GEF

Global Environment Facility

MOHAMED T. EL-ASHRY
CHIEF EXECUTIVE OFFICER
AND CHAIRMAN

November 19, 1999

Dear Council Member:

I am writing to notify you that the World Bank, the Implementing Agency for the project entitled, *Mexico: Renewable Energy for Agriculture,* has submitted the proposed project document for CEO endorsement prior to final approval of the project in accordance with World Bank procedures. We have today posted the proposed project document on the GEF website at www.gefweb.org.

The Secretariat has reviewed the project document and I can confirm that the project as proposed is consistent with the proposal approved by the Council in May 1999. I also can confirm that it continues to be consistent with the Instrument and GEF policies and procedures and that all comments raised by Council Members have been fully addressed. Therefore, I am endorsing the project document.

If you do not have access to the Web, you may request the local field office of UNDP or the World Bank to down load the document for you. Alternatively, you may request a copy of the document from the Secretariat. If you make such a request, please provide us with your current mailing address.

Sincerely,

Mohamed T. El-Ashry
Chief Executive Officer
and Chairman

cc: Alternates, Implementing Agencies, STAP

GEF SECRETARIAT, 1818 H STREET NW, WASHINGTON, DC 20433 USA
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THE WORLD BANK/IFC/M.I.G.A.

OFFICE MEMORANDUM

DATE: November 2, 1999

TO: Mr. Mohamed El-Ashry, CEO/Chairman, GEF

FROM: Lars Vidaeus, GEF Executive Coordinator

EXTENSION: 34188

SUBJECT: ***MEXICO: Renewable Energy for Agriculture Project***
Final GEF CEO Endorsement

1. Please find attached 2 copies of the Project Appraisal Document (PAD) for the above-mentioned project for review by Secretariat staff and your final endorsement.

2. The PAD is fully consistent with the objectives and scope of the proposal endorsed by Council as part of the May 1999 work program. Some minor changes have been introduced through final project preparation:

   - The overall project cost has increased from $26.2 million to $31.29 million, due in large part to a) a clarification of *Alianza's* cost-sharing formula and b) a change in that formula, both of which increased *Alianza's* share of the demonstration component's cost.

   - The GEF's total contribution to the project has increased from $8.7 million to $8.9 million due to minor increases in the cost of several components, but its share of total project costs has decreased from 33% to 28%, indicating an increased leveraging effect.

   - The number of demonstration systems has increased from 900 to 1,230, which will enhance the project's barrier removal impact in the field. GEF support for the demonstration component has decreased from $4.0 million to $3.83 million.

   - Estimates of avoided carbon emissions from the project-supported systems have been revised upward from 5,400 to 6,000 metric tons per year, due to the increase in the number of demonstration systems and the inclusion of vendor financed systems. However, the avoided carbon emissions per system have been revised downward due to a detailed review and revision of the emission calculation methodology, which has reduced the expected carbon emissions from post-project replication from 24 million to 14.6 million metric tons.

   These changes are summarized in the following table:

	PCD	PAD
Budget ($ 000)		
Government	900	1,800
Farmers	8,300	6,895
Alianza/IBRD	8,300	13,695
GEF	8,700	8,900
Total	*$26,200*	*$31,290*
Demonstration Systems	900	1,230
Avoided Carbon Emissions (metric tons)		
• Annually through project-supported systems	5,400	6,000
• Through penetration of RE systems among one-third of unelectrified farms	24 million	14.6 million

3. The PAD reflects comments made during the Work Program entry process by GEFSEC, STAP and Council members. The following summarizes how key comments were addressed.

Comments by GEFSEC

- *Timeframe for estimation of impacts and benefits:* GEFSEC suggested that the discussion of the project's impacts and benefits be adjusted to encompass expected post-project replication. Annexes 1 and 6 of the PAD, containing the project design summary and incremental cost analysis, were adjusted to address this comment.

- *Contingent financing:* GEFSEC suggested that the demonstration component's grant modality be replaced with a contingent financing modality. This was considered by the country client as impractical and costly, given that the federal government's ongoing *Alianza* program,[1] within which this project will operate, does not currently recover funds from farmers. *Alianza* annually issues grants totaling hundreds of millions of dollars for tens of thousands of subprojects. Recovering payments for the renewable energy systems supported by this GEF project would entail establishing an entirely new mechanism in all participating states for a relatively small number of subprojects and repayment stream (1,100 subprojects and up to a maximum of $3.8 million in grant repayments over 4 years).

- *Sustainability of the market for renewable energy systems in the agriculture sector:* GEFSEC requested more information on this topic. Section F.1. of the PAD has been expanded to address this request.

[1] Financed in part by a World Bank loan (Loan 4428-ME).

- *Monitoring and evaluation plan:* GEFSEC noted that the Project Concept Document lacked a monitoring and evaluation plan. A comprehensive plan, including a detailed set of performance indicators, was developed during final preparation and is documented in Annex 8 of the PAD.

Comments by STAP

- *End-user risks and benefits:* The STAP reviewer suggested that the discussion of risks and benefits facing the farmer in relation to renewable energy equipment be expanded. This subject was expanded upon in sections B.3., E.2. and F.1. as well as Annex 4 of the PAD.

- *Leasing:* The STAP reviewer suggested that leasing receive consideration as a potential mechanism to be tested within the vendor financing component. In the course of project preparation, the country client has in fact selected leasing as the preferred mechanism (see Annex 2 of the PAD).

Mexico's 600,000 unelectrified farms. The country client and project team are confident that such a market exists, considering that most livestock farmers currently operate gasoline-powered pumps to water their animals and that renewable energy-powered pumps are more economic on a life-cycle basis and more reliable than gasoline-powered pumps. In addition, a preliminary market assessment carried out under the USAID/USDOE-supported Mexico Renewable Energy Program documented a substantial potential market for renewable energy systems in Mexico's agricultural sector.

- *Ongoing maintenance:* The Council member from France expressed concern that the project's dispersed nature would make ongoing maintenance impossible. The client and Bank team consider this risk to be modest, since the demonstration and vendor financing components will involve private sector delivery by local equipment vendors. The project would promote their provision of after-sales service to farmers.

- *Sustainability of the market for renewable energy systems in the agriculture sector:* The Council member from Switzerland expressed concern over the sustainability of post-project demand for renewable energy systems. The discussion of this issue was expanded in Section F.1. of the PAD.

4. Please let me know if you require any additional information to complete your review of the project document. Many thanks.

Attachments

cc: Messrs./Mmes. King, Rittner (GEFSEC); Lafourcade, Brizzi, Clifford (LCC1C); Redwood, Wiens, Carroll, Kimes, Ahmed, Soler, Rudran (LCSES); Goldmark, Halpern (LCSFP); Feinstein, Sinha, Aryal, Towsey (ENV); Duffy (Consultant)

ENVGC ISC
IRIS1
Project Files
Chrono

Document of
The World Bank

Report No:

PROJECT APPRAISAL DOCUMENT

ON A

PROPOSED GRANT FROM THE

GLOBAL ENVIRONMENT FACILITY TRUST FUND

IN THE AMOUNT OF US$8.9 MILLION

TO

THE UNITED MEXICAN STATES

FOR A

RENEWABLE ENERGY FOR AGRICULTURE PROJECT

OCTOBER 29, 1999

Environmentally and Socially Sustainable Development
Mexico Country Managing Unit
Latin America and the Caribbean Region

CURRENCY EQUIVALENTS

(Exchange Rate Effective June 1999)

Currency Unit = Mexican Peso (Mx$)
Mx$1.0 = US$0.10
US$1.0 = Mx$9.7

FISCAL YEAR

January 1 – December 31

ABBREVIATIONS

ALCAMPO	Proyecto de Mejoramiento de la Productividad Agropecuaria Agricultural Productivity Improvement Project
ALIANZA	Programa Alianza para el Campo *Alianza para el Campo* Program
FIRCO	Fideicomiso de Riesgo Compartido Trust Fund for Shared Risk
SAGAR	Secretaria de Agricultura, Ganaderia y Desarrollo Rural Secretariat of Agriculture, Livestock, and Rural Development
USAID	United States Agency for International Development
USDOE	United States Department of Energy

Vice President:	David De Ferranti
Country Director:	Olivier Lafourcade
Sector Manager:	John Redwood
Sector Leader:	Adolfo Brizzi
Task Team Leader:	Michael Carroll

MEXICO
RENEWABLE ENERGY FOR AGRICULTURE

CONTENTS

Annexes

MEXICO

RENEWABLE ENERGY FOR AGRICULTURE PROJECT

Project Appraisal Document

Latin America and the Caribbean Region
Mexico Country Managing Unit

Date: October 29, 1999	Task Team Leader: Michael Carroll
Country Director: Olivier Lafourcade	Sector Manager: John Redwood
Project ID: MX-GE-60718 Sector: Agriculture	Program Objective Category: Environmentally Sustainable Development
GEF Supplement ID:	Focal Area: Climate Change
Financial Instrument: GEF Grant	Program of Targeted Intervention: [ ] Yes [X] No

Project Financing Data [ ] **Loan** [ ] **Credit** [ ] **Guarantee** [X] **Grant** [ ] **Other [Specify]**

Amount: GEF Grant: US$8.9 million

Financing plan (US$ 000s):

Source	Local	Foreign	Total
Beneficiaries	5,255	1,640	6,895
Government	1,800	--	1,800
IBRD[1]	8,820	4,875	13,695
GEF	6,090	2,810	8,900
Total	21,965	9,325	31,290

Grant Recipient: Nacional Financiera, S.N.C.
Responsible Agency: Trust Fund for Shared Risk (FIRCO)

Estimated disbursements of GEF Grant (Bank FY/US$M):	2000	2001	2002	2003	2004
Annual	1.0	3.0	2.5	2.0	0.4
Cumulative	1.0	4.0	6.5	8.5	8.9

Project implementation period: 4 years Expected effectiveness date: Jan 2000 Expected closing date: June 2004

[1] Via the Federal Government's *Alianza para el Campo* Program, with financing from the Bank-supported Agricultural Productivity Improvement Project (ALCAMPO) (Loan 4428-ME, approved December 22, 1998).

A: Project Development Objective

1. Project development objectives and key performance indicators (see Annex 1):

The project's development objectives are:

a) to provide unelectrified farmers with reliable electricity supply for productive purposes in a least-cost and sustainable manner using renewable energy technologies;
b) to increase the productivity and income of unelectrified farmers by supporting the adoption of productive investments and improved farming practices; and
c) to improve FIRCO's ability to catalyze the penetration of renewable energy technologies in the agriculture sector.

Performance indicators, outlined in Annex 1, would focus on the installation of renewable energy systems and changes in farm productivity and incomes.

2. Project global objectives and key performance indicators (see Annex 1):

This is the first GEF project to target renewable energy in the agriculture sector. It's global objectives are:

a) to promote the use of renewable energy for productive purposes in Mexico's agriculture sector by removing barriers and reducing implementation costs; and
b) to reduce greenhouse gas emissions in the agriculture sector.

Performance indicators, outlined in Annex 1, would focus on the removal of barriers and growth in demand for renewable energy systems among unelectrified farmers, as well as avoided greenhouse gas emissions.

Operating within the context of the ongoing Agricultural Productivity Improvement Project (ALCAMPO), the project would support the above development and global objectives by removing barriers to the penetration of renewable energy technologies in Mexico's agriculture sector. Despite the fact that, in certain applications, renewable energy systems are less costly than conventional gasoline-powered systems on a life-cycle basis, several barriers impede their market penetration. The project would remove these barriers by a) implementing a nation-wide promotion campaign to increase farmers' awareness of renewable energy systems; b) building the capacity of technicians and agricultural extensionists through training; c) introducing technical specifications and certification procedures for farm-based renewable energy equipment; d) carrying out studies on the potential market and applications for renewable energy in Mexico's agriculture sector; e) installing renewable energy systems (such as solar- and wind-powered pumps, solar-powered refrigerated milk storage tanks, etc.) on selected farms as demonstration units to reduce other farmers' perceived risk; f) supporting the proper operation of these renewable energy systems through the provision of on-going technical assistance to participating farmers by trained extensionists; and g) testing innovative vendor financing mechanisms for farm-based renewable energy systems in four states.

B: Strategic Context

1(a). Sector-related Country Assistance Strategy (CAS) themes supported by the project (see Annex 1):

Report number: 19289-MX Discussed: May 13, 1999

The World Bank Group Mexico Country Assistance Strategy emphasizes a development agenda with

three core themes: (i) social sustainability; (ii) removing obstacles to sustainable growth and maintaining macro-economic stability; and (iii) more effective public governance. The project would contribute directly to all three themes. The social theme would be addressed by increasing the income of farmers and thereby improving the standard of living in rural areas. The growth theme, as well as its key element of protecting the environment, would be addressed by improving the productivity of farmers using environmentally-benign, least-cost renewable energy technologies. Finally, the public governance theme would be addressed by assisting the Government in its decentralization efforts and building the capacity of government agencies to provide farmers with technical assistance in the use of renewable energy technologies.

The project is also directly consistent with the World Bank Group's strategy on the environment in Mexico, under which "priority will be given to identifying "win-win" investment opportunities, where global environmental benefits *and* national economic benefits can be generated through an integrated and mainstreamed approach to development priorities".

b. GEF Operational Program objective addressed by the project:

The project is fully consistent with GEF Operational Program 6: Promoting renewable energy by removing barriers and reducing implementation costs. GEF support would help to: a) remove information and awareness barriers among unelectrified farmers by supporting a renewable energy promotion campaign aimed at the unelectrified agriculture sector; b) remove human capacity barriers by training private sector and government technicians, agricultural extensionists and vendors in the design, installation, operation and maintenance of farm-based renewable energy systems; c) remove consumer confidence barriers by introducing technical specifications and certification procedures for renewable energy equipment and services; d) remove information barriers and reduce market entry costs by supporting market and technology assessments of renewable energy in Mexico's agriculture sector; e) remove perceived risk barriers by supporting the installation of renewable energy systems on farms in selected states as demonstration units; and f) contribute towards the removal of financing barriers by testing innovative vendor financing mechanisms for farm-based renewable energy systems.

2. Main sector issues and Government strategy:

The project addresses issues in the agriculture and energy sectors.

Agriculture: Agriculture remains a weak sector of the Mexican economy. Rural poverty has been expanding in recent years and many farmers have limited options to cope with income and consumption fluctuations. Nevertheless, agriculture could remain an important economic sector provided a) its commercial sector continues to be competitive through the permanent use of modern technologies and increased yields and b) the productive potential of small-scale farming can be fully developed.

Improving the delivery of financial services to the rural population remains one of the main constraints to the development of the agricultural sector. Financial services remain severely deficient in rural areas and access to financial resources for productive investment continues to be limited, especially for small farmers.

In 1996, the Government launched a national agriculture and rural development initiative – the *Alianza para el Campo (Alianza)* Program – to increase capitalization in the agriculture sector with the aim of promoting improved agricultural productivity and production and increased farmer incomes. The Program fosters agricultural productivity improvement by financing productive investments (under a matching grant

scheme) and by providing support services (research, extension, information and training) for a wide range of agricultural activities. In providing matching grants for the acquisition of capital equipment, *Alianza* essentially substitutes for absent rural finance services. The cornerstones of the *Alianza* program are its decentralized approach, with a delegation of administration and decision-making to the States, and its demand-driven nature, providing financing and support services only in response to requests from farmers.

The Government most recently developed the Agricultural Productivity Improvement Project[1] (ALCAMPO) to support and improve *Alianza's* delivery of financing and technical services. The project was approved for a loan of US$445 million from the World Bank in December 1998 and began implementation in early 1999.

