

Project Document

1. Identifiers:

Project Number: BOL/97/G31/A/1G/99

Name of Project: Program of Rural Electrification with Renewable Energy,
Using the Popular Participation Law

Duration: Four Years

Implementing agency: UNDP

Executing Agency: Ministry of Economic Development

Requesting Country: **Bolivia**

Eligibility: Bolivia ratified the Framework Convention on Climate Change
on 3 October, 1994 and is eligible for UNDP technical assistance

GEF Focal Area: Climate Change

GEF Programming Framework: OP #6: Promoting the adoption of renewable energy by removing
barriers and lowering implementation costs

2. **Summary:** This Program will remove barriers to the successful implementation of rural electrification projects using renewable energy technology. By focusing on the financial, institutional, technical and human resources barriers, the Program will be sustainable and replicable in other areas of the country. Because of the socio-economic and institutional diversity found in rural Bolivia, as well as the innovative nature of the Program, the experiences in each community will be carefully documented and evaluated in order to identify the most viable and cost-effective options to meet the goals of renewable rural electrification. The proposed Program will establish 22 electrification projects in Bolivia's rural areas. Using historical data of CO₂ emissions generated by the normally utilized diesel generation equipment, it is estimated that the average municipal-level project of this Program will avoid the production of approximately 50,59 MT of CO₂ for each year of operation. In this manner, the 22 projects will contribute to avoid the production of nearly 21,000 MT of CO₂ during a 25-year period. Additionally, through the use of the funds recovered by the revolving fund, another 47 projects can be implemented in the next 25 years. The effect in this case would be to reduce CO₂ emissions by about 37,759 MT. The Program will provide an effective model for large-scale user of such renewable energy technologies, and if successful in stimulating replication throughout Bolivia, the actual quantity of greenhouse gas emissions avoided would be greatly increased.

3. Costs and Financing (US\$):

GEF

Full project	3,983,719
[of which administrative cost are	122,671]
PDF B	234,000
Sub-total	4,217,719

Co-financing and Associated Financing:

UNDP	100,000
Government of Bolivia:	
Govt of Bolivia (in cash)	1,000,000
Govt. of Bolivia (in-kind)	250,000
Under Popular Participation Law	1,390,800
Private Sector	603,750
User contribution	711,700
Sub-total:	4,056,250

Total Project Cost: 8,273,969

4. Operational Focal point Endorsement:

Name: Lic. Carlos Balderrama M. Title: Secretario Nacional de Recursos Naturales y medio ambiente a.i.
Organization: Ministerio de Desarrollo Sostenible y Medio Ambiente Date: 28 February 1997

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ABBREVIATIONS

ANELEC	National Association of Electric Companies
C	Centigrade
CESSA	Compañía de Electricidad de Sucre, S.A.
c.i.f	Costs, insurance and freight
CO ₂	Carbon dioxide
COBEE	Compañía Boliviana de Energía Eléctrica
CRE	Cooperativa Rural de Electricidad, Ltda. (Santa Cruz)
DGE	Dirección General de Energía
ELECTROPAZ	Empresa de Electricidad de La Paz
ELFEO	Empresa de Electricidad de Oruro
EMV	Empresa Metalúrgica de Vinto
ENDE	Empresa Nacional de Electricidad
ENFE	Empresa Nacional de Ferrocarriles
ENTEL	Empresa Nacional de Telecomunicaciones
FDC	Fondo de Desarrollo Campesino
FIS	Fondo de Inversión Social
FNDR	Fondo Nacional de Desarrollo Rural
FONAMA	Fondo Nacional para el Medio Ambiente
GDP	Gross Domestic Product
GEF	Global Environment Facility
GTZ	German Technical Assistance Society
IBNORCA	Instituto Boliviano de Normas y Calidad
IPF	International Programs Funding
IRR	Internal Rate of Return
kW	Kilowatt
kWh	Kilowatt hour
MCH	Micro-hydroelectric plant
MT	Metric Tons
mtoe	Millions of Tons Oil Equivalent
MW	Megawatts
NIS	National Interconnected System
NRECA	National Rural Electrification Cooperative
NGO	Non-governmental Organization
NPV	Net Present Value
OTB	Organización Territorial de Bases
PDF-B	Program Development Facility - Bolivia
PFC	Program Facilitation Unit
PONER	Programa Nacional de Electrificación Rural
PPER	Project Performance Evaluation Report
PROPER	Programa para la Difusión de Energías Renovables
PV	Photovoltaic

