SERVICES PROJECT
UNITED STATES OF AMERICA
AREA OF MAP
Gulf of Mexico
PACIFIC OCEAN
MEXICO
BELIZE
GUATEMALA
EL SALVADOR
INTER-AMERICAN HIGHWAY
MAIN HIGHWAYS
SELECTED MAIN ROADS
RAILROADS
PRINCIPAL AIRPORTS
RIVERS
SELECTED CITIES AND TOWNS
STATE CAPITALS
NATIONAL CAPITAL
STATE BOUNDARIES
INTERNATIONAL BOUNDARIES
90°
100°
20°
Bay of Campeche
Progreso
Merida
Tizimin
Pto. Juárez
Cancun
Valladolid
Cozumel
YUCATAN
Peto
Tulum
Campeche
QUINTANA ROO
CAMPECHE
Cd. del Carmen
Chetumal
TABASCO
Villahermosa
Taxco
Balsas
GUERRERO
Zihuatenejo
Chilpancingo
Acapulco
Oaxaca
OAXACA
Pinotepa Nacional
Puerto Escondido
Juchitan
Tehuantepec
CHIAPAS
Grijalva
Usumacinta
Tuxtla Gutierrez
BELIZE
GUATEMALA
HONDURAS
Tapachula
0 100 200 Kilometers
0 100 200 Miles
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SEPTEMBER 2007
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MEXICO
SELECTED CITIES AND TOWNS
STATE CAPITALS
NATIONAL CAPITAL
RIVERS
MAIN ROADS
RAILROADS
STATE BOUNDARIES
INTERNATIONAL BOUNDARIES
UNITED STATES OF AMERICA
PACIFIC OCEAN
Gulf of Mexico
Gulf of California
Bay of Campeche
Gulf of Tehuantepec
Gulf of Honduras
BAJA CALIFORNIA
BAJA CALIFORNIA SUR
SONORA
CHIHUAHUA
COAHUILA
NUEVO LEON
TAMAULIPAS
DURANGO
ZACATECAS
SAN LUIS POTOSI
AGUASCALIENTES
NAYARIT
SINALOA
JALISCO
COLIMA
MICHOACAN
GUANAJUATO
QUERÉTARO
HIDALGO
VERACRUZ
DISTRITO FEDERAL
TLAXCALA
PUEBLA
MORELOS
GUERRERO
OAXACA
CHIAPAS
TABASCO
CAMPECHE
YUCATAN
QUINTANA ROO
BELIZE
GUATEMALA
HONDURAS
EL SALVADOR
Sierra Madre Occidental
Sierra Madre Oriental
Sierra Madre del Sur
Río Grande
Río Bravo
Salado
Conchos
Fuerte
Yaqui
Lerma
Balsas
Usumacinta
Citlaltépetl (5,747 m)
Tijuana
Mexicali
Ensenada
San Felipe
Sonoita
Nogales
Agua Prieta
Ciudad Juárez
Ojinaga
Hermosillo
Guaymas
Chihuahua
Santa Rosalia
Navojoa
Loreto
Los Mochis
Culiacán
La Paz
Cabo San Lucas
Mazatlán
Durango
Torreón
Saltillo
Laredo
Frontera
Monterrey
Matamoros
Ciudad Victória
Tampico
Zacatecas
San Luis Potosi
Aguascalientes
Tepic
Guanajuato
Querétaro
Pachuca
Jalapa
Veracruz
Tlaxcala
Toluca
MEXICO CITY
Morelia
Guadalajara
PuertoVallerta
Colima
Cuernavaca
Puebla
Chilpancingo
Acapulco
Oaxaca
Tehuantepec
Puerto Escondido
Villahermosa
Tuxtla Gutiérrez
Tapachula
Merida
Campeche
Chetumal
Cancun
Cozumel
To Los Angeles
To Gila Bend
To Albuquerque
To Alamogordo
To Midland
To San Antonio
To Houston
To San Salvador
115°W
110°W
105°W
100°W
95°W
90°W
85°W
30°N
25°N
20°N
15°N
0 100 200 300 Kilometers
0 50 100 150 200 Miles
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NOVEMBER 2004
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