The Government is also engaged with the World Bank on a number of initiatives to improve rural finance. In 1994, the Government worked with the Bank on a study of rural financial markets. In 1996 it initiated the Rural Finance Technical Assistance and Pilot Project with World Bank assistance to encourage private banks to increase their services in rural areas. Through the Bank-supported Rural Development in Marginal Areas Project, the Government is experimenting with community-based revolving loan funds and cost-recovery within *Alianza*. SAGAR is currently working with the Bank on a new study of the potential for savings mobilization and deposit instruments in marginal areas. And SAGAR is also exploring the possibility of a World Bank loan to finance its Micro-Credit Fund for Rural Women.

Energy: Approximately 5 percent of Mexico's population remains without access to electricity, including an estimated 5 million people, 88,000 villages and 600,000 livestock farms. While governments at all levels recognize the productivity and social development benefits of rural electrification, and especially of the electrification of farms, budget limitations and rural poverty will prevent the electrification of the vast majority of these energy users in the foreseeable future.

The Federal Government supports rural electrification through transfer payments to state and municipal governments for infrastructure and social development investments. The decision over how to use these funds, whether for rural electrification or other purposes, is left to state and municipal governments. Several states have used these federal funds to support the electrification of rural households with renewable energy by providing matching grants towards the purchase of solar home systems.

In 1994, the Federal Government began to support the electrification of farms with renewable energy in 8 of the country's 32 states through FIRCO's participation in the USAID/USDOE-supported Mexico Renewable Energy Program.[2] The experience gained by FIRCO through this program has enabled the government to expand the scope of *Alianza* to cover the electrification of farms with renewable energy systems. Farmers can now receive matching grants from *Alianza* towards the purchase of renewable energy systems to pump water and power farm equipment. Further, farmers can receive proportionately larger grants for renewable energy systems than for conventional farm equipment and infrastructure. However, a number of barriers have been encountered in the implementation of this program, which have impeded the development of a self-sustaining market in farm-based renewable energy systems.

The barriers impeding penetration of renewable energy technologies in Mexico's agriculture sector include: a) the lack of awareness among unelectrified farmers regarding renewable energy technologies; b) a lack of trained technicians and vendors that can design, install and service renewable energy systems and agricultural extensionists that can advise farmers on their proper operation; c) the lack of technical specifications and certification processes for renewable energy equipment; d) uncertainty within the

[1] MX-PE-48505

[2] Further information on this program is provided in Annex 2: Project Background and Description.

Mexican renewable energy industry regarding the potential market for renewable energy systems in the agricultural sector and potential applications of renewable energy technologies on farms; e) farmers' perception of renewable energy technologies as risky, simply because they are novel; and f) the high initial cost of renewable energy systems, relative to conventional alternatives, coupled with deficient rural finance services that prevent farmers from financing their higher initial cost over time.[1]

3. Sector issues to be addressed by the project and strategic choices:

The agriculture sector issues noted above are being addressed through the on-going *Alianza* program, with the help of the Bank-supported Agricultural Productivity Improvement Project.

The project would address the identified barriers to the penetration of renewable energy technologies in Mexico's agriculture sector by a) implementing a nation-wide promotion campaign to increase farmers' awareness of renewable energy systems; b) building the capacity of technicians and agricultural extensionists through training; c) introducing technical specifications and certification procedures for farm-based renewable energy equipment; d) carrying out studies on the potential market and applications for renewable energy in Mexico's agriculture sector; e) installing renewable energy systems (such as solar- and wind-powered pumps and solar-powered refrigerated milk storage tanks, etc.) on selected farms as demonstration units to reduce other farmers' perceived risk; f) supporting the proper operation of these renewable energy systems through the provision of on-going technical assistance to participating farmers by trained extensionists; and g) testing innovative vendor financing mechanisms for farm-based renewable energy systems in four states.

Together, the above activities would build upon the achievements of the USAID/USDOE-supported Mexico Renewable Energy Program and expand the foundation for growth in the market for farm-based renewable energy systems. The a) promotion campaign and b) specifications and certification would seed the market by vastly increasing the number of farmers that are a) aware of renewable energy systems and b) assured that they meet basic quality standards. Seeing demonstration units operating on farms throughout the country would substantially reduce the risk that unelectrified farmers perceive in investing in this new technology. Trained technicians and agricultural extensionists would be able to provide quality services and advice to farmers on their renewable energy systems. Information from the market and technology assessments would increase the confidence of vendors and distributors to enter the renewable energy market while training would build their capabilities to provide quality equipment and services. And finally the vendor financing program would demonstrate whether this is a viable option with which to finance farm-based renewable energy systems.

One of the most important strategic choices adopted for the project is to implement it within the framework of the federal government's *Alianza para el Campo* Program. *Alianza* is an established and well-run program that covers the entire nation and enjoys substantial support among farmers and all levels of government. Its demand-driven and participatory approach to the provision of financial and technical assistance to farmers supports economic efficiency and local ownership. *Alianza* provides the project with an established vehicle with which to deliver renewable energy-focused financial and technical assistance to unelectrified farmers throughout the country.

Another strategic choice is to experiment with vendor financing as an approach to the financing of farm-based renewable energy systems. Given the deficiency of consumer financing in rural areas, vendors of

[1] Renewable energy systems (and specifically solar- and wind-powered water pumping systems and solar-powered refrigerated milk storage tanks) are substantially more expensive to purchase then conventional, gasoline-powered systems but are typically less costly on a life-cycle basis.

renewable energy systems represent an efficient conduit with which to deliver financing to farmers.

C: Project Description Summary

1. Project components (see Annex 2 for a detailed description and Annex 3 for a detailed cost breakdown):

Component	Category	Cost[1] (US$k)	% of Total	Bank-financing (US$k)	%	GEF Financing (US$k)	%
1. Promotion A promotion campaign targeting renewable energy for productive purposes in the agriculture sector will be carried out.	Institutional strengthening	$1,824	6	--	--	$1,298	71
2. Institutional Strengthening Technicians, agricultural extensionists and renewable energy system vendors will receive training.	Institutional strengthening	$1,590	5	--	--	$1,298	82
3. Specifications and Certification Technical specifications and certification procedures will be introduced for farm-based renewable energy equipment and its installation.	Institutional strengthening	$275	1	--	--	$212	77
4. Market Development Studies will be carried out on the potential market and productive applications for renewable energy systems in the agriculture sector.	Institutional strengthening	$686	2	--	--	$662	97
5. Demonstration Renewable energy systems (such as solar- and wind-powered water pumping systems and solar-powered refrigerated milk storage tanks, etc.) will be installed among participating farmers as demonstration units.	Physical	$18,770	60	$8,965	48	$3,830	20
6. Technical Assistance Renewable energy-trained agricultural extensionists will advise participating farmers on the proper operation of their renewable energy systems.	Capacity building	$4,919	16	$3,530	72	$434	9
7. Vendor Financing A pilot program will test innovative vendor financing mechanisms for farm-based renewable energy systems in four states.	Institutional strengthening	$2,261	7	1,200	53	$636	28
8. Project Management Project administration, auditing, monitoring and evaluation will be carried out or coordinated by FIRCO.	Project management	$965	3	--	--	$530	55
	Total	$31,290	100	$13,695	44	$8,900	28

2. Key policy and institutional reforms supported by the project:

The project builds on the Government's existing policy and institutional framework in the agricultural

[1] Including contingencies.

sector. It aims to fully integrate renewable energy into the Government's *Alianza* program of financial and technical assistance to farmers.

3. Benefits and target population:

The project's target population is the estimated 600,000 unelectrified livestock farms throughout Mexico and the potential industry of renewable energy vendors and service providers that could cater to this market. The project's demonstration component would target *Alianza* participants while the rest of the project's components would target *Alianza* participants and non-participants. A select number of farmers within the target population will be wealthy enough to purchase renewable energy systems without financial assistance from *Alianza* or the GEF. While they will not participate in the demonstration component, that and other project components would increase their awareness of, and confidence in, renewable energy systems and thereby increase their purchase of these systems. Poorer farmers that would be unable to purchase a renewable energy system on their own, even with the project's financial assistance, would still be able to participate by joining with neighboring farmers to purchase a renewable energy system that would serve them as a group. For example, several farmers with adjacent properties could construct a central watering trough connected to a solar-powered pump. Many of the solar-powered pumps installed by the USAID/USDOE-supported Mexico Renewable Energy Programs supply water to two or more farmers. Market research to be carried out early in project implementation will improve this definition of the target population.

The project's economic benefits will be increased farmer incomes derived from investments in production systems that are made possible due to the superior reliability and lower life-cycle costs of renewable energy systems in comparison to conventional gasoline-powered systems. Experience under the USAID/USDOE-supported Mexico Renewable Energy Program indicates that solar-powered pumps are more reliable than gasoline-powered pumps, in part because they have fewer moving parts. Fuel costs make up roughly half the life-cycle cost of gasoline-powered pumps and since solar- and wind-powered pumps have no fuel costs, this leads to an immediate saving among participating farmers and an average 16 percent return on investment. Further increases in participating farmer incomes of between 85 and 190 percent would result from production increases that are made possible by the low operating costs of renewable energy systems. Since additional operation of solar- and wind-powered pumps is essentially free, some farmers pump more water and use the excess to irrigate a small field for forage or fruit and vegetable production. The high fuel and operating costs of gasoline-powered pumps do not make this additional pumping economic. While the overall financial benefit to participating farmers is substantial, it is important to remember that these farmers are hosting demonstration systems and the project's financial assistance is considered necessary to overcome their perceived risk towards new renewable energy technologies in order to get these systems into the field where they can have a demonstration impact among other farmers. In social terms, the project will lead to improvements in overall food security and quality of life in rural areas.

Environmentally, the project will avoid the emission of greenhouse gases from gasoline-powered or grid-connected systems that would be substituted with solar- and wind-powered systems. It is anticipated that the demonstration and vendor financed systems installed by the project would abate roughly 6,000 metric tonnes of carbon per year, or roughly 120,000 metric tonnes over the 20 year life span of the renewable energy systems. More importantly, the project would catalyze a national market for farm-based renewable energy systems among Mexico's estimated 600,000 unelectrified livestock farms. It is expected that the project would catalyze the penetration of renewable energy systems among one-third of the country's unelectrified farms within ten years, a development that would avoid an estimated 0.73 million metric tonnes of carbon annually. In addition, the project would reduce local air, water and soil

pollution associated with gasoline-powered farm equipment. The reduction in water and soil pollution is particularly significant as gasoline-powered pumps are typically located at or in wells that serve livestock and human populations.

4. Institutional and implementation arrangements:

Implementation period:	4 years (2000-2003)
Executing agency:	Trust Fund for Shared Risk (FIRCO)
Financial agency:	Nacional Financiera, S.N.C. (NAFIN)

The project would be executed by FIRCO, a para-statal agency operating under the Secretariat of Agriculture, Livestock and Rural Development (SAGAR), in cooperation with NAFIN as the financial agency. Through its offices in each state, FIRCO administers three of the four *Alianza* sub-programs that involve energy-consuming equipment which could be powered by renewable energy: Irrigation Development (pumps), Improved Pasture Establishment (pumps and electric fences) and Dairy Technology Improvement (refrigerated milk storage tanks). The fourth *Alianza* sub-program involving energy consuming equipment - Rural Development - is administered by SAGAR. FIRCO will coordinate with SAGAR to ensure that farmers participating in the Rural Development sub-program are able to participate in the project if they wish. Assurances will be attained by the Bank at negotiations regarding this coordination.

FIRCO has also been one of the principal Mexican counterparts in the USAID/USDOE-supported Mexico Renewable Energy Program, which has provided farmers and other end-users with technical and financial assistance towards their acquisition and use of renewable energy systems. Through its participation in this program, FIRCO staff in eight states have developed expertise in renewable energy systems and coordinated the installation of over 100 solar-powered water pumping systems on farms. In the process, FIRCO has developed a substantial capability in the provision of financial and technical support to farmers in the area of renewable energy.

FIRCO would establish a Project Coordination Office (PCO) in its Mexico City headquarters to direct the project's implementation, with the help of its offices in each state and a contracted firm that would carry out day-to-day project management. The PCO would execute the promotion, institutional strengthening, market development and specifications and certification components, with support from FIRCO's state offices. The demonstration, technical assistance and vendor financing components would be delegated to FIRCO's state offices, with the support of the PCO and management firm. The state offices would implement the demonstration and technical assistance components by integrating renewable energy and GEF support into their ongoing implementation of the above-mentioned *Alianza* sub-programs. The vendor financing pilot program would be implemented in the four target states by the FIRCO offices in those states.

Accounting, financial report and auditing arrangements *(See Annex 9):* The financial management, accounting system and internal controls are already in place as part of the *Alianza* program and are utilized by FIRCO for the recently completed Rainfed Areas Development Project (Ln. 3778-ME). They have been operating satisfactorily and their use would be continued under the present project. Resources and mechanisms to permit financial monitoring and reporting of the project will be in place prior to effectiveness.

Financial reporting would be carried out FIRCO, including information required for preparation of statement of expenditures (SOEs), should they be utilized. FIRCO would carry out financial accounting

and maintain separate project accounts and records for project-related expenditures, in accordance with sound and accepted accounting practices. Financial reports and SOEs would be consolidated for submission to the Bank. Financial audits would be carried out annually by an independent auditor acceptable to the Bank and Government of Mexico. Audit reports would be prepared in accordance with International Auditing Standards (IAS), FARAH and MET (Framework agreement between the Bank and Secretariat for Administrative Control - SECODAM). The annual auditor's opinion would be submitted to the Bank within six months of the end of each calendar year.

Procurement *(see Annex 9):* Procurement of goods and small works financed by the project would be carried out in accordance with the Bank's *Guidelines for Procurement under IBRD Loans and IDA Credits* (January 1995, revised January and August 1996, September 1997 and January 1999). All consultants would be selected in accordance with the Bank's *Guidelines for the Use of Consultants* (January 1997 and revised September 1997).

Most of the equipment and goods to be procured under this project would be carried out with direct participation and financial contribution of the beneficiaries, and implemented as part of the Demonstration Component. Procurement would be carried out by the beneficiaries and payments made through the state FIRCO office. Eligibility criteria and operation procedures would be included in the Operational Manual. Given the remote and scattered location of beneficiaries, there is little competition among contractors for these small projects, which would lead one to expect that formal bidding at the community level will not reduce cost given all the transaction costs involved. In this case, participation substitutes for formal processes in ensuring cost-effectiveness. Consequently, simplified procurement procedures, including the utilization of local shopping and direct contracting, will be utilized in most cases. The implementation of these procedures would require strong supervision on the part of FIRCO and its state offices. However, as sole or joint implementing agency of other Bank supported projects, FIRCO has developed sufficient capacity to meet the Bank's minimum procurement management requirements, as verified by the preliminary capacity assessment performed at appraisal

The Project Procurement Plan would be agreed upon during negotiations and the final version would be incorporated in the Operational Manual to be submitted to the Bank as a condition of effectiveness.

Monitoring and Evaluation *(see Annex 8):* FIRCO would establish and implement a comprehensive monitoring and evaluation program for the project.

For monitoring, FIRCO would adapt its own module within ALCAMPO's computerized management information system to track the project's inputs, outputs and outcomes and to ensure that implementation is consistent with the rules and criteria included in the Operational Manual. Information would be collected by FIRCO staff at headquarters and in state offices as well as participating extensionists.

For evaluation, FIRCO would coordinate the implementation of two project evaluations -- one at mid-term and one upon project completion – by independent consultants. Evaluation would focus on the project's implementation and its development impact. The market assessment study (included in the market development component) would establish a baseline for several of the impact indicators. The results of the mid-term evaluation would inform project implementation in years three and four.