ABBREVIATIONS CONTINUED

SA	Sociedad Anónima
SAM	Sociedad Anónima Mixta
SEPSA	Sistema de Electricidad de Potosí, S.A.
SHP	Small Hydroelectric Plant
SRL	Sociedad de Responsabilidad Limitada
tcf	Trillions Cubic Feet
UNDP	United Nations Development Program
US\$	U.S. Dollars
USAID	United States Agency for International Development
VAT	Value Added Tax
VMEH	Vice Ministry of Energy and Hydrocarbons
W	Watt
YPFB	Yacimientos Petrolíferos Fiscales Bolivianos

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Brief Description

1. This Program will remove barriers to the successful implementation of rural electrification projects using renewable energy technology. By focusing on the financial, institutional, technical and human resource barriers, the Program will be sustainable and replicable in other areas of the country. Because of the diversity found in rural Bolivia, as well as on the various institutional levels, and the innovative nature of the Program, the experiences in each community will be carefully documented and evaluated in order to identify the best possible solutions to meet the goals of renewable rural electrification.

2. The proposed Program is consistent with the goals of GEF Program 6, to Promote the Adoption of Renewable Energy through Removing Barriers and Reducing Implementation Costs. Using historical data of CO₂ emissions caused by the normally utilized diesel generation equipment, it is estimated that the average municipal-level project of this Program will avoid the production of approximately 50.59 MT of CO₂ for each year of operation. In this manner, the 22 projects of the Program will contribute to avoid the production of nearly 21,100 MT of CO₂ during a 25-year period.

Additionally, through the use of funds recovered by the revolving fund, another 47 projects can be implemented in the next 25 years (bringing the total number of projects to 69). The effect in this case would be to reduce CO₂ emissions by about 37,795 MT. (If all rural Bolivians outside the economic reach of the grid were provided with electricity from the renewable sources, the potential total CO₂ savings comes to 664,753 tons CO₂ over 20 years.) The Program will provide an effective model for the large-scale use of such renewable energy technologies, and if successful in stimulating replication throughout Bolivia, the actual quantity of greenhouse gas emissions avoided would be greatly increased.

A. Context

1. Description of country and subsector

3. Bolivia is a landlocked republic located between 9° and 23° south latitude, and between 57° and 70° west longitude. The country borders on Chile and Peru to the west, Argentina and Paraguay to the South, and Brazil to the north and east. The total land area of the country is 1,098,581 square kilometers, about equal to the combined size of France and Spain. Geographically, Bolivia is comprised of three distinct climate regions: the lowland plains, the valleys and the highlands or *altiplano*. The lowland plains are found in the eastern region of the country at altitudes less than 500 m above sea level. This region is under the influence of the Amazon and Pilcomayo River basins, and registers an average temperature of 25°C. The high valleys are located in a band running through the center of the country, forming a temperate zone with altitudes varying between 1,000 and 3,000 meters above sea level. The average temperature in the region is 15°C. The *altiplano* (high plateau) is located in the western part of the country at an average altitude of 3,500 meters above sea level. The average temperature is 10°C.

4. According to the National Institute of Statistics, the population of Bolivia was about 6.4 million in 1992 and grew at about a 2.1 percent annual rate between 1976 and 1990. Approximately 51 percent of the population live in the *altiplano*, 32 percent in the high valleys and only 17 percent in the lowlands. This results in a much higher population density in the high valleys and *altiplano*, the areas with the lowest levels of natural and economic resources. In 1992, the per capita GDP in Bolivia was barely US\$ 818 per annum, placing Bolivia in a position among the lowest in Latin America. In the same year, it was estimated that almost 85 percent of the Bolivian population had attended one or more years of school. Approximately 42 percent of the population of Bolivia reside outside of the urban

centers. The socioeconomic situation of these rural dwellers is clearly worse than that of their urban counterparts. For example, the per capita income in the urban sector was around US\$ 503 in the year 1992, while that for the rural area was about US\$ 387. Another indicator of the difference is seen in the poverty index of 52.6 percent in urban areas of Bolivia, compared with 95.1 percent in the rural sector.

5. Over the past few years, Bolivia has taken significant steps related to sustainable development and environmental protection. Foremost among these is the passing of the Environmental Law (*Ley de Medio Ambiente*) Number 1333, in April of 1992. This Law established guidelines for the Environmental Impact Evaluation as a fundamental instrument in project feasibility analysis. Additionally, it provides for the protection of the environment and the conservation of the country's natural resources by establishing guidelines for the relationship between man and nature, and promoting sustainable development. The goal is to improve the quality of life of the population, satisfying the needs of the present generation without jeopardizing the ability to satisfy the needs of future generations.