D: Project Rationale

1. Project alternatives considered and reasons for rejection:

With respect to the scope of the project, a broader scope encompassing all rural energy users, including farms, households, schools, health clinics and small/cottage industries, was considered. While such a broad scope could offer economies of scale in catalyzing the rural market for renewable energy, it was rejected for four reasons. First, the Secretariat of Energy has requested World Bank assistance to prepare a separate rural energy project in Mexico that would address barriers to renewable energy use among other rural energy users. That project would aim to foster new approaches to rural electrification using renewable energy technologies that rely more on the private sector and less on government subsidies. Second, one of the intentions of the proposed project would be to mainstream renewable energy within *Alianza* -- an established nation-wide agricultural development program that constitutes a ready-made delivery mechanism for the project's activities. A more comprehensive approach would have necessitated the creation of new delivery mechanisms to reach other types of rural energy users, a change that would likely complicate and slow project implementation, and possibly hinder the mainstreaming impact within *Alianza*. Third, the prevalence of *ejidos* in rural areas would have limited the potential synergies between farm and household electrification. *Ejidos* are rural communities where people live in small, concentrated hamlets and travel daily to their fields in surrounding areas. Simultaneous electrification of farms and households using renewable energy systems is usually unviable in an *ejido* due to the long distances between them. Fourth, potential synergies would have been similarly limited by voltage and current incompatibilities between solar-powered farm and household electrical equipment.

In terms of the choice of technology for the electrification of isolated farms, grid connection and gasoline-powered systems were rejected because they are not least cost on a life-cycle basis and because they would contribute to additional greenhouse gas emissions.

In defining the project's delivery mechanism, implementation outside the auspices of *Alianza* was rejected because doing so would necessitate the creation of an entirely new institutional structure with which to reach farms throughout the country. In *Alianza* the project will enjoy the benefits of operating within an established, well-respected and well-run program that already provides farmers throughout the entire country with financial and technical assistance for the acquisition of capital equipment and for improved operations.

Regarding the geographical scope of the project's demonstration component, a more limited scope encompassing a smaller number of states, in order to test the impact of demonstration units in the field, was rejected based on experience under the USAID/USDOE-supported Mexico Renewable Energy Program which has proven the positive impact of demonstration units.

With respect to the type of financing provided by the GEF within the demonstration component, a contingent financing approach, whereby the GEF grant to individual farmers would be repayable in the event the renewable energy system was profitable, was examined, but was rejected as not being cost-effective. *Alianza* does not currently recover grants from farmers, and recovering repayments for the RE systems only would entail establishing an entirely new mechanism in all participating states for a relatively small number of subprojects and repayment stream (1,230 sub-projects and a maximum of $3.8 million in grant repayments). Pursuing this option was considered impractical and costly by FIRCO and was therefore rejected.

With respect to financing-related activities, a focus on consumer financing was rejected due to deficiencies in the rural financing sector and the fact that addressing these deficiencies would be beyond

the scope of a renewable energy project such as this. Instead, vendor financing will be tested as an option to remove the high initial investment barrier facing renewable energy equipment.

2. Major related projects financed by the Bank and/or other development agencies:

Sector issue	Project	Latest Supervision (Form 590) Ratings (Bank-financed projects only)	
		Implementation Progress (IP)	Development Objective (DO)
<u>Bank-financed: Agriculture and Irrigation</u>			
Assist private sector with the improvement of on-farm irrigation efficiency	Mexico: On-Farm and Minor Irrigation Improvement Project (Ln. 3704-ME)	S	S
Improve productivity of rainfed farming activities	Mexico: Rainfed Areas Development Project (Ln. 3778-ME)	S	S
Poverty alleviation in highly marginalized rural areas	Mexico: Rural Development in Marginal Areas	S	S
Support capitalization and productivity improvement among small- and medium-scale farmers.	Mexico: Agricultural Productivity Improvement Project (Ln. 4428-ME)	S	S
<u>Bank/GEF-financed: Renewable Energy</u>			
Remove barriers to rural electrification with renewable energy	Argentina: Renewable Energy in Rural Markets Project	S	S
Remove barriers to rural electrification and grid-connected electricity generation with renewable energy	India: Renewable Resources Development Project	S	S
Remove barriers to rural electrification and grid-connected electricity generation with renewable energy	Sri Lanka: Energy Services Delivery Project	S	S
Remove barriers to rural electrification with solar energy	Indonesia: Solar Home Systems Project	S	S
<u>Other development agencies</u>			
Promote renewable energy in Mexico's agricultural sector	USAID/USDOE Mexico Renewable Energy Program	n/a	n/a

IP/DO Ratings: HS (Highly Satisfactory), S (Satisfactory), U (Unsatisfactory), HU (Highly Unsatisfactory)

3. Lessons learned and reflected in the project design:

Flexibility and demand-driven approaches are key to building ownership, defining local priorities and facilitating improved implementation and sustainability of rural and agricultural development initiatives.

- Through its incorporation in the *Alianza* program, the project adopts a flexible and demand-driven approach to the provision of financial and technical assistance for renewable energy systems.

Micro-investment programs risk forming a disparate collection of interventions that may not catalyze the critical mass of activities to attract the private sector, generate competition among suppliers and foster the establishment of support services.

- While operating within *Alianza's* demand-driven approach, through strategic marketing the project will aim to install an average of 34 renewable energy systems in each participating state. In this way, it will catalyze local and/or regional markets for renewable energy systems. Experience under the USAID/USDOE-supported Mexico Renewable Energy Program indicates that as few as 15 systems can lead to the entry of new renewable energy suppliers in local markets.

It is important that investments in new technologies or practices be accompanied by technical assistance in their proper operation.

- The project will make renewable energy-trained extensionists available to participating farmers in order to ensure the satisfactory operation of newly acquired renewable energy systems.

Poor timing and lengthy budgetary and bureaucratic processes are likely to jeopardize the implementation of rural development programs, particularly in agriculture where natural cycles impose time constraints.

- The project will adopt *Alianza's* agile mechanisms for project approval and disbursements, and will benefit from the Bank-supported ALCAMPO project's activities that will further improve *Alianza's* delivery of financial and technical assistance. In addition, the project will benefit from FIRCO's decentralized structure that supports a responsive approach to local demands for technology-related financial and technical assistance.

Developmental considerations, rather than technology or environmental considerations, should dominate any initiative to penetrate agricultural markets with new, environmentally-benign technologies, since farmers are primarily interested in productivity and income gains than new technology or environmental benefits.

- By setting the project within the auspices of the *Alianza* program, developmental considerations will dominate the project. It will add renewable energy systems to the menu of options that *Alianza* offers farmers to address their individual needs.

4. Indications of borrower commitment and ownership:

The Mexican Government has supported renewable energy systems for rural electrification since the early 1990s, when it initiated a large-scale photovoltaic development program that led to the installation of approximately 60,000 solar home systems. The Government continues to support rural electrification with renewable energy, but indirectly now that it is up to state and municipal governments to decide how to spend federal transfer payments on infrastructure and social development.

In 1994, the Government expanded the scope of its renewable energy-based rural electrification activities when FIRCO began to promote the electrification of farms using renewable energy technologies, under the auspices of the USAID/USDOE-supported Mexico Renewable Energy Program. Through FIRCO, the Program operated in 8 of the country's 32 states, training government and private sector technicians in renewable energy systems and supporting the installation of 108 solar-powered water pumping systems on farms. The Program continues to operate in 1999, although its focus has shifted from training and investment to leveraging replication among other farmers and monitoring impacts.[1] The GEF project would build upon the Program's achievements and expand the scope to a national level.

The proposed project would become part of the ongoing, nation-wide *Alianza para el Campo* Program, launched by the federal government in 1996. *Alianza* enjoys strong political support and received a substantial budget increase in 1998 and again in 1999. Its decentralized strategy and matching contributions by state governments ensures substantial involvement and ownership at the state level. As a result of its participation in the USAID/USDOE-supported Mexico Renewable Energy Program, the Government has expanded the scope of the *Alianza* program to encompass renewable energy systems. And as a result of the development of this GEF project, the Government has decided to provide incremental government grants to farm-based renewable energy systems through *Alianza*.

Mexico's GEF operational focal point (Secretariat of Finance) has endorsed the request for GEF support for the project (in a letter dated April 23, 1999).

5. Value added of Bank and Global support in this project:

The Bank, with its extensive experience in both renewable energy and decentralized, demand-driven agricultural and rural development projects, is well qualified to support the Government of Mexico in its efforts to integrate renewable energy into its agricultural development programs. Bank participation in the project would complement federal and state government expertise, bringing lessons and insights from related projects in other countries, to ensure the design of an effective program of financial and technical assistance for renewable energy in the agriculture sector. The project would also benefit from the Bank's involvement in the associated ALCAMPO project, which includes actions to strengthen *Alianza's* delivery of financial and technical assistance to farmers. In addition, the project support the development of a comprehensive and systematic monitoring and evaluation program within FIRCO, leading to improved operations in the provision of financial and technical assistance to farmers in the area of renewable energy.

GEF support would enable FIRCO to expand the scope of its renewable energy-related activities to a national level and to adopt an integrated approach to the removal of barriers to renewable energy systems in the agriculture sector (combining promotion, demonstration, technical assistance, research and specifications and certification). This expanded scope would support accelerated penetration of renewable energy technologies in Mexico's agriculture sector.

E: Summary Project Analysis (Detailed assessments are in the project file, see Annex 11)

1. Economic (see Annex 4):

[X] Cost-Benefit Analysis: NPV = US$ 25.6 million; ERR = 30.9%

[1] Further information on the program is presented in Annex 2: Project Background and Description.

Economic analysis focused on the demonstration component, since it is the only component involving investments on the ground. The project's overall economic return was estimated using a) an expected distribution of demonstration systems by type (e.g. solar- and wind-powered water pumping systems and solar-powered refrigerated milk tanks) and b) for each type, an expected economic return based on historical data from the USAID-USDOE-supported Mexico Renewable Energy Program. This rate of return reflects only the direct benefits stemming from the demonstration component and does not capture the project's positive externalities, such as lower emissions of greenhouse gases.

2. Financial (see Annex 4):

NPV = US$ 32.2 million; FRR = 39.9%

The financial rates of return of individual farm models are higher than the ERR due to the subsidies in certain investment costs. The models show increases in total on-farm income of between 85 and 190 percent at full development, signaling that the investment incentives and technical assistance provided should be attractive to small farmers and promote their interest in the proposed types of productive investments that are made possible by renewable energy systems.

The high financial rate of return associated with the renewable energy systems installed by the project begs the question why GEF assistance is required. The answer to this question is because of the high perception of risk among isolated farmers when it comes to this new technology. The GEF contribution is necessary to overcome this perceived risk barrier and get renewable energy systems into the field where they can have a demonstration impact and help convince other farmers to invest in them.

Fiscal impact: The project would be implemented under the *Alianza para el Campo* Program. The total cost of the Project, excluding farmers' contribution, is estimated at about US$24.4 million (US$31.3 million inclusive of farmers' contribution), or about US$6 million *per annum.* Roughly two-thirds of those costs would be covered by federal sources and state governments with World Bank support and the remaining one-third by the GEF. The project would operate within the existing budgets of SAGAR and state governments and would not generate additional budgetary financial requirements. Given the income of the target population, and the fact that agriculture-related activities are mostly exempt from Value Added Tax (IVA), incremental tax revenues accruing to the Federal Government as a result of project activities would be relatively small, amounting to approximately US$1.6 million. Therefore, while the fiscal impact of the project would be negative, it would remain within the bounds of that already derived from current *Alianza* programs.

3. Technical:

The project is considered to be technically sound, given that:

a) it involves technologies that are either proven in the field, such as solar- and wind-powered pumps, or that have been fully developed and tested prior to field installation, such as solar-powered refrigerated milk storage tanks; and

b) individual systems would comply with technical specifications approved by FIRCO;

c) the operation of these systems would be supported by an existing network of *Alianza*-supported extensionists who would receive training on the operation and maintenance of farm-based renewable energy systems;

d) the project includes an integrated set of actions that are designed to remove all barriers to the increased penetration of renewable energy systems in the agriculture sector; and

e) the project employs *Alianza's* decentralized structures that ensure state participation and contribution.

4. Institutional:

The project is considered to be institutionally sound, given that:

a) *Alianza's* ongoing matching grant program, within which the project's demonstration component would operate, is well-established, with specific limitations being addressed by the ongoing ALCAMPO project;

b) through its participation in the USAID/USDOE-supported Mexico Renewable Energy Program, FIRCO has gained relevant experience for the project, including:
   - coordinating training programs for technicians and extensionists;
   - promoting renewable energy technologies among farmers;
   - combining *Alianza* and foreign funds in a matching grant scheme to support farmers' purchase of renewable energy systems; and
   - supporting farmers' successful operation of renewable energy technologies with ongoing technical assistance; and

c) for those activities in which FIRCO lacks experience (e.g. certain aspects of promotion, specifications and certification, technology development, etc.), it will engage qualified individuals and institutions to carry out project activities.

5. Social:

The project is considered to be socially sound given that it will operate within *Alianza* which has existing mechanisms regarding the utilization of culturally appropriate instruments to ensure access and active participation of indigenous communities. These mechanisms are being strengthened by the ongoing Bank-supported ALCAMPO project, which is targeting small farmers and rural poor households, many of which do not have access to electricity and are therefore within this project's focus. Specifically, the project would make extensionists and information available to farmers in the languages of the major indigenous groups whose members are potentially eligible to participate in the project.

Notwithstanding the above, the market assessment to be carried out within the Market Development component will include a socioeconomic analysis of project beneficiaries. The results of this assessment will be used to adjust project implementation if necessary.

6. Environmental assessment: (see Annex 7)

Environmental Category[ ] A [X] B [ ] C

The solar and wind technologies whose agricultural applications are to be demonstrated through the project are considered to be among the most environment-friendly forms of energy. Environmental benefits at the global level will be reduction in emission of greenhouse gases; and at the local level, abatement of air, water and soil pollution through substitution of gasoline-powered equipment. All potential negative environmental impacts associated with the use of renewable energy systems to increase agricultural

productivity will be addressed through the environmental procedures established the Operational Manual. This manual replicates the environmental procedures from the ALCAMPO manual, which apply regardless of the source of energy, with additions covering one aspect (battery disposal) which is specific to certain uses of solar energy.

In the case of wind energy, the technology itself presents no potential risks to the environment, with the exception of noise or wind-farms located in flyways of migratory birds – situations which do not apply to this project. However, the project would involve some solar energy applications that may employ batteries (e.g. refrigerated milk storage tanks and milking machines). Given the small amount of batteries that would be involved, and the fact that no formal battery recycling programs exist in Mexico, the project would not involve a formal battery recycling program. Instead, the project will take steps to mitigate potential environmental damage from improper battery disposal. The technician training program will include information on proper battery issue and disposal.

In order to avoid more general environmental impacts associated with on-farm investment projects, the project would employ the same environmental procedures as required by ALCAMPO.

7. Participatory approach:

The project's key stakeholders are unelectrified farmers, agricultural extensionists, renewable energy system vendors, State governments and FIRCO state offices.

Through its participation in the USAID/USDOE-supported Mexico Renewable Energy Program, FIRCO has established communication channels with these stakeholders. Previous and ongoing consultations with these stakeholders, as well as FIRCO's experience in implementing that Program, contributed to the design of this project.

By operating within *Alianza*, the project will adopt the participatory approach of that program, whereby State-level decisions on sub-program priorities, investment proposals and payments to beneficiaries are made by a committee of representatives from farmer organizations, state agencies and SAGAR. In addition, the project will adopt *Alianza's* participatory and demand-driven approach to investment project identification, design and selection, whereby farmers decide what equipment is installed on their farms, albeit with the advice of a trained extensionist.