6. Bolivia has a rich endowment of energy resources. These energy resources include traditional fuels (fuelwood, bagasse and animal waste), hydroelectric power (potential estimated to be in the range of 18,000 MW, of which only some 300 MW has been exploited), and fossil fuels (reserves estimated at about 24 mtoe of oil and 3.8 tcf of gas). Both solar and wind resources are abundant.

7. The electric power sector currently consists of approximately 994.3 MW of installed capacity. Power generation currently is divided between hydroelectric facilities (312.7 MW or 31 percent) and thermal (681.6 MW or 69 percent), the latter being supplied by a combination of gas turbines and diesel engines. However, the very large land area of the country, the mountainous terrain and the highly dispersed population, create many physical problems and very high costs for the distribution system. As a result, only 25 percent of the rural population currently has access to electricity (versus 95 percent of the urban sector).

8. The Bolivian electricity system is composed of the National Interconnected System (NIS) and diverse Isolated Systems. The NIS attends to the principal cities - La Paz, Cochabamba, Santa Cruz, Oruro, Sucre and Potosí - and neighboring urban centers. It also serves the traditional mining centers in the west of Bolivia. The Isolated Systems include the market of the city of Tarija and other urban centers in that department, the cities of Trinidad, Guayaramerín and Riberalta in the department of Beni, the city of Cobija in the department of Pando and other minor isolated systems.

9. The primary entities authorized to operate generation facilities in the NIS are Guaracachi, Valle Hermosa, Corani and COBEE. The annual growth rate of installed capacity is only about 4 per cent. The electric distribution companies in Bolivia are under the supervision of ENDE. These are ELECTROPAZ in La Paz, ELFEO in Oruro, ELFEC in Cochabamba, CRE in Santa Cruz, CESSA in Sucre y SEPSA in Potosí. The exploitation of hydroelectric resources in Bolivia is still relatively expensive, leading to the conclusion that gas is the least-cost solution to the expansion of the electricity sector in the medium term. Diesel generators are the principal sources of energy for isolated systems. These systems, combined with small autonomous generators, represent about one-fifth of the total installed capacity and 15 percent of the total electricity production in Bolivia.

10. The new legal framework of the energy sector is characterized by permitting: a) competition among investors in the generation of electricity; b) the existence of a natural monopoly in the transmission of the electricity, regulated by the setting of transmission use rates; and c) the existence of

a natural monopoly in the distribution of electricity, regulated by price setting.

11. Grid extension is still the most common means of rural electrification for those areas within the reach of the national grid. However, given Bolivia's rugged terrain and dispersed population, much of the country is too decentralized to be economically connected to the grid.

12. In Bolivia, power generation for decentralized, small communities traditionally has been undertaken through the use of small diesel generators. These systems are normally inexpensive to acquire and install. However, the cost of operation and maintenance tends to be much higher than that of systems which employ renewable energy sources. Even with the past practice of subsidizing the cost of diesel, transportation costs for bringing the fuel to the decentralized generators have made electricity costs high and the supply situation erratic. With the de-regulation of the price of diesel, the provision of diesel fuel to these remote areas will become even more expensive.

2. Host country strategy

13. During the past decade, the administrative and functional structure of the government of Bolivia has changed dramatically away from a centralized model--wherein the State served as a provider of goods and services -- toward a more decentralized model -- where the State exists to create an environment where market mechanisms provide goods and services through private and mixed public-private enterprises. These changes have been brought about as a reflection of the desire and commitment of the political forces to create an atmosphere within which the nation can progress economically and socially. One of the first actions taken during this period of change was Executive Decree No. 23660 of October 1993 which provided for the Reorganization of the Executive Branch and created a new order of ministerial functions including the Ministry of Sustainable Development and Environment. This was one of the first times a government had given this level of attention to the environment and sustainable development. A second action taken was the passing of the Capitalization Law (*Ley de Capitalización, No.1544*), on March 21, 1994, authorizing the executive branch of the government to provide assets and rights of public sector enterprises in exchange for the capital paid in the constitution of new mixed (public-private sector) companies. The entities capitalized under this law were the national petroleum company (YPFB), the national electric company (ENDE), the national telecommunications company (ENTEL) and the national railway company (ENFE), among other companies. Other legal reforms were applied to the electrical industry sector, and the agrarian and education sectors.