F: Sustainability and Risks

1. Sustainability:

The project aims to remove barriers to renewable energy in the agriculture sector in order to foster sustainable markets for them. It has been prepared on the assumption that the low penetration rate of renewable energy systems among unelectrified farmers is due to the gap between a) the initial cost of renewable energy systems and b) farmers' willingness to pay for them. The project intends to eliminate this gap, and thereby catalyze widespread market penetration, by a) reducing the cost of renewable energy systems by seeding the market with 1,230 demonstration systems in states where they have yet to be demonstrated, b) testing vendor financing as a mechanism to overcome the high initial cost barrier and c) increasing farmers' willingness to pay for these systems by reducing their perceived risk through information dissemination, technical specifications and certification, field demonstration and technical assistance. Experience under the USAID/USDOE-supported Mexico Renewable Energy Program

indicates that these types of activities can catalyze sustainable markets for renewable energy systems in the agriculture sector.

More specifically, the prospects for sustainability of barrier removal are as follows:

- Lack of awareness among farmers: The project's promotion, demonstration and technical assistance components should permanently remove this barrier in participating states. News of superior technology travels fast in rural agricultural communities and the combination of promotion activities, on-the-ground demonstration and on-going extension services will go a long way towards permanently raising the awareness of farmers throughout the participating states.
- Farmers' perceived risks with respect to renewable energy: The project's demonstration component should go a long way towards removing this barrier permanently. Seeing is believing in most rural areas and witnessing the successful operation of demonstration units will convince many farmers that renewable energy systems are reliable and cost-effective.
- Lack of renewable energy-trained technicians and extensionists: Technicians and extensionists trained under the program would maintain their knowledge base through their work installing renewable energy systems and advising farmers on their proper operation. In addition, these trained professionals as well as their trainers would represent a pool of knowledge that could be tapped in the future to train new technicians and extensionists.
- Higher initial cost of renewable energy systems, coupled with deficient rural finance services: The recently announced incremental government support for renewable energy systems will help to diminish this barrier. In addition, vendor financing, to be tested in the project's vendor financing pilot, could also contribute to removing this barrier.
- Lack of information on the renewable energy market and viable applications in agriculture: This barrier would be permanently removed by the studies to be implemented by the project.
- Lack of specifications and certification: This barrier would be permanently removed by introducing specifications and certification processes for farm-based renewable energy systems.

Sustainability of project benefits is expected to be high, given that the investments in renewable energy systems would be complemented by technical assistance to ensure their proper operation. In addition, increases in net income as a result of the renewable energy equipment will support improved maintenance of that equipment over time and further investments in productivity-improving equipment.

2. Critical Risks (reflecting assumptions in the fourth column of Annex 1):

Risk	Risk Rating	Risk Minimization Measure
Project outputs to development objectives		
Promotion campaign does not reach target population.	M	The project will use SAGAR's Social Communication Department, which has substantial experience in communications with the rural sector, to plan and implement the promotion campaign.
Market and technology assessments are insufficient to reduce/eliminate private sector's uncertainty.	M	The project will involve active consultation with renewable energy industry in order to ensure that the assessments produce the necessary information.
Renewable energy is not effectively integrated into operations of selected *Alianza* sub-programs.	N	FIRCO's existing integration of renewable energy in *Alianza* operations in selected states will inform similar efforts in other states.
Extensionists do not provide effective technical assistance to farmers.	M	Training programs and annual workshops will build the capacity of extensionists.
Project components to outputs		
Component implementation procedures are ineffective.	M	The project's supervision activities will ensure effective implementation.
Political interference impacts on project cycle.	M	Clear targeting criteria and enforcement of subproject selection procedures and enforcement of demand-driven mechanisms should minimize political interference.
Change in government impacts *Alianza* and project implementation.	N	Strong State Government participation should contribute to the project's continuity beyond the present Federal administration.
Overall Risk Rating	M	

Risk Rating - H (High Risk), S (Substantial Risk), M (Modest Risk), N (Negligible or Low Risk)

3. Possible Controversial Aspects:

No controversial aspects are envisaged.

G: Conditions for Effectiveness

a) Approval of the Operational Manual, including an Implementation Plan for Year 1 of the project
b) Approval of a cooperation agreement between FIRCO and SAGAR regarding the project's links with *Alianza's* technical assistance and rural development programs. The draft terms and conditions of the agreement between SAGAR and FIRCO were satisfactorily reviewed at appraisal, and FIRCO indicated shortly thereafter that the agreement was secured. The signed agreement would be submitted to the Bank prior to effectiveness.

H. Readiness for Implementation

[ ] The engineering design documents for the first year's activities are complete and ready for the start of project implementation. [X] Not applicable.

[X] The procurement documents for the first year's activities would be ready for the start of project implementation.

I. Compliance with Bank Policies

[X] This project complies with all applicable Bank policies.

[signature]
Task Team Leader: Michael Carroll (LCSES)

[signature]
Acting Sector Manager: John Redwood (LCSES)

[signature]
Country Director: Olivier Lafourcade (LCC1C)

Annex 1
Project Design Summary

Narrative Summary	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
a. Sector-related CAS Goal: Support social sustainability and protect the environment.	- Reduced incidence of poverty among project beneficiaries. - Increased farm productivity among participating farms. - Fewer negative environmental impacts among participating farms.	Project evaluations	Continued federal and state government support for actions to improve the livelihood of farming families using environmentally-benign technologies and practices.
b. GEF Operational Program: Promote renewable energy by removing barriers and reducing implementation costs.	- 50 - 80% increase in national sales of renewable energy systems for productive agricultural applications. - 20% reduction in average price of farm-based renewable energy systems.	Project evaluation	
Project Development Objective: · Provide farmers in isolated areas with reliable electricity supply for productive purposes in a sustainable manner, using renewable energy technologies where feasible.	Number of renewable energy systems installed and operating correctly, either directly through the project's activities or via replication among 600,000 non-participating unelectrified farms.	Project implementation reports Project evaluations	Future currency devaluations do not significantly increase the cost of imported renewable energy systems.
· Increase the productivity and income of farmers by supporting productive investments and improving farming practices.	Changes in productivity and income among participating farmers.	Project evaluations	
Global Objectives: · Remove barriers and reduce implementation costs of renewable energy in the agriculture sector.	- Barriers removed: - awareness increased - perceived risk reduced - technicians, extensionists and vendors trained - market and technology information disseminated - specification and certification procedures introduced - Penetration of renewable energy equipment among one third of Mexico's estimated 600,000 unelectrified livestock farms within 10 years.	Project implementation reports Project evaluations	Targeted barriers can be removed through project activities over 4 years. Project receives sufficient commitment and resources to support successful barrier removal.
Reduce greenhouse gas emissions in the agriculture sector.	Avoided carbon emissions by project completion of 30,000 metric tonnes per year by renewable energy systems in productive agricultural applications.	Project evaluations	

Project Design Summary (cont'd)

Narrative Summary	Key Performance Indicators	Monitoring and Evaluation	Critical Assumptions
Project Outputs: Widespread increase in awareness of renewable energy systems among 600,000 unelectrified farmers	- Change in awareness levels - Publications, radio advertisements and videos produced/disseminated - Workshops/demonstration days held - Fairs/expositions attended	Surveys of rural populations Project implementation reports	Promotion campaign reaches target population.
Up to 1,230 demonstration renewable energy systems installed and operating correctly	- Up to 1,050 solar-powered water pump systems installed - Up to 55 wind-powered water pump systems installed - Up to 24 solar-powered refrigerated milk storage tanks installed - A select number of other systems	Project implementation reports Vendor surveys	Renewable energy is effectively integrated into operations of selected *Alianza* sub-programs.
Participating farmers receive technical assistance in the operation of their renewable energy systems	Farmers receive technical assistance	Project implementation reports	Extensionists are able to provide effective technical assistance on renewable energy systems.
2,500 technicians, agricultural extensionists and equipment vendors trained in renewable energy systems	2,500 technicians, extensionists and vendors trained	Project implementation reports	
Reduced uncertainty regarding the market for, and applications of, renewable energy in the agriculture sector.	Dissemination of results from market and technology assessments.	Project implementation reports	Market and technology assessments are sufficient to reduce/eliminate private sector's uncertainty.
Improved understanding of prospects for vendor financing of farm-based renewable energy systems.	Dissemination of lessons from vendor financing pilot program	Project implementation reports	
Introduction of specifications and certification procedures	Successful introduction of specifications and certification procedures	Project implementation reports	
Project Components:	Budget for each component ($ 000s)		
Promotion Institutional Strengthening Specifications and Certification Market Development Demonstration Technical Assistance Vendor Financing Project Management	1,824 1,590 275 686 18,770 4,919 2,261 965		Component implementation procedures are effective. Political interference has minimal impact on project cycle.
TOTAL	*31,290*		

Annex 2
Project Background and Description

A. Background

Alianza para el Campo

The proposed project would be implemented within the framework of the *Alianza para el Campo (Alianza)*, a program established by the federal government in 1996 to increase capitalization in the agriculture sector. Operating under a matching-grant scheme, the program supports farmers' investment in equipment and infrastructure, including that powered by renewable energy, and the provision of support services, including research, extension, information and training. The program's aim is to promote improved agricultural productivity and production and increased income among farmers. Its budget was approximately US$350 million in 1997 and has been increased in 1998 and 1999.

The program operates on a demand-driven basis, providing financial and technical assistance to farmers only in response to their request. Farmer's submit proposals for equipment or infrastructure investments to local rural development agencies. The proposals are reviewed and approved for funding by state-level committees made up of representatives from state and federal agencies as well as farmer associations. Farmers' requests for support services are handled in a similar manner. Depending on the type of investment or service, *Alianza* provides farmers with a grant that covers between 25 and 90 percent of the total cost.

Alianza operates through 27 sub-programs, each of which is focused on a specific type of investment or service. Three of the larger sub-programs are a) Improved Pasture Establishment, b) Irrigation Development and c) Dairy Technology Improvement. These three sub-programs support investments that include energy-consuming equipment such as water pumps, electric fences, refrigerated milk storage tanks and milking machines. Among the hundreds of thousands of farms without access to electricity, solar and wind energy are viable alternatives to gasoline as an energy source to power these types of equipment. Renewable energy equipment is explicitly included as eligible for government support under these three sub-programs. All three sub-programs are administered by the Trust Fund for Shared Risk (FIRCO), a para-statal agency operating under the Secretariat of Agriculture, Livestock and Rural Development (SAGAR). A fourth *Alianza* sub-program, Rural Development, supports investments in energy-consuming equipment such as water pumps and is implemented by SAGAR. FIRCO will coordinate with SAGAR to ensure that participating farmers in the Rural Development sub-program are able to access the project's financing and support for renewable energy systems if they wish.

In March 1999, the federal government adjusted the cost sharing formulas within two of the above *Alianza* sub-programs in order to provide additional support for renewable energy systems. The changes were a direct result of the development of this GEF project. In the Dairy Technology Improvement sub-program, the federal government will now cover 50 percent of the cost of renewable energy equipment, compared to the standard 25 percent. And in the Improved Pasture Establishment sub-program, the government will now cover 50 percent of the cost of renewable-energy powered equipment, compared to the standard 40 percent.

Agricultural Productivity Improvement Project

In early 1999, SAGAR and FIRCO began implementation of the Agricultural Productivity Improvement Project (ALCAMPO), a US$556 million project financed in part by a loan of US$444 million from the World Bank. The project's objective is to support and improve SAGAR and FIRCO's implementation of

selected *Alianza* sub-programs, including the three sub-programs noted above. The idea for a GEF-supported renewable energy project operating within the auspices of these three *Alianza* sub-programs emerged during preparation of ALCAMPO.

Mexico Renewable Energy Program

Since 1994, the US Agency for International Development and US Department of Energy have supported the Mexico Renewable Energy Program, which aims to increase the use of renewable energy systems in unelectrified areas of Mexico. FIRCO is one of several Mexican organizations that are participating in the program, and has increased its capability to support farmers' acquisition and operation of renewable energy systems. The program has supported the training of FIRCO and private sector technicians in 8 of the country's 32 states on photovoltaic (PV) water pumping systems and, through FIRCO, has provided financial and technical assistance to the installation of 108 PV water pumps in eight states, representing a total investment of $7.5 million. 101 of these systems were installed in just four states. Since 1996, the program has provided this support through the *Alianza* program.

FIRCO is convinced of the developmental benefits of renewable energy systems for unelectrified farmers, and has expanded the scope of the three *Alianza* sub-programs that it administers to encompass renewable energy systems. Farmers can now receive matching grants from *Alianza* towards the purchase of renewable energy systems to pump water and power farm equipment. While the USAID/USDOE-supported program continues to support FIRCO's activities in renewable energy, its focus has shifted from training and field demonstration to leveraging replication among other farmers and monitoring impacts. FIRCO is now seeking additional financial and technical assistance to expand its renewable energy promotion and support activities throughout the country.

B. Socio-Economic Characterization of the Target Population[1]

There are an estimated 4.4 million rural production units (farms) in Mexico, of which an estimated 1.3 million are dedicated to livestock. The project would focus on livestock farms since a) renewable energy-powered pumping systems are generally too small to produce enough water for large-scale field irrigation and b) refrigerated milk storage tanks would only be located on livestock farms. An estimated 0.6 million of the 1.3 million livestock farms do not have access to electricity.

Indigenous people make up an estimated 11 percent of the national population. Of this total, an estimated 51 percent speak an indigenous language and of these, an estimated 17 percent are monolingual, speaking only that indigenous language. In other words, roughly 9 percent (900,000) of the county's indigenous population does not speak Spanish.

[1] Based on statistics from the national statistical agency (INEGI) and *Alianza*.

The 0.6 million livestock farms without electricity can be categorized as follows:

	Number of Farms	Proportion of Total	Number of Animals per Farm	Avg Family Income ($/yr)	Number of Indigenous Farmers (monolingual)
Subsistence	276,000	46%	1-5	1,650	19,500 (3,000)
Semi-commercial	216,000	36%	5-20	3,100	7,500 (400)
Commercial	108,000	18%	> 20	8,250	750 (75)
TOTAL	600,000	100%			27,750 (3,475)

The above figures indicate that roughly half the target population is made up of subsistence farmers, with the balance being semi-commercial or commercial farmers. Of the 600,000 unelectrified farms, less than five percent (27,750) are owned by indigenous people, of which roughly ten percent (3,475) do not speak Spanish.

C. Project Description

The proposed project would be the first GEF project to target renewable energy in the agriculture sector. It would remove barriers to the use of renewable energy systems in Mexico's agriculture sector and support increased integration of renewable energy into *Alianza*. The project would include eight components:

1. Promotion - US$1.824 million (6% of total project cost)

This component would aim to increase the awareness of renewable energy technologies and their potential benefits among Mexico's farmers and their associated network of private sector companies and government agencies. In addition, the component would promote participation in the proposed project. This would be achieved through a variety of media:

- pamphlets and brochures;
- posters;
- technical briefs;
- radio advertising;
- videos;
- workshops for farmers;
- demonstration events; and
- agricultural fairs and expositions.

2. Institutional Strengthening - US$1.590 million (5% of total project cost)

The objectives of this component would be a) to increase the capacity of private sector technicians to design, install and maintain farm-based renewable energy systems in Mexico, b) to increase the capacity of both private sector and government agricultural extensionists to advise farmers on their proper

operation and c) to build the capacity of vendors to operate successfully in the renewable energy market. It would include the following sub-components:

- training of trainers;
- training of technicians, extensionists and vendors; and
- national and regional seminars.