14. In the context of these changes, possibly the most important reform resulted in the passage of the Popular Participation Law (No. 1551, signed on April 20, 1994). Under this law, 20 percent of national government revenues are channeled to municipal governments for their exclusive use. These funds are disbursed into bank accounts opened by each municipality or groups of municipalities with 5000 or fewer inhabitants. For the year 1995, the first year for which this law was binding, over US\$ 20 per inhabitant was transferred out to the participating municipalities. Municipalities have now begun identifying priority projects which can be initiated with these new sources of funding, rather than waiting for the national government to take action. This law is seen as an important way for communities to garner resources to meet their development objectives.

3. Prior and ongoing assistance

15. In the late 1980's, a project sponsored by the Government of Spain involved the installation of some 900 PV systems. The project demonstrated that PV technology is accepted by users for their basic electricity requirements. However, the systems were heavily subsidized and users were not

required to pay back the subsidy. In effect, a number of systems were actually sold by the original beneficiaries to users outside the project area for a profit. The Chimboata Project in Cochabamba, a 60-system project sponsored by the French Government and implemented by Energética, demonstrated that credit financing of renewable energy projects can work when initial and installment payments are gauged to the seasonal abilities of users to pay. This project found that there is better system maintenance if the systems are credit-financed, proved that user fees are linked to their payment capabilities. The NRECA project, sponsored by USAID provided results similar to those of the Chimboata project. The Dutch Government sponsored a small hydro-electric plant in Totorá (90 kW) in 1982. The project was organized through a cooperative. Problems which occurred in this project revealed the need for skilled personnel (and training) for accounting and mechanics. More training and care is required in the determination of user rates based upon the real costs of system administration, operation and maintenance. Projects will also require additional financing to expand coverage to a larger number of users, as successful projects consolidate the electricity markets in the area. More recently, the Dutch-sponsored project in the Department of Santa Cruz (implemented through the *Cooperativa Rural de Electricidad-CRE*) has shown that the private sector can function effectively in the rural electrification area. PV systems, even when subsidized, must be marketable so that they may be bought, sold, or transferred within a project area. It has also shown that the financial sector has a long-way to go before it is adequately attuned to the requirements for financing renewable energy projects.

4. Institutional framework

16. The two of Governmental ministries which will take major roles in the current Program are the Ministry of Economic Development and Ministry of Treasury. The Program itself will be the responsibility of the Director General of Energy of the Vice Ministry of Energy and Hydrocarbons of the Ministry of Economic Development. This office will have the primary obligation for overseeing the implementation of the Program and insuring its overall results. On the other hand the Vice Ministry of Public Investment and External Financing of the Ministry of Treasury, is the primary entity of the Government of Bolivia in charge of handling monetary matters related to externally-financed Programs. This entity will be in charge of the financial and monetary matters between the Government of Bolivia and the International Organizations involved in the Program.

17. In matters related to the final definition and implementation of the Program, several departmental and local public sector entities, as well as private sector groups, will be involved. These will include the *Prefecturas* (Departmental Governments), *Municipios* (Municipal Governments), various financial entities of the private sector (both banks and financial intermediaries), local private sector companies, and non-governmental organizations.

B. Program Justification

1. Present situation and problem to be addressed

18. Although the government of Bolivia has a solid commitment to rural electrification, a number of barriers appear to prevent the Government from achieving its goal of 78 percent rural electrification by the year 2001. Complete rural electrification has been estimated to require more than US\$ 1 billion over the next 30 years. At the national level, there is and will continue to be a clear need for greater financial resources to be mobilized for rural development in general, and rural electricity provision, in particular. Such an enormous quantity of resources can only be made available for rural electrification if the private sector can be mobilized to support rural electrification in addition to the flow of resources

already available from the public sector.

19. Another way to demonstrate the magnitude of the need for additional help in financing rural electrification is to examine the projects put forward for implementation by local communities for financing by departmental governments or under the popular participation law. For this year, over three hundred rural electrification projects were identified. Although most of these projects involve either grid extension or small diesel or natural gas-based generation, some of them involve rural electrification *via* renewables. Of the US\$ 65 million identified as being necessary for implementing these projects, only about US\$ 15 million is available. Thus, at the present moment, a large number of rural electrification projects are not being implemented for lack of financing. There appears to be a significant “pent-up” demand for electricity in rural areas brought about by limited capital flows to rural areas and limited financing alternatives to harness that willingness to pay through time.

20. The PDF activities undertaken to prepare this Program have identified five barriers to the sustainable financing of rural electrification through renewable energy technologies. These barriers have been identified by a process involving both a careful analysis of the Bolivian situation and a consultative process involving the affected rural communities. The effectiveness of these barriers can be seen in the fact that fewer than 2000 photovoltaic systems (50 W each or 100 kW total) and one small hydro system are sold commercially in Bolivia each year. The barriers identified are listed below.

- **Institutional Barrier:** For a rural community wishing to electrify through renewable (or non-renewable means), the best form of organization in order to guarantee financing and ensure adequate maintenance over time is not clear. The new electricity law indicates that only public-private corporations (SA's) can generate electricity in quantities over 300 kW. For entities generating less than 300 kW, the law does not prescribe a form of legal organization. However, for many rural villages wishing to electrify, their small size would dictate that such enterprises may not yet be financially viable. And yet, some form of profit-making enterprise is necessary to obtain the requisite financing, ensure system maintenance, and qualify for the resources available under the Popular Participation Law. Once identified and established, these institutions will have to be made familiar with the process of renewable energy system procurement, operation, and maintenance.
- **Finance-Institutional Barrier:** Bolivia's finance institutions have been inactive in financing rural electrification. Although a number of reasons can be advanced for this situation, it is clear that national goals for electrification can be achieved only if this reality is changed, allowing private and public-sector financial resources to be directed toward renewable rural electrification. Banking practices restrict financing to companies with a significant credit history; a large, existing capital base; and a limited set of known investment types. High interest rates (18%), short payback periods (3-4 years) and unnecessarily strict collateral requirements (200 percent guarantees) are all deterrents to bank financing of this type of Program. Financial institutions have little or no familiarity with the technical and economic performance of renewable energy systems and will require considerable technical assistance, capacity-building and some capitalization if they are going to become involved in financing projects of this kind. Even “second-story” financial entities (that is, a financial organization or non-governmental organization that operates particularly as a financial intermediary for micro-finance in the rural areas) are unwilling or unable to make loans of this kind. Technical support is needed to enable the financial sector to evaluate and make loans for renewable rural electrification.

- **High Capital Cost or “First-Cost” Barrier:** In many cases, renewable options for decentralized rural electrification are less expensive (on a discounted life-cycle basis) than are conventional options. However, the capital costs or initial costs of small-hydro systems, PV systems, and small wind generators are frequently higher than those of the more conventional alternatives. In such cases, particularly when dealing with poorer rural communities, the renewable option will not be chosen over the conventional option. Given the complex of other barriers relating to institutions and finances (mentioned as barriers above), rural households will have little or no ability to pay the high capital or “first costs” associated with renewable energy installations. Financing is required to get over these “first-cost” barriers. Establishing a revolving fund will, in combination with the technical assistance to the financial sector, enable these activities to obtain financing and demonstrate their suitability for long-term commercial profitability.
- **Human Resource Limitations:** Human resource limitations serve as a significant barrier to electrification with renewables in the rural areas. Although the population at large is familiar with renewable energy technologies, those who do not now receive their electricity from those systems have no idea how such systems operate, how they are built, what their maintenance requirements are, and what their likely costs are. In addition, they have no familiarity with mixed public-private enterprises and other likely institutional forms judged necessary to implement such projects. Also, technicians and managers will have to be identified and trained to operate and maintain these renewable energy systems.
- **Technical Barriers:** Previous demonstration projects have shown that renewable energy systems can operate soundly in Bolivia over extended periods of time. However, there are still no firm standards for PV installations, and there are no technical capabilities to verify that installations are made according to standards. As a result, some installations being made in Bolivia are being undertaken in an unprofessional manner. The result is that solar and small-wind installations get a bad reputation among the rural population, and they are unwilling to invest their money in such systems. Although the PDF activities sponsored to prepare this program have helped push forward the process of developing standards, codes, and certification procedures, much still remains to be done.

21. This overall program of rural electrification with renewable energy-based power sources, using the popular participation process, has been designed as an integrated set of activities which, taken as a whole, will address all of the identified barriers. Each of these barriers and the manner in which the Program intends to attack it, is enumerated in the sections which follow. The PDF-supported activities have drawn on a wide range of experience and experts, both nationally and internationally, in an effort to insure that the latest technology and methods are available to the rural communities targeted for inclusion in this pilot Program.