Given the number and geographical scope of people to be trained (an estimated 2,500 throughout the country), the component would begin with the training of a selected number of professionals who would in turn deliver training to technicians, extensionists and vendors throughout the country. In this way, Mexico will develop the capacity to build and maintain the necessary human resources to support the sustainable use of renewable energy technologies in the agriculture sector.

The technician and extensionist training would combine theoretical and practical subjects, culminating in the group's installation of a renewable energy system on a farm, under the guidance of qualified trainers. Prior participation in this training would be compulsory for those extensionists that would provide participating farmers with technical assistance on the operation of their renewable energy systems.

Annual seminars in each of six regions would provide fora for the project's participants, and in particular government and private sector technicians that are in direct contact with farmers, to exchange ideas and experiences.

Over time, as the demand for farm-based renewable energy systems grows, responsibility for supporting farmers owning renewable energy systems will switch from government-funded technicians to private sector vendors servicing local markets.

3. Specifications and Certification - US$0.275 million (1% of total project cost)

The purpose of this component would be to improve farmers' confidence in renewable energy systems by introducing specifications and certification procedures that ensure high quality renewable energy equipment and support services.

Technical specifications for solar-powered pumps would be developed based upon those currently in use by the USAID/USDOE-supported Mexico Renewable Energy Program. Specifications for other types of equipment, such as wind-powered pumps and solar-powered refrigerated milk storage tanks, would be newly developed by a contracted specialist consulting firm.

Certification procedures would be introduced for renewable energy equipment and service providers, including vendors and technicians.

4. Market Development - US$0.686 million (2% of total project cost)

This component would aim to reduce uncertainty regarding the potential markets for renewable energy technologies in Mexico's agriculture sector, and therefore encourage the entry of private sector equipment and service providers. This would be achieved through two types of studies: a) a market assessment and b) technology assessments. The results of these studies would be widely disseminated among potential equipment and service providers.

The market assessment would document a) the number of farms lacking electricity and which therefore

could use renewable energy systems for their energy-consuming equipment, b) farmers' capacity and willingness to pay for renewable energy systems, and c) Mexican renewable energy system manufacturers, assemblers, vendors and service providers, as well as the technical quality and prices of their products and services. The assessment would also analyze opportunities for the domestic renewable energy industry to improve the scope and quality of the products and services that it offers to farmers.

A series of technology assessments would determine the commercial feasibility of renewable energy applications, taking into consideration technology that is currently and potentially available in Mexico. One technology assessment would focus on solar-powered milk storage tanks. Others would focus on other possibilities, including solar-powered milking machines and solar-, wind-, biomass- and biogas-powered tools and equipment.

The market and technology assessments would be carried out early in the project implementation period. Their results would be widely disseminated among Mexico's renewable energy industry and incorporated into the project's relevant activities.

5. Demonstration - US$18.770 million (60% of total project cost)

This component would aim to reduce farmers' perceived risks in purchasing renewable energy systems by installing demonstration units throughout the country, and thereby support replication among the estimated 600,000 unelectrified livestock farms in the country. Preliminary and detailed investigation of the market for farm-based renewable energy systems during project implementation will improve estimates of the potential for replication.

The component's indicative investment plan provides for the installation of up to 1,150 solar-powered water pumping systems in 28 states[1], up to 55 wind-powered water pumping systems in 15 states[2] and up to 24 solar-powered refrigerated milk storage tanks in 12 states[3], or a total of up to 1,230 systems. Some of the solar- and wind-powered pumping systems, and all of the solar-powered refrigerated milk storage tanks, are expected to be purchased by groups of neighboring farmers. Depending on the actual demand from farmers and the development of other applications for renewable energy in the sector, the final investment plan will differ from this indicative plan.

The distribution of systems among unelectrified farms would be determined based on a) farmers' demands (since Alianza is a demand-driven program) and b) FIRCO's application of pre-established criteria such as location, income level and type of farm. The latter criteria will incorporate new information from the market assessment on the potential market for farm-based renewable energy systems on a state-by-state basis. GEF funds would be incorporated into *Alianza's* cost sharing formula in order to provide an additional subsidy to participating farmers, to mitigate the risk that they perceive in purchasing a new and undemonstrated technology.

The investment plan is indicative because, under *Alianza's* demand-driven approach, it is farmers who

[1] The 28 states that have *not* received more than one or two demonstration units under the USAID/USDOE-supported Mexico Renewable Energy Program. Four states (Baja California Sur, Chihuahua, Quintana Roo and Sonora) have each received between 14 and 34 demonstration units each through that program.

[2] Where wind resources are considerable: Baja California, Baja California Sur, Chiapas, Coahuila, Hidalgo, Michoacan, Nuevo Leon, Quintana Roo, San Luis Potosi, Oaxaca, Sonora, Tamaulipas, Veracruz, Yucatan and Zacatecas.

[3] Where there is considerable dairy farming in unelectrified areas: Aguascalientes, Campeche, Chiapas, Guerrero, Hidalgo, Jalisco, Oaxaca, Quintana Roo, San Luis Potosi, Tabasco, Tlaxcala and Veracruz.

ultimately decide what investments take place. As such, it is impossible to determine at the outset exactly how many systems of each type will be installed under the project. However, by intensifying or de-intensifying the project's promotional activities on a regional and sub-regional basis, FIRCO will strive to achieve a rational distribution of renewable energy systems throughout the country in order to maximize their demonstration impact.

Eligibility criteria and operation procedures would be included in the Operational Manual. Key eligibility criteria for participation in the demonstration component will be: a) renewable energy equipment supported by the project must be part of a technically and economically sound investment project financed by *Alianza*, as deemed by FIRCO; b) demonstration systems must be at least 1 km. from the electrical grid and a minimum distance from similar demonstration systems (to be determined on a state by state basis); c) beneficiaries must permit access to other producers wishing to view their demonstration system; and d) a minimum quantity of water must be available year-round in the case of water pumping systems.

This component would work in conjunction with the promotion and technical assistance components to maximize the exposure of unelectrified farmers to the demonstration units. In avoiding the four states where solar-powered pumps have already been substantially demonstrated under the USAID/USDOE-supported Mexico Renewable Energy Program, the demonstration component does not overlap geographically with the vendor financing component (see below).

6. Technical Assistance - US$4.919 million (16% of total project cost)

This component would have two aims: a) to ensure that renewable energy systems acquired under the project's auspices operate in a satisfactory manner and b) to disseminate information about the successful operation of the installed renewable energy systems among neighboring farmers.

The component would support the provision of technical assistance to farmers by renewable-energy trained extensionists. *Alianza* already supports the provision of technical assistance to farmers by extensionists who advise farmers on livestock care, crop management and other subjects. The Institutional Strengthening component would train these existing extensionists in renewable energy systems. Using an innovative bonus scheme, extensionists would be rewarded based on the number of renewable energy systems purchased by their assigned farmers. Extensionists would receive an annual bonus of $140 per system installed by farmers that they support. This equals about 2.5 percent of their annual salary and is therefore not expected to disrupt their provision of technical assistance on subjects other than renewable energy systems. Extensionists would promote renewable energy systems among unelectrified farmers and advise participating farmers on the operation of their renewable energy system. Through their interactions with neighboring farmers, these extensionists would also disseminate information on the successful operation of the demonstration renewable energy systems.

Since this component will be implemented under the auspices of the *Alianza* technical assistance program which is implemented by SAGAR, a coordination agreement is required between FIRCO and SAGAR. That agreement was secured in July 1999. This component would also be implemented in conjunction with the technical assistance activities within the ALCAMPO project.

7. Vendor Financing - US$2.261 million (7% of total project cost)

The purpose of this component would be to establish a pilot scheme to test vendor financing of farm-based renewable energy systems. Specifically, the pilot would consist of an innovative vendor financing

mechanism in the four states[1] where solar-powered pumps have already been substantially demonstrated and vendors exist.

The component would assist the renewable energy industry's introduction of equipment leasing as a financing mechanism for farm-based renewable energy systems, in order to fill the existing gap in availability of lending services in rural areas where many banks and financial institutions have withdrawn services, or are reluctant to establish new loan operations for productive purposes.

A newly created and industry-owned leasing company would lease farmers renewable energy systems. Vendors would be partners of the company and would agree to purchase back those systems repossessed due to loan defaults. The leasing company would finance with GEF support the balance of the system's cost that is not covered by *Alianza* (60% of initial value) and the farmer's down-payment (10% of initial value). The farmer's debt would include an 11% surcharge on the amount of the loan, to cover customary markup (6%) and a commission (5%) that would help finance the operations of the leasing company and an insurance plan. The usual leasing period would be 36 months, and the interest charged would be the inter-bank loan rate. Ownership of the system would remain with the leasing company throughout the leasing period, and the producer would have the option of stopping payments at any time, return the equipment to the leasing company and surrender final ownership of the system. Monthly lease payments would be affordable given that only a fraction of the system's cost would be financed. Defaults should be minimal due to the affordability of the payments, and given the fact that those payments would count towards the purchase of the system and that the producer, with support from *Alianza*, would already have contributed the major part of the system's cost at the beginning of the operation.

This component will not overlap with the demonstration component, which would not support the installation of renewable energy systems in these four states because many farmers are already aware of the technology there. Final implementation arrangements for this component, based on the proposal set forth, would become available before effectiveness.

8. Project Management - US$0.965 million (3% of total project cost)

FIRCO would execute the proposed project, using a Project Coordination Office (PCO) in its Mexico City headquarters and a network of staff in each of its state offices. The PCO would be responsible for overall execution of the project, including:

- coordination of all project activities;
- periodic progress reporting;
- management of disbursements and financial control procedures;
- coordination of annual audits, to be carried out by external auditors selected by Mexico's Secretariat of Administrative Control (SECODAM);
- coordination with SAGAR on *Alianza*- and ALCAMPO-related issues; and
- monitoring of project indicators and coordination of evaluation activities.

The PCO would be directly responsible for execution of six project components (promotion, institutional strengthening, specifications and certification, market development, vendor financing and project management), and would receive support as needed from FIRCO's state offices. The demonstration and technical assistance components would be delegated to state offices, which would receive implementation support from the PCO.

[1] Baja California Sur, Sonora, Chihuahua and Quintana Roo.

FIRCO would organize an annual national seminar as a forum for the project team to review progress in project implementation and address any necessary changes in the project's activities or operating procedures.

FIRCO would also implement a comprehensive monitoring and evaluation program (detailed in Annex 8).

Annex 3
Estimated Project Costs

Project Component	Local	Foreign	Total
	---------- US $ thousands ----------		
1. Promotion	1,795	--	1,795
2. Institutional Strengthening	1,565	--	1,565
3. Specifications and Certification	270	--	270
4. Market Development	500	175	675
5. Demonstration	10,670	7,800	18,470
6. Technical Assistance	4,840	--	4,840
7. Vendor Financing	1,025	1,200	2,225
8. Project Management	950	--	950
Total Baseline Cost	21,615	9,175	30,790
Contingencies	350	150	500
Total Project Cost	$21,965	$9,325	$31,290

Annex 4
Economic and Financial Analysis

(1999 US$ million)

	Present Value of Flows		Fiscal Impact	
	Economic Analysis	Financial Analysis	Taxes[1]	Subsidies[2]
Benefits	51.9	51.9	1.6	13.7
Costs	26.2	19.7		
Net Benefits:	25.7	32.2		
IRR:	30.9%	39.9%		

[1] Agricultural production is not subject to VAT in México

[2] Includes value of state and federal contributions to total project costs

Switching values of critical items:

Investment costs: 153%
Operating costs: 270%
Benefits: -49%

Summary of Benefits and Costs:

The project would provide technical and financial assistance to some 1,230 mostly small commercial producers to carry out productive investments in new or improved production and marketing systems based on the utilization of renewable energy (RE) technology, thus improving their competitiveness in an increasingly open economy.

Economic benefits of the proposed project would be increased farmer incomes, derived from more efficient agricultural production attained with lower CO_2 emissions, through the use of more reliable and more economical renewable energy systems, relative to conventional gasoline-powered systems. The comparative analysis of life cycle costs for conventional energy powered equipment and renewable energy powered equipment indicates that RE equipment is up to 40 percent less expensive to operate in the long run and provides a financial rate of return on investment of 14% to 17% depending on farm size. Market penetration, however, is low because RE equipment have up-front investment costs that are up to four times higher than equivalent conventional equipment. The analysis of a sample of proposed productive systems based on the use of RE powered equipment shows that small commercial farmers would generate a significant increase in net sales. In most cases lower long run operating costs and independence from geographical proximity to the electric grid allowed new, more efficient and profitable production or marketing systems to be adopted.

Sustainability of project benefits is expected to be high, given the reliability of the systems promoted along with the improvements in human capital through training, technical assistance, organization and better access to project financial, marketing and technological services. About 62 percent of project resources are likely to be channeled to productive investment demanded by beneficiaries, while an additional 31 percent would be allocated to technical assistance and training of the target population and to applied

research. The combination of improved provision of production-related support services, and the assistance to decentralized management and administration of rural services is expected to increase the effectiveness and efficiency of public expenditure.

As a result of project activities, small business and enterprises supplying RE systems are expected to strengthen as the market for those systems and the provision of technical support establishes itself. The project would also promote private sector participation in the provision of production support services, particularly technical assistance to producers, which is expected to increase the impact of project-financed on-farm investments.

The total cost of the Project, excluding farmers' contribution, is estimated at about US$24.4 million (US$31.3 million inclusive of farmers' contribution), or about US$6 million *per annum*. Beneficiaries' contribution would be about US$6.9 million (22%), with federal and state governments contributing US$15.5 million, supported by a World Bank loan of about US$13.7 million. The GEF would contribute about US$8.9 million.

Economic Analysis:

Economic return estimates were based on a sample of the investment subprojects to be implemented by beneficiaries of the demonstration component, using data from the systems installed as part of the USAID/USDOE-supported Mexico Renewable Energy Program. The impact of these investments on agricultural productivity and farmers' income was analyzed with the help of farm models illustrative of typical farming situations in the main agro-ecological zones of the country (see Table 1). Assumptions regarding yield increases and herd expansion, where applicable, were conservative to reflect the risk-minimizing production strategies that normally characterize small farmers. A summary of the main characteristics and results of these farm models are presented in the table below. The results obtained from each model were aggregated, according to their relative importance as indicated by the proposed geographical distribution of demonstrative projects, to obtain an estimate of the component's likely overall rate of return.

Table 1. Sample of Illustrative Models

Type of Model	Farm size	Investment	On-Farm Income		E.R.R.
			w/o project	w/project	
	(ha)	(US$)	(US$)	(US$)	(%)
Livestock production					
Model 1 – Arid & semi-arid areas	3,000	20,250	12,400	24,400	44
Model 2 – Temperate areas	900	19,500	6,000	11,100	19
Model 3 – Tropical areas	230	15,000	5,200	12,300	35

Economic return calculations included the cost of incremental on-farm productive investment and recurrent expenditure for the adoption of sustainable agricultural production systems promoted under the project, incremental technical assistance to farmers and a share of institutional strengthening and project administration costs. The benefits considered included increased production – or improved sale prices where applicable -- and lower farm costs. Excluded from the economic analysis were the costs of the promotion, market development, certification and vendor financing components since their impact would be difficult to quantify and, in any case, would be available not only to demonstration component beneficiaries but to the farming community at large. The discount rate was assumed to be 12 percent.

Under these assumptions, the internal economic rate of return was estimated at 30.9 percent. However, as calculated, this rate of return reflects only the direct benefits stemming from the productive investments supported by the demonstration component and made possible by the adoption of RE systems. It does not capture the positive externalities the project is designed to create, such as lower emissions of greenhouse gases.