2. Expected situation at end of program:

22. The proposed Program is intended to promote the widespread adoption of renewable energy in rural Bolivia by removing barriers to its replicable implementation. As such, it is consistent with the goals of GEF Program 6. The Program will result in:

- Twenty-two local projects (15 photovoltaic systems, 3 small hydroelectric plants and 4 hybrid projects) implemented through local electric companies. The Program will give support mainly on organization of the schedule and training, and access to information and to credit.

- The framework conditions (market, access to credit, maintenance, etc.) to allow more installations with renewable energy, will be established and functioning.
- Using historical data of CO₂ emissions caused by diesel generation equipment, it is estimated that the average project of this Program will avoid the production of approximately 50.59 MT of CO₂ for each year of operation. In this manner, the 22 project of the Program will contribute to avoid the production of nearly 21,100 MT of CO₂ during a 25-year period. (See Annex 2.) Additionally, through the use of funds recovered by the revolving fund, another 47 projects can be implemented in the next 25 years (bringing the total number of projects to 69). The effect in this case would be to reduce CO₂ emissions by about 37,795 MT. (If all rural Bolivians outside the economic reach of the grid were provided with electricity from the renewable sources, the potential total CO₂ savings comes to 664,753 tons CO₂ over 20 years.) The Program will provide an effective model for the large-scale use of such renewable energy technologies, and if successful in stimulating replication throughout Bolivia, the actual quantity of greenhouse gas emissions avoided would be greatly increased.

23. The Program is estimated to have incremental costs of approximately US\$ 4,089,048 million, as demonstrated in Annex 1.

3. Target beneficiaries

24. From an initial list of over 100 rural communities interested in obtaining access to electricity from renewable sources, the PDF activities have identified 22 municipality-based projects where the use of renewable energy technologies to meet household, community, and productive demands is both economically and financially viable. The purpose of this Program is to provide technical assistance and incremental financing to enable these community-based projects to be implemented, thereby piloting or testing the identified process for sustainable renewable electrification. There will be a wide range of beneficiaries, to include:

- a. direct benefits to:
 - local electricity companies (to be formed by the Program process);
 - local users;
 - local institutions;
- b. capacity building for:
 - technical institutions;
 - financial institutions;
- c. support to government in order to facilitate the process.

25. Given the complexity of the Bolivian rural sector, the number of technological options available to the rural villages (PV, small hydro, and small wind generators) and the institutional mix that is required to finance these initiatives on a sustainable basis, obtaining the track record, repayment history and experience from these 22 pilot projects will be important for spreading the concept.

4. Program strategy and implementation arrangements

26. During the implementation of the PDF activities for this Program, a participatory process for rural electricity provision was identified and initiated. The strategic focus of the Government of Bolivia is on sustainable development, participation, and partnerships between the public and private sectors. As a result, the program being initiated in this Program seeks to test out a process whereby rural communities can develop an organization to obtain financing for their renewable electrification investments, procure the renewable energy services from private sector providers, oversee installation of those systems and contract for the maintenance of those systems. For this process to be sustainable, the households and communities must be satisfied with the electricity services provided while paying back the principal and interest to the relevant financial institutions.

27. As part of the PDF activities, the institutional, financial, "first-cost", human resource, and technical barriers to the implementation of renewable rural electrification were identified. Program activities were designed to eliminate those barriers and to provide the foundation for a long-term sustainable program of renewable-based rural electrification. In carrying out the PDF, the team of consultants visited each local community to discuss their options with them, to carry out a pre-feasibility or feasibility study, and to confirm the willingness of the municipal authorities to allocate funds to each of the rural communities for rural electrification using the funds made available under the Popular Participation Law. For most installations, the funds available under the Popular Participation Law will account for nearly 20 percent of system capital costs. Within each individual project area, it has been assumed that about 60 percent of the village will have both the willingness to participate and the requisite down payment or user contribution. The user contribution amounts to about 10 percent of the system costs and is a pre-condition to participation in the program.

28. The model which has been developed for the rural electrification using renewable energies, centers on the identification (or constitution) of a local entity in the case of each participating municipal section which would be charged with the implementation of the project and its later operation and administration. This entity has been given the name of the "Local Electric Company". It is anticipated that the Company will be organized as a *Sociedad Anónima Mixta (SAM)*, with participation by both the public sector (Municipality) and the private sector (local firms and/or individuals) on a share purchase basis. However, other organization options be investigated as part of Objective 1 of the Program. The Company will be staffed with a minimal number of executive, administrative and technical personnel. System maintenance will be provided through the contracting of a firm specialized in this area. This same firm should provide technical and administrative support to the Company.

29. The Company will provide electric service to users on a fee basis. In the case of PV projects, a flat monthly rate will be charged to users for the provision of a free-standing, household community or productive PV system. For small hydro-electric projects, rates will be based on the metered kWhs consumed each month.

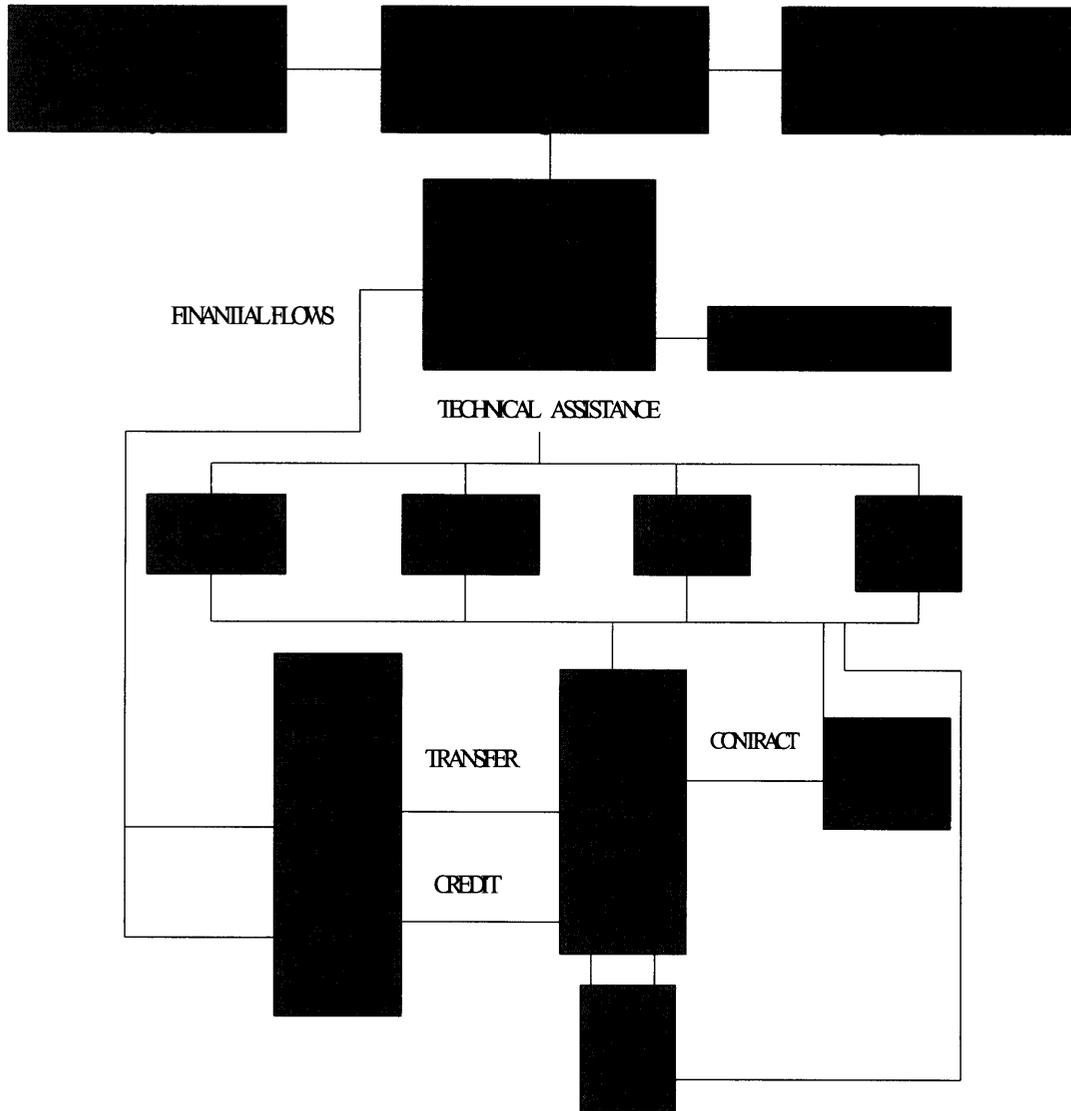
30. One of the most difficult tasks in the design of a rural electrification project and its financial components, is the determination of energy "rates" or tariffs which will permit the electricity company to cover both its operational costs and its financial obligations, without overburdening the economies of the families involved in the project. To determine the sustainability of the program, sensitivity analysis was applied for each project. This involved the development of a typical economic cashflow analysis to determine project viability. Second, a financial cashflow was prepared to establish the user-rates to be set at a level which would guarantee sufficient income to the Electricity Company to cover operating costs and repay loan monies to a revolving fund. The sensitivity analysis then calculates the Net Present Value (NPV) of the cashflow, considering the amount of investment to be recovered as the