Pricing Assumptions:

Price contingencies were excluded and base costs plus physical contingencies less taxes were used for the IERR. Given the policy reforms and the opening of the economy of the last decade, the rate of exchange of the Mexican Peso is currently determined in the open market and trade restrictions have been gradually lowered and domestic prices tend to correspond much closer to border economic values. For the purposes of economic analysis, border prices were estimated for main tradables produced by the project and imported machinery. A conversion factor of 0.90 was used for the rest of tradable, machinery and other inputs. While the project would increase on-farm and off-farm employment, it would not have an impact on unemployment and under-employment due to its scale. Thus, the shadow price for unskilled labor was estimated at 80 percent of the net market wage rate.

Sensitivity Analysis:

Analyses performed to measure the sensitivity of the IERR to the estimated benefits and costs of the productive investment activities indicated that if benefits were to fall by 10 percent from their expected estimates, the IERR would be 27.6 percent. Similarly, were investment costs to exceed their expected values by 10 percent, the IERR would be 28.4 percent. Finally, if both situations were to occur simultaneously, the IERR would fall to 24.8 percent, and would still be 16.4% were benefits to fall by 25% and costs increase by 25% simultaneously. Were the stream of benefits to occur one year later than expected, the IERR would be 24.2 percent. These results indicate that the net benefits derived from the productive investments are very stable, However, financial returns on the full costs (without any subsidies) of replacing RE systems for non RE ones are quite sensitive, falling below 12% as a result of changes as low as 15% in costs.

Financial Analysis:

The financial analysis was carried out to assess the financial viability of the productive investments supported by the demonstration activities. As was to be expected, given the level of subsidy provided to the various on-farm investments under the project, the production systems models analyzed showed relatively high financial rates of return. Increases in farmers' income, as a result of project-financed on-farm investment, ranged from about 85 percent to 190 percent at full development. The results obtained from individual productive investment models were aggregated, using the same aggregation criteria used for the economic analysis, to calculate the overall financial rate of return of the project, which was estimated at 39.9 percent. These calculations included the cost to the farmer of incremental on-farm investment and recurrent expenditure plus the incremented cost of the project's technical assistance and institutional strengthening components, including the project administration. Input and output prices were assumed constant, as was the real exchange rate, throughout the 20-year time horizon used in the financial analysis. The discount rate was assumed to be 12 percent.

At 40 percent, the expected rate of return enjoyed by participating farmers is quite high, and begs the question why *Alianza* and GEF assistance is required to purchase the renewable energy systems. The

answer to this question has two parts.

First, it is important to note that this rate of return is produced by two separate effects of the systems: a) a decrease in operating and maintenance costs, mostly due to the elimination of fuel costs and b) an increase in production associated with limited irrigation that is made possible by the renewable energy systems. On this latter point, the high fuel and operating costs of gasoline-powered pumps causes farmers to limit their use to watering livestock only. In contrast, the very low (practically zero) operating costs of solar- and wind-powered pumps permit farmers to not only water their livestock but irrigate a small parcel of land (e.g. 0.5 – 2 ha). On this land farmers are able to grow forage or vegetables for their own consumption or for market.

Second, and more importantly, it is important to remember that the systems installed by this project are demonstration systems that are intended to introduce neighboring farmers to this new technology. Despite their high financial return, farmers will not invest in renewable energy systems due to high perceived risk. The farmers targeted by this project live in isolated, largely unelectrified areas throughout the country's 32 states and are rarely exposed to new technologies. They need to see new technologies in successful operation before they will consider investing in them. Participating farmers receive a limited windfall associated with the additional GEF contribution but this is necessary in order to get the systems into the field where they can have a demonstration impact.

Fiscal Impact:

The project would be implemented under the *Alianza para el Campo* Program. The total cost of the Project, excluding farmers' contribution, is estimated at about US$20 million, or about US$5 million *per annum*, of which roughly close to one half would come from federal sources and the state governments. The proposed project would support ongoing SAGAR programs and would operate within the existing budget allocation of SAGAR and the state governments, and will not generate additional budgetary financial requirements for the Federal Government beyond the annual amounts in matching-grants already foreseen in SAGAR's budget for these programs. Productive investment and expenditure directly benefiting farmers (i.e., technical assistance and training) account for nearly 78 percent of total project cost. Incremental tax revenues accrued to the Federal Government as a result of project activities would be negligible as sales of goods and services in the agricultural sector are exempt from the Value Added Tax (IVA). Income tax revenues from incremental profitability of on-farm production would be negligible given the level of income of the target population. Consequently, the fiscal impact of the project would also be negative, but it would be below the level of the current *Alianza* Programs, given the revenues from taxes on imported equipment, that would amount to approximately US$ 1.6 million. State governments derive the bulk of their budgetary resources from federal transfers as they cannot retain tax revenues. Consequently, financial sustainability of the states' contribution to project-financed activities would depend on the resource allocation criteria applied by various state governments rather than on their budget allocation.

Annex 5
Financial Summary

Years Ending December 31
(US $ thousands)

	Implementation Period				
	2000	2001	2002	2003	Total
Project Costs					
Investment Costs	6,900	9,900	7,500	6,025	30,325
Recurrent Costs	190	190	292	293	965
Total	7,090	10,090	7,792	6,318	31,290
Financing Sources					
Beneficiaries	1,377	2,290	1,790	1,438	6,895
Government	605	445	375	375	1,800
IBRD	2,660	4,583	3,589	2,863	13,695
GEF	2,448	2,772	2,038	1,642	8,900
Total	7,090	10,090	7,792	6,318	31,290

Annex 6
Incremental Cost Analysis

Broad Development Goals

The Government aims to reduce rural poverty by increasing agricultural productivity and production through investment in farm equipment and infrastructure and improved support services in the agriculture sector, including the electrification of unelectrified farms.

Baseline

The baseline is characterized by a continuation of the *Alianza para el Campo* program and the participation of the Trust Fund for Shared Risk (FIRCO) within that program, whereby farmers receive financial and technical assistance in their acquisition of energy-consuming equipment. In eight of the country's 32 states, FIRCO would continue to integrate renewable energy into these operations with limited financial and technical assistance from the USAID/USDOE-supported Mexico Renewable Energy Program. Sustainable demand for farm-based renewable energy systems would likely not develop due to the persistence of several barriers.

Barriers to Renewable Energy

The barriers impeding penetration of renewable energy technologies in Mexico's agriculture sector include: a) the lack of awareness among unelectrified farmers regarding renewable energy technologies; b) farmers' perception of renewable energy technologies as risky, simply because they are novel; c) a lack of trained technicians and vendors that can design, install and service renewable energy systems and agricultural extensionists that can advise farmers on their proper operation; d) uncertainty regarding the potential market for renewable energy in the agricultural sector and potential applications of renewable energy technologies on farms, e) the high initial cost of renewable energy systems, relative to conventional alternatives, coupled with deficient rural finance services that prevent farmers from financing their higher initial cost over time[1]; and f) the lack of technical specifications and certification processes for renewable energy equipment.

Global Environmental Objective

The proposed project's global environmental objectives are a) to promote the use of renewable energy for productive purposes in Mexico's agriculture sector by removing barriers and reducing implementation costs and b) to reduce greenhouse gas emissions in the agriculture sector.

GEF Alternative

The GEF alternative would build the capability of FIRCO and the private sector to promote and provide renewable energy systems to farmers and greatly expand the scale of FIRCO's activities in this area. A promotion campaign would build awareness of renewable energy systems and their operational benefits among unelectrified farmers throughout the country. Approximately 1,230 renewable energy systems would be installed in all 32 states as demonstration units, including up to 1,150 solar-power water pumping

[1] Renewable energy systems (and specifically solar- and wind-powered water pumping systems and solar-powered refrigerated milk storage tanks) are substantially more expensive to purchase then conventional, gasoline-powered systems but are less costly on a life-cycle basis.

systems, 55 wind-powered water pumping systems and 24 solar-powered refrigerated milk storage tanks. Other types of renewable energy systems may be installed based on the results of the market and technology assessments. Participating farmers would receive technical assistance to ensure that their renewable energy systems operate properly for several years. An estimated 2,500 government and private sector technicians, agricultural extensionists and equipment vendors would receive training in the design, installation, operation and maintenance of farm-based renewable energy systems. The results of renewable energy market and technology assessments would be disseminated among Mexico's renewable energy industry. Vendor financing of farm-based renewable energy systems would be tested in four states where these systems have already been demonstrated and vendors exist. Technical specifications and certification procedures would be introduced for renewable energy equipment and service providers, thereby improving consumer confidence in the technology.

An important aim of the GEF alternative would be to achieve reductions in the price of farm-based renewable energy systems by initiating markets and creating competition among local vendors. The ongoing USAID/USDOE-supported Mexico Renewable Energy Program has demonstrated the potential for this price reduction impact. In that case, the program supported the installation of 15 to 35 solar-powered water pumping systems in each of four states between 1995 and 1997.[1] During that time, the average installed cost of PV pump systems decreased by 33 percent, from $24.70 to $16.60 per peak watt. The Program's managers suggest three factors are largely responsible for this price reduction:

- Increased competition: The number of vendors of PV water pumping systems in each state increased in response to the Program, thereby creating more competition that forced prices downwards.
- Increased design capabilities among vendors: Initially, vendors with no experience in PV systems had their wholesalers design the individual systems. Wholesalers included the cost of this design service in their wholesale price. Once vendors gained some experience with the systems, they began to design them themselves at a lower overall cost. In addition, since they did not visit the individual farms, wholesalers based in Mexico City or Monterrey typically oversized the systems in order to ensure that they operated correctly in the field. Vendors were able to size the systems more appropriately since they had first-hand experience with the site conditions and water requirements of each farm.
- Increased confidence among vendors: Through their experience with the initial systems, the confidence of vendors in PV water pumping systems increased, leading them to reduce their margin for warranty service.

By initiating and expanding markets in the country's other 28 states, the GEF alternative is expected to generate price reductions there, although they may not be as great as those generated by the USAID/USDOE-supported program to the extent that the latter has generated permanent price reductions at the national level.

Scope of the Analysis

The analysis encompasses the national agriculture sector.

Costs

Demonstration Component

Under the baseline scenario, farmers would acquire conventional farm equipment with a matching grant

[1] One or two systems were also installed in each of four other states as part of training programs.

from *Alianza*. Under the GEF alternative, farmers would acquire renewable energy-powered equipment at an additional cost.

In the case of solar-powered pumping systems, an average[1] conventional system would cost $950 while an average solar system would cost $7,750, representing an additional cost of $6,800. Under its established cost-sharing formula, *Alianza* would cover $4,650 of the solar system's cost, which includes an extra 10% subsidy for renewable energy equipment. Farmers would contribute an extra $300 over the baseline, resulting in an outstanding additional cost of $2,325 to be paid by the GEF, representing 30% and 34% of the system cost and additional cost, respectively.

In the case of wind-powered pumps, a larger system is assumed based on the economics of wind-powered pumps. This larger pump would serve several farmers. An average conventional system would cost $3,800 while an average wind-powered system would cost $15,000, representing an additional cost of $11,200. Under its established cost-sharing formula, *Alianza* would cover $9,000 of the wind-powered system's cost, which includes an extra 10% subsidy for renewable energy equipment. Farmers would contribute 20 percent less than the baseline, given the higher risk associated with their reliance on a new and undemonstrated technology. This would result in an outstanding additional cost of $4,500 to be paid by the GEF, representing 30% and 40% of the system cost and additional cost, respectively.

In the case of solar-powered refrigerated milk storage tank systems, a conventional system would cost $29,000 while a solar-powered system would cost $64,000, representing an additional cost of $35,000. *Alianza* would cover $12,800 of the solar system's cost while a group of investing farmers would contribute $22,400, leaving an outstanding additional cost of $28,800 to be paid by the GEF, representing 45% and 82% of the system cost and additional cost, respectively. This cost-sharing formula reflects the impact of absolute limits on *Alianza* funding for any one subproject due to the high cost of these tank systems, with the result that farmers are required to contribute a greater share of the system cost than for pumping systems (35% vs. 10%). However, it is expected that farmers will be able to afford this greater share since it would be spread among a group of farmers, each of whom would be better able to contribute their individual share.

In the case of other types of renewable energy systems, similar cost analysis will be performed by FIRCO and a cost-sharing formula developed that is agreeable to the Bank.

Baseline investment costs would be $9.3 million, while the GEF alternative would cost $18.8 million, representing an increment of $9.5 million. *Alianza* and farmers would absorb $5.7 million (60%) of this increment, leaving $3.8 million (40%) to be covered by the GEF.

Technical Assistance Component

Under the baseline scenario, farmers and *Alianza* would co-fund agricultural extension services totaling $4.5 million over four years. These extensionists would advise farmers on a full range of farming activities, but would have no expertise in renewable energy systems.

[1] System costs vary with the depth of the well, or head.

Under the GEF alternative, these extensionists would be trained in renewable energy systems and apply this knowledge to their work with participating farmers that acquired renewable energy systems. The additional time consumed in examining and testing renewable energy systems and advising farmers on their proper operation would bring the total cost for extension services to $4.9 million, representing an increment of $434,000.

Other Components

Under the baseline scenario, FIRCO would mobilize $3.0 million in cash and in-kind resources for renewable energy-related activities in promotion, institutional strengthening, market development, vendor financing, specifications/certification and project management.

Under the GEF alternative, these activities would be greatly expanded to reach the entire country and to permanently remove barriers. The total cost of these activities would amount to $7.6 million, representing an increment of $4.6 million.

Summary

The baseline scenario would cost $16.73 million, comprising investment ($9.3 million), technical assistance ($4.5 million), and other barrier removal activities ($3.0 million). The GEF Alternative would cost $31.29 million, with the corresponding component costs estimated at: (a) $18.8 million, (b) $4.9 million, and (c) $7.6 million, respectively. The incremental cost would therefore be $14.56 million, of which GEF is requested to provide $8.9 million in incremental cost funding (see matrix attached).

Incremental Cost Matrix

	Baseline	GEF Alternative	Incremental
Domestic Benefits	Given level of energy service provided to remote farmers.	· Improved level of energy service provided to unelectrified farmers. · Removal of information, perceived risk, human capacity and consumer confidence barriers. · Improved government and private sector capability to support electrification of farms with renewable energy.	· Improvement in level of energy service provided to unelectrified farmers · Barriers removed · Improved government and private sector services
Global Environmental Benefits	GHG emissions associated with the provision of energy services using gasoline or grid-connected electricity.	No GHG emissions.	6,000 tonnes of carbon emissions avoided annually through demonstration units 730,000 tonnes avoided annually with penetration of renewable energy systems among one third of Mexico's estimated 600,000 unelectrified farms within 10 years.
Costs ($ 000s)			
1. Promotion	526	1,824	1,298
2. Inst'l strengthening	292	1,590	1,298
3. Spec's and certification	63	275	212
4. Market development	24	686	662
5. Demonstration	9,280	18,770	9,490
6. Technical assistance	4,485	4,919	434
7. Vendor financing	1,625	2,261	636
8. Project management	435	965	530
TOTAL	**$16,730**	**$31,290**	**$14,560**
GEF contribution			***$8,900***
Alianza/farmers contribution to demonstration component			***$5,660***

Annex 7
Environmental Assessment

The project generally involves the same environmental issues as ALCAMPO, therefore all relevant environmental provisions of the ALCAMPO manual would be incorporated in the project's manual. Consequently, the only remaining environmental issues are those specifically related to the use of renewable energy technologies – environmental benefits and negative environmental impacts.

Environmental Benefits

Global environmental benefits include avoided greenhouse gas emissions from gasoline-powered or grid-connected systems that would be substituted with solar- and wind-powered systems. It is anticipated that the demonstration and vendor financed systems installed by the project would abate roughly 6,000 metric tonnes of carbon per year, or roughly 120,000 metric tonnes over the 20 year life span of the renewable energy systems. More importantly, the project would catalyze a national market for farm-based renewable energy systems among Mexico's estimated 600,000 unelectrified livestock farms. It is expected that the project would catalyze the penetration of renewable energy systems among one-third of the country's unelectrified farms within ten years, a development that would avoid an estimated 0.73 million metric tonnes of carbon annually.

Local environmental benefits include reductions in air, water and soil pollution through the substitution of renewable energy systems for gasoline-powered systems. These local benefits have not been estimated, in part because renewable energy systems are financially and economically viable without the addition of these benefits and in part because the local benefits would likely be small given that they would occur in marginal areas of rural Mexico with a low density of contaminating energy sources and relatively high pollutant absorptive or dispersal capacity.

Negative Environmental Impacts

While this project would support the purchase and installation of water pumping equipment, depletion of groundwater resources is not a concern because the solar- and wind-powered pumping systems to be installed under the project are too small to pose a threat to these resources.

The only potentially negative environmental issue associated specifically with the project's renewable energy systems relates to inappropriate disposal of used batteries from some solar applications. The potential severity of this issue hinges on the number of battery-powered systems installed by the project, the battery life affecting the rate of discard, and the opportunities and constraints in heightening the awareness of farmers and vendors on the importance of recycling.

With respect to the total number of batteries involved, the project expects to install roughly 1,230 renewable energy systems throughout the country over a four-year period (2000-2003). Of these, roughly 1,050 would be solar-powered pump systems with no battery requirement, 55 would be wind-powered pump systems with no battery requirement and 24 would be solar-powered refrigerated milk storage tanks or other farm equipment (e.g. milking machines) that may or may not require batteries. Uncertainty concerning the latter systems' use of batteries is due to the fact that their final design is not yet complete and some options do not involve batteries. In sum, no more than three percent of the renewable energy systems installed by the project are expected to employ batteries. Applying this proportion to expected

post-project replication (200,000 systems over ten years) yields a projected increase of 6,000 batteries nationally.

In order to put the above figures in perspective with respect to the potential for significant environmental damage, the experience of promoting solar home systems in Mexican rural areas in the decade of the 1990s provides some insights. During this period about 100,000 solar home systems, each employing one battery, were installed through various government programs, including 60,000 systems under the PRONASOL program. The latter program was poorly executed and it is estimated that up to 50 percent of the systems may have been abandoned, suggesting a high rate of battery discard. A recent evaluation of the program in three states (Hidalgo, Campeche and Quintana Roo) raised questions on battery recycling but found no evidence of negative environmental impacts. Battery recycling has clearly been difficult to implement in rural communities. It will be even more complicated in widely dispersed agricultural uses with difficult access.

The above experience, combined with the enormous challenge faced by Mexico in disposing of millions of spent batteries per year suggests a) that the incremental load imposed by the project will be insignificant and b) that any effort to recycle batteries under the project would only be meaningful within a wider regulated and/or market-driven recycling system.

On the question of battery life, the project will emphasize installation of quality systems, e.g. deep cycle batteries, sound operating procedures and good maintenance. As a result, average battery life is expected to exceed ten years, relative to the current average of two years for the regular lead car batteries in standard use on farms. Therefore, to the extent that solar-powered batteries replace others, the number of batteries discarded on project farms (or those replicating the systems) should be significantly reduced.

In spite of the apparent disinterest in Mexico in potential harmful effects from inappropriate battery disposal, as implied above, the project will take active steps to mitigate potential environmental damage which may be attributable to large-scale replication of solar energy systems deriving from the demonstration exercise. The technician training program will include information on proper battery issue and disposal. In addition, the support components of the project – notably certification, market development and vendor financing – will emphasize equipment, installation, operation and maintenance of systems which reduce the rate at which batteries are discarded.

Annex 8
Monitoring and Evaluation Program

A: Operational Arrangements

In order to support adequate supervision of project implementation progress in relation to agreed overall goals and annual targets, as well as an assessment of the project's impact on beneficiaries and the economy, a comprehensive Monitoring and Evaluation (M&E) Program would be implemented by FIRCO.

Information on agreed indicators (see Table 1) would be collected by FIRCO staff at headquarters and in state offices, as well as by participating extensionists that would be in direct contact with participating farmers. FIRCO would ensure that these extensionists carefully collect the required information and monitor their respective performances in project implementation.

FIRCO's module within ALCAMPO's centralized management information system (MIS) would be expanded to help collect and process data on the project's physical and financial progress as well as its impacts. As an add-on to ALCAMPO's MIS, it would inherit the latter's main features. These include taking advantage of existing communications infrastructure and capabilities to allow close to real time data recording and processing of information through a centralized data storage location with decentralized data input and access features.

B: Conceptual Basis

The structure of the project's MIS would be based on two different modules: one devoted to physical and financial monitoring and another to performance evaluation. The system would allow FIRCO to record and process information from different sources on the set of indicators needed by the M&E system to achieve its objectives. These indicators would be divided into five categories: input, output, outcome, process and impact, thus providing the conceptual basis for the M&E framework. Monitoring of physical and financial implementation performance would be based on the first two groups of indicators while impact evaluation would focus mostly on the last three categories.

C: Evaluation

FIRCO would coordinate evaluation of the project's implementation performance and development impact, to be conducted by independent entities with nationwide experience using standard evaluation procedures. The evaluation process would encompass three different studies: a) a baseline study at project initiation (to be integrated with the market assessment) to determine the initial status of project beneficiaries and market indicators; b) a mid-term evaluation at the end of the second year of implementation to permit an assessment of the any required corrections in project implementation; and c) a final project evaluation at the end of the implementation period to evaluate the project's development impact.

Evaluation of the project's development impact would focus on changes in selected indicators, such as (i) prices and sales of farm-based renewable energy systems, (ii) avoided greenhouse gas emissions and (iii) participating farmers' income. Input data for project evaluation would come from continuous evaluation and periodic surveys to be implemented in conjunction with the three evaluations. Continuous evaluation would be closely associated with the monitoring system and would track a selected set of indicators of "potential development" based on known relationships between activities' outputs and development impacts. A list of performance indicators is

provided in Table 1.

D: Reports

FIRCO would be responsible for the preparation of the following reports:

Annual budget and work plan. Annual plans would be produced describing all project activities to be done in the subsequent year along with their corresponding budgets.

Semi-annual progress reports. Semi-annual progress reports with a format and coverage acceptable to the Bank would cover all project activities in the previous six months. The reports would document progress in project implementation in both physical and financial terms, based on the relevant performance indicators. One of the two-semi-annual reports would provide an overview of the preceding 12 months and a summary of performance indicators, a statement on the status of compliance with procedures outlined in the Operational Manual and analyses and recommendations relevant for optimizing project implementation.

Mid-term evaluation. A mid-term evaluation of the project would be undertaken to evaluate a) overall progress in project implementation, b) achievement of expected results and c) the need and measures to reorient project implementation as necessary.

Table 1
PERFORMANCE INDICATORS

Indicator	Unit	Component[1]
INPUTS		
Train-the-trainers courses held	#	IS
Technician courses held	#	IS
Company courses held	#	IS
National workshops held	#	IS
Regional workshops held	#	IS
Pamphlets/brochures produced	#	P
Posters produced	#	P
Radio messages produced	#	P
Videos produced	#	P
Technical brochures produced	#	P
Demonstration days held	#	P
Farmer workshops held	#	P
Fairs/exhibitions attended by RE booth/display	#	P
Sub-project requests submitted	#	D
Visits to farmers by RE-trained extensionists	#	TA
Market assessment completed	-	MD
Copies of market assessment report or summary distributed	#	MD
Technical studies completed	-	MD
Copies of technical study report or summary distributed	#	MD
Specifications issued	#	SC
Certification program initiated	-	SC
National project coordination unit formed	-	PM
Project progress reports produced	#	PM
Monitoring system initiated	-	ME
OUTPUTS		
Trainers trained	#	IS
FIRCO technicians trained, by state	#	IS
Vendor technicians trained, by state	#	IS
Other organization technicians trained, by state	#	IS
Extensionists trained, by state	#	IS

[1] Acronyms:

PW - Project-wide
IS - Institutional Strengthening
P - Promotion
MD - Market Development
SC - Specifications and Certification
D - Demonstration
TA - Technical Assistance
VF - Vendor Financing Pilot
PM - Project Management
ME - Monitoring and Evaluation
RE - Renewable energy

Total technicians and extensionists trained, by state	#	IS
Vendor managers trained	#	IS
National workshop participants	#	IS
Regional workshop participants	#	IS
Pamphlets/brochures distributed	#	P
Posters distributed	#	P
Radio message airings	#	P
Video cassettes distributed	#	P
Technical brochures distributed	#	P
Demonstration day participants	#	P
Fair/exhibition attendees	#	P
PV pumps installed and operating correctly	#	D
PV electric fences installed and operating correctly	#	D
Wind pumps installed and operating correctly	#	D
PV refrigerated tanks installed and operating correctly	#	D
Other RE systems installed and operating correctly	#	D
Total RE systems installed and operating correctly	#	D
Subsistence farmers participating	#, %	D
Semi-commercial farmers participating	#, %	D
Commercial farmers participating	#, %	D
States with demonstration systems	#	D
Certified technicians, by affiliation[1]	#	SC
Certified vendors	#	SC
Certified installations of RE systems, by type	#	SC
Farmers receiving advice from RE-trained extensionists	#	TA
Vendors trained in vendor financing	#	VF
RE systems purchased with vendor financing	#	VF
Proportion of project-supported RE systems purchased with vendor financing	%	VF
Value of vendor financing issued to farmers	$	VF
Proportion of issued vendor financing in default	%	VF
Revolutions of vendor financing revolving fund (if employed)	#	VF
OUTCOMES		
Additional training sessions/courses delivered by trainers or trained technicians	#	IS
Sub-projects rejected due to failure to meet specifications	#, %	SC
Proportion of trained technicians that received certification	%	IS, SC
Change in proportion of farmers that are aware of RE technologies[2]	%	P, D, TA
New agriculture sector RE applications commercialized[3]	#	MD
Types of RE technology applications demonstrated (with 100% financing)	#	D
Gasoline-powered pumps replaced by RE-powered pumps	#, hp	D
Traditional-charged batteries replaced by PV-charged batteries for electric fences	#, V	D
RE-powered pumps irrigating land for forage production	#	D
RE-powered pumps irrigating land for fruit and vegetable production	#	D
Area irrigated with RE-powered pumps	Ha	D
Area enclosed by PV electric fences	Ha	D
Amount of marketed milk that is refrigerated using RE systems	Litres	D
Amount of marketed milk that is milked mechanically using RE systems	Litres	D

[1] Government, vendor or extensionist

[2] Measured by survey at least three times: at project initiation, at mid-term and at project end.

[3] For example, RE-powered refrigerated tanks, milking machines or feed mixers.

Average level of satisfaction with RE systems among participating farmers	%	D
Proportion of participating farmers reporting dissatisfaction with RE systems	%	D
Proportion of participating farmers abandoning their RE systems	%	D
Scheduled maintenance visits by vendors on project-supported RE systems	#	D
Unscheduled maintenance visits by vendors on project-supported RE systems	#	D
RE-trained extensionists registered by FIRCO	#	TA
Vendors selling RE systems for productive agricultural applications, by state	#	PW
Vendors offering financing to their customers for the purchase of RE systems for productive agricultural applications, by state	#	VF
IMPACTS		
RE systems for productive agricultural applications purchased with VF	%	VF
Change in average price of RE systems, by type	%	PW
National sales of RE systems for productive agricultural applications, by type[1]	#/yr, $/yr	PW
CO_2 emissions avoided by project-supported RE systems	Tonne/yr	D
CO_2 emissions avoided nationally by RE systems in productive agricultural applications	Tonne/yr	PW
Change in average net income of participating farmers	%, $/yr	D
Change in forage production among project-supported pumps	DM/AU/yr	D
Change in fruit and vegetable production among project-supported pumps	Tonne/yr	D

[1] Measured by survey of vendors at least twice: at mid-term and at project end.

Annex 9
Procurement and Disbursement Arrangements

As executor of the Bank-supported Rainfed Areas Development Project, FIRCO is an ongoing Bank client that is performing project administration activities in a satisfactory manner. The Bank expects FIRCO to administer this project in a similarly satisfactory manner.

A detailed institutional (financial management) assessment to define specific requirements for project administration would be finalized by appraisal. However, procurement and financial management arrangements are expected to be the same as those utilized by the recently initiated ALCAMPO project (Ln. 4428-ME). Those arrangements are detailed below.

Procurement

Procurement of equipment and goods financed by the project would be carried out in accordance with the Bank's *Guidelines for Procurement under IBRD Loans and IDA Credits* (January 1995, revised January and August 1996, September 1997 and January 1999). All consulting services to provide technical assistance and training would be selected in accordance with the Bank's *Guidelines for the Use of Consultants* (January 1997 and revised in September 1997).

Subprojects. Most of the equipment and goods to be procured under this project would be carried out with direct participation and financial contribution of the beneficiaries, and implemented as part of the Demonstration Component. Procurement would be carried out by the beneficiaries and payments made through the state FIRCO office. Eligibility criteria and operation procedures would be included in the Operational Manual. Given the remote and scattered location of beneficiaries, there is little competition among contractors for these small projects, which would lead one to expect that formal bidding at community level will not reduce cost given all the transaction costs involved. In this case, participation substitutes for formal processes in ensuring cost-effectiveness. Consequently, simplified procurement procedures, including the utilization of local shopping and direct contracting, will be utilized for projects with eligible expenditures costing under US$50,000, while NCB procurement would be applied otherwise.

The implementation of these procedures would require strong supervision on the part of FIRCO and its state offices. As sole or joint implementing agency of other Bank supported projects, FIRCO has developed sufficient capacity to meet the Bank's minimum procurement management requirements, as verified by the preliminary capacity assessment performed at appraisal. At the national level, FIRCO would have a qualified procurement officer familiar with Bank procurement rules that would be responsible for organizing the supervision and monitoring of procurement activities at the state level. In the state offices, there would be an Accounts Clerk, trained in handling the transfers of funds and in reviewing bank statements, and a Procurement Clerk, who will be able to advise and assist beneficiaries in procurement activities.

At the first national seminar (part of the Promotion Component), special attention would be given to explain the project concept and the procedures for procurement and disbursement. The participants in the seminar would include staff at various levels of project execution and not be limited to senior management. In addition, a special seminar for Procurement Clerks will be held in the Mexico resident Mission to ensure adequate project implementation. The project's Operational Manual would be reviewed at this seminar. As part of the ALCAMPO project, both national and state staff will have been trained in the steps necessary to prepare, execute and monitor the new procurement and disbursement systems, and state

staff will have been trained to assist the beneficiaries in key elements of the subproject cycle, including the preparation of subproject proposals.

Consultants. About US$1.1 million of consulting services would be procured by FIRCO utilizing the Quality and Cost-Based Selection system (QCBS). Advance procurement procedures would be utilized to facilitate project implementation, in particular the use of standard terms of reference for the contracting of assignments of similar nature and scope (e.g. technical assistance for beneficiaries[1]). Draft standard terms of reference will be agreed upon at negotiations and incorporate in the Operational Manual.

Bank Prior Review. The Bank would prior review contracts for the first five beneficiary sub-projects under US$50,000 and contracts for all beneficiary sub-projects over this amount, as well as terms of reference of individual consultants for assignments up to US$50,000 and all contracts for assignments above this amount. In the case of consulting firms, the Bank would prior review terms of reference for assignments up to US$100,000 and all contracts for assignments above this amount. In addition, prior review would be required for assignments of a critical nature, such as the mid-term and final project evaluations.