amount of loan funds employed and uses reiterative process to determine the Internal Rate of Return (IRR) which the project can support. The endogenous variables in this analysis are the amounts of loan funds and transfers used in financing the project and the rates of interest. However, the upper limit for the monthly payments is constrained by the limited income levels of the rural population. Successive trials were run to determine the minimum levels of investment capital necessary in order to permit the establishment of user-fees at levels acceptable to the population.

31. Program implementation will be led and coordinated by the Project Facilitation Center. (See Figure 1, Program Organization Chart.) The Center will be a decentralized unit of the Vice Ministry of Energy and Hydrocarbons, offering a point of encounter for entities involved in the supply and demand for rural electrification. It will work with and coordinate the contributions of participating organizations and institutions, both national and international, including NGOs, academic institutions and the private sector. The Director of the Center will be named by the VMEH/DGE. He will be assisted by a technical staff consisting of two consultants.

32. The functions of the PFU will be to provide technical assistance and training to any requesting entity involved in this specialized sector. The technical assistance is meant to promote compliance with the Rural Electrification Regulations (RER) and insure acceptable Internal Rates of Return (IRR) and Net Value Added (NVA) for the projects. Training will be arranged for institutions, companies and/or user groups in order to guarantee programs which will be technically effective and socially and economically sustainable. The PFC will be assisted in these activities by one or more specialized consulting firms identified for the purpose. Technical assistance and training will be provided during early stages of Program and project implementation on a non-reimbursable. In later years of the system life, administrative and technical support will be acquired by the Local Electric Company under a contract similar to that of the maintenance services. It is visualized that this should be a long-term relationship.

Figure 1 Program Organization Chart



33. The Program will be monitored by the Directorate General of Energy of the Vice Ministry of Energy and Hydrocarbons, the Project Facilitation Center, the Program Implementation Contractor and experts selected by UNDP/GEF.

34. Financing of the projects will be arranged through the combination of monies from a variety of sources. A portion of the funds will come from initial fees (down-payments) charged to users (approximately 10 percent) and incremental costs, non-reimbursable transfers from the GEF (about 10 percent). Some 20 percent of the funds will originate in the monies available through the Popular Participation Law. Initial calculations result in credit financing of approximately 30 percent of the total investment costs. Finally, the last 30 percent of the funds will come from a source yet to be fully defined - donations from the Departmental Governments (*Prefecturas*), non-reimbursable transfers from international or bilateral donors, or a revolving fund to which GEF and the Government will contribute equally. The latter two categories will constitute the portion of the project investment funds which it will be necessary to recover and repay into the system - either as credit or a revolving fund. (See Annex 3.)

35. In addition to the implementation of 22 projects, it is anticipated that GEF will provide some amount of funds to the Program through a grant to the Bolivian Government. Initially, these funds will be utilized to offset the costs of barrier removal in creating the conditions under which this type of Program can be implemented. This will include costs of institution building, training, reinforcement of the financial mechanism in rural areas of the country, supervision of program implementation in the early years, creating a capacity for long-term maintenance and support, etc.

36. In the Program Organization Chart, credit monies are handled through financial institutions in the private sector, while non-reimbursable transfers are channeled through a public sector financial group.

Operationally, the Program will function as follows:

- With technical assistance provided by the Program and participation of community residents, the Local Electric Company will be constituted and will apply for Program funding of its electrification project.
- The Local Electric Company may request technical assistance and training from the Project Facilitation Center for preparation of project documents and/or identification of likely sources of project financing.
- The application will be presented to the "indicated" financial institution(s) who will perform a prefeasibility financial analysis and, if acceptable, transmit the application with recommendation to the Project Facilitation Center. Financial institutions also may avail themselves of the services of the PFC to acquire technical assistance and training in this process. Additionally, the PFC function as facilitator may utilized by the institutions to help identify sources of credit lines or non-reimbursable funding.
- Once approved by the financial institution, funds