Procurement arrangements and prior review thresholds are summarized in Tables A and B, respectively. The Project Procurement Plan would be agreed upon during negotiations and the final version would be incorporated in the Operational Manual to be submitted to the Bank as a condition of effectiveness.

Disbursement

Use of statements of expenditures (SOEs): The Bank is examining the feasibility of implementing the project under the terms of the Loan Administrative Change Initiative (LACI). Under LACI, use of SOE's would be replaced by a system whereby disbursements would be granted to FIRCO or the executing agency on the basis of a set of agreed-upon quarterly reports, detailing the financial, physical and procurement activities (historical and planned) under the project.

Conversion to PMRs based disbursement is expected within the timing agreed for the Agricultural Productivity Project, this implementation period is based on the close coordination between both agencies on the MISs. During the transition period, disbursements would be based on traditional procedures, using Statements of Expenditures (SOEs), which limits are below (i) $ 50,000 for subprojects (ii) $ 100,000 for consultant firms contracts and (iii) $ 50,000 for individual consultants contracts.

Consequently FIRCO should adhere all procedures to Bank requirements under this disbursement methodology. Documentation supporting SOEs would be retained by FIRCO at the central level and by FIRCO's delegations in every state, and made available for examination by Bank staff or the auditors as requested

Should SOE disbursement procedures be employed, financial reporting would be carried out by the FIRCO office in each state, including the preparation of SOE's. FIRCO would consolidate financial reports at the central level for transmission and review by the Bank. The financial management, accounting system and internal controls are already in place as part of the *Alianza* program and are being utilized by FIRCO for the Rainfed Areas Development Project. They have been operating satisfactorily.

[1] These terms of reference will be a revised version of the standard terms of reference already in place for the ALCAMPO project. The revision will insert additional responsibilities for extensionists corresponding to their promotion of renewable energy systems and their provision of support to farmers acquiring these systems.

An action plan would be developed during project implementation by FIRCO, in coordination with Bank financial management staff, to adjust the current management information system and enable the regular production of new Financial Management Reports (FMRs). Once the Bank confirms FIRCO's capacity to generate quarterly reports that are fully consistent with LACI principals, the project would be considered by the Bank for full conversion to LACI-style disbursements. Conversion would require a request by the Grant Recipient and approval by the Bank's Loan Department.

Resources and mechanisms to permit financial monitoring and reporting of project activities would be in place prior to effectiveness.

Special account: In order to facilitate project implementation, the GOM would establish a special account in US Dollars at the Central Bank with an authorized allocation and initial advance of US$750,000, corresponding to the average of four months of expenditures that are expected to be made from the account. The replenishment application will be supported by the required/agreed documentation. The Special Account would be audited in conjunction with the annual financial audit of the project.

Table A: Project Costs by Procurement Arrangements

In US$ 000s equivalent, including contingencies.
Figures in parenthesis are the amounts to be financed by the GEF grant.

Expenditure Category	Procurement Method				Total Cost
	ICB	NCB	QCBS	OTHER	
1. Works					
None					
2. Goods					
Equipment				20,861.6* (4,360.0)	20,861.6* (4,360.0)
3. Services					
Promotion materials & services			1,824.1 (1,297.9)		1,824.1 (1,297.9)
Training services			1,590.4 (1,297.9)		1,590.4 (1,297.9)
Extensionist services			4,918.6 (434.4)		4,918.6 (434.4)
Consulting services (market development, spec's and certification, vendor financing)			1,129.9 (980.0)		1,129.9 (980.0)
4. Miscellaneous					
Project administration			965.4 (529.8)		965.4 (529.8)
Total			10,428.4 (4,540.0)	20,861.6 (4,360.0)	31,290.0 (8,900.0)

* Procurement to be carried out by beneficiaries. Fifty to sixty percent of the total cost would be contributed by *Alianza* via Ln. 4428-ME.

Table B: Thresholds for Procurement Methods and Prior Review

Expenditure Category	Contract Value	Procurement Method	Contracts Subject to Prior Review
	(US$ thousands)		
1. Beneficiary Subprojects	< 50	Direct Contracting (Reference Prices)	First 5 subprojects
	> 50	NCB	All
2. Goods			
None			
3. Services			
(a) Individuals	< 50	TOR, CV	TOR
	> 50	QCBS	All
(b) Firms	< 100	QCBS	TOR
	> 100	QCBS	All

Table C: Allocation of Grant Proceeds

Expenditure Category	Amount (US$ thousands)	Financing Percentage
Beneficiary subprojects	4,115	20
Consulting, training, promotion and other services	4,285	42
Unallocated	500	100
Total	8,900	28

Annex 10
Project Processing Budget and Schedule

A. Project Budget (US$000)	Planned (At final PCD stage)	Actual
		US$111,000

B. Project Schedule	Planned (At final PCD stage)	Actual
Time taken to prepare the project	6 months	7 months
Identification mission	Jan 1999	Jan 1999
Appraisal mission	June 1999	July 1999
Negotiations	Sept 1999	Nov 1999
Planned date of effectiveness	Jan 2000	

Prepared by: Trust Fund for Shared Risk (FIRCO)

Preparation assistance: Canadian consultant trust fund – US$61,000

Bank staff who worked on the project included:

Name	Specialty
Michael Carroll	Sr. Agriculturist/Task Team Leader
Alvaro Soler	Agricultural Economist (Cons.)
John Duffy	Renewable Energy Specialist (Cons.)
Christine Kimes	GEF Coordinator
Ferenc Molnar	Lawyer
Alberto Ninio	Lawyer
Lea Braslavsky	Procurement Specialist
Victor Ordonez	Financial Specialist
Michael Nelson	Environmental Specialist (Cons.)
Charles Feinstein	GEF Advisor
Chandra Shekhar Sinha	GEF Advisor
Ranjinee Rudran	Team Assistant
Patricia Soto	Team Assistant (Mexico)
Arun Sanghvi	Peer Reviewer
Fernando Manibog	Peer Reviewer
Daniel Kammen	GEF STAP Reviewer (Cons.)

Annex 11
Documents in the Project File*

A. Project Implementation Plan

FIRCO (1999), *Manual de Operacion del Proyecto*

B. Bank Staff Assessments

Kammen, Daniel (March 1999), *GEF STAP Review Comments*

Nelson, Michael (April 1999), *Report on Environmental Aspects*

Soler, Alvaro (July 1999), *Economic and Financial Analysis*

C. Other

Global Transition Consulting (June 1999), *Componente de Financiamiento a Proveedores: Analisis y Recomendaciones*

Credit Partners (October 1999), *Componente de Financiamiento*

*Including electronic files.

Annex 12
Statement of Loans and Credits
As of 21-Jun-99

Project ID	Fiscal Year	Borrower	Purpose	Original Amount in US$ Millions IBRD	IDA	Cancellations	Undisb
Number of Closed Projects: 143							
Active Projects							
MX-PE-48505	1999	NAFIN	AGRICULTURAL PRODUCT	444.45	0.00	0.00	
MX-PE-7610	1999	BANOBRAS	FOVI RESTRUCTURING	505.05	0.00	0.00	
MX-PE-40199	1998	MEXICAN GOVERNMENT	BASIC EDC. DEV.	115.00	0.00	0.00	
MX-PE-44531	1998	GOM	KNOWLEDGE & INNOV.	300.00	0.00	0.00	
MX-PE-49895	1998	MINISTRY OF FINANCE	HIGHER ED. FINANCING	180.20	0.00	0.00	
MX-PE-55061	1998	BANOBRAS	HLTH.SYSTEM REF. TA	25.00	0.00	0.00	
MX-PE-7711	1998	NAFIN	RURAL DEV. MARG.AREA	47.00	0.00	0.00	
MX-PE-7720	1998	BANOBRAS	HEALTH SYSTEM REFORM	700.00	0.00	0.00	
MX-PE-7700	1997	GOVT OF MEXICO	COMMUNITY FORESTRY	15.00	0.00	0.00	
MX-PE-7726	1997	GOVERNMENT	AQUACULTURE	40.00	0.00	0.00	
MX-PE-7732	1997	GOVERNMENT	RURAL FIN. MKTS T.A.	30.00	0.00	0.00	
MX-PE-40685	1996	NACIONAL FINANCIERA (NAFI	INFRA. PRIVATZTN TA	30.00	0.00	0.00	
MX-PE-7689	1996	NAFIN	BASIC HLTH II	310.00	0.00	0.00	
MX-PE-7713	1996	GOM	WATER RESOURCES MANA	186.50	0.00	0.00	
MX-PE-34161	1995	NAFINSA	FINANCIAL SEC T.A.	37.40	0.00	0.00	
MX-PE-34490	1995	NAFIN	TECH EDU/TRAING	265.00	0.00	30.00	
MX-PE-7702	1995	SEDESOL	SECOND DECENTRALZTN	500.00	0.00	0.00	
MX-PE-7612	1994	BANOBRAS	SOLID WASTE II	200.00	0.00	193.06	
MX-PE-7701	1994	NAFIN	ON-FARM & MINOR IRRI	200.00	0.00	30.00	
MX-PE-7707	1994	BANOBRAS	WATER/SANIT II	350.00	0.00	0.00	
MX-PE-7710	1994	BANOBRAS	N. BORDER I ENVIRONM	368.00	0.00	273.40	
MX-PE-7725	1994	NAFIN	PRIM.EDUC.II	412.00	0.00	40.00	
MX-PE-7648	1993	BANOBRAS	MEDIUM CITIES TRANSP	200.00	0.00	23.00	
MX-PE-7694	1993	NAFIN	TRNSPRT AIR POLL CON	220.00	0.00	43.12	
MX-PE-7723	1993	BANOBRAS	HWY RHB & SAFETY	480.00	0.00	0.00	
MX-PE-7667	1992	NAFINSA	IRRIG SCTR	400.00	0.00	50.00	
Total				6,560.60	0.00	682.58	3,

	Active Projects	Closed Projects	Total
Total Disbursed (IBRD and IDA):	2,325.83	21,290.14	23,615.97
of which has been repaid:	95.52	12,277.71	12,373.23
Total now held by IBRD and IDA:	5,782.49	9,015.45	14,797.94
Amount sold :	0.00	92.34	92.34
Of which repaid :	0.00	92.34	92.34
Total Undisbursed :	3,552.18	2.99	3,555.17

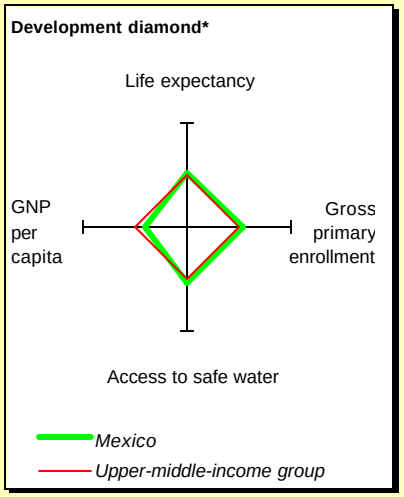
a. Intended disbursements to date minus actual disbursements to date as projected at appraisal.

Note:
Disbursement data is updated at the end of the first week of the month and is currently as of 31-May-99.

Mexico at a glance

9/1/98

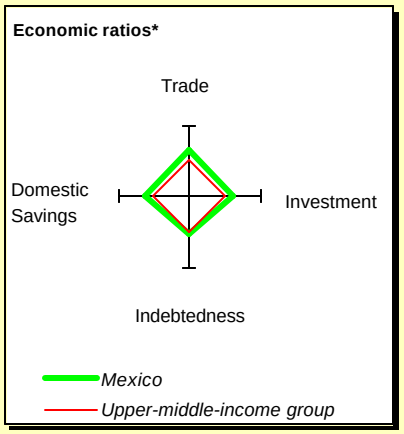
POVERTY and SOCIAL	Mexico	Latin America & Carib.	Upper-middle-income
1997			
Population, mid-year *(millions)*	94.8	494	571
GNP per capita *(Atlas method, US$)*	3,680	3,880	4,520
GNP *(Atlas method, US$ billions)*	348.9	1,917	2,584
Average annual growth, 1991-97			
Population *(%)*	1.8	1.7	1.5
Labor force *(%)*	2.8	2.3	1.9
Most recent estimate (latest year available, 1991-97)			
Poverty *(% of population below national poverty line)*	..	..	..
Urban population *(% of total population)*	74	74	73
Life expectancy at birth *(years)*	72	70	70
Infant mortality *(per 1,000 live births)*	30	32	30
Child malnutrition *(% of children under 5)*	14	..	..
Access to safe water *(% of population)*	83	73	79
Illiteracy *(% of population age 15+)*	10	13	15
Gross primary enrollment *(% of school-age population)*	115	111	107
Male	116	..	..
Female	113	..	..



KEY ECONOMIC RATIOS and LONG-TERM TRENDS

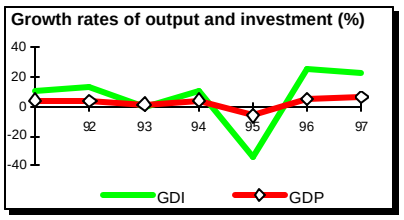
	1976	1986	1996	1997
GDP *(US$ billions)*	95.3	128.8	329.5	403.0
Gross domestic investment/GDP	21.0	18.1	23.3	26.4
Exports of goods and services/GDP	7.0	17.4	32.5	30.2
Gross domestic savings/GDP	18.8	22.0	25.4	26.4
Gross national savings/GDP	16.5	17.4	22.7	24.5
Current account balance/GDP	-3.7	-1.1	-0.6	-1.8
Interest payments/GDP	1.4	6.0	2.5	2.2
Total debt/GDP	25.1	78.3	47.7	37.3
Total debt service/exports	46.5	50.3	35.4	28.4
Present value of debt/GDP	..	..	45.1	..
Present value of debt/exports	..	..	128.9	..

	1976-86	1987-97	1996	1997	1998-02
(average annual growth)					
GDP	3.8	2.8	5.2	7.0	4.9
GNP per capita	0.9	0.6	4.0	6.2	2.9
Exports of goods and services	10.3	11.1	18.2	13.0	7.4

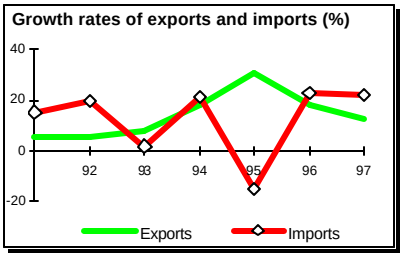


STRUCTURE of the ECONOMY

	1976	1986	1996	1997
(% of GDP)				
Agriculture	10.2	9.0	6.1	5.8
Industry	29.8	33.9	28.4	28.3
Manufacturing	21.6	24.7	21.5	21.7
Services	60.0	57.1	65.5	65.9
Private consumption	71.3	68.8	64.9	65.3
General government consumption	9.9	9.1	9.7	8.4
Imports of goods and services	9.2	13.5	30.3	30.2



	1976-86	1987-97	1996	1997
(average annual growth)				
Agriculture	2.7	1.6	3.8	1.0
Industry	3.6	3.3	10.2	9.3
Manufacturing	3.2	3.7	10.9	9.8
Services	4.0	2.9	3.3	6.6
Private consumption	3.0	2.7	2.2	6.3
General government consumption	5.8	2.0	-0.7	1.8
Gross domestic investment	-0.2	4.1	25.7	22.8
Imports of goods and services	0.1	13.3	22.8	22.0
Gross national product	3.4	2.5	5.8	8.0



Note: 1997 data are preliminary estimates.

* 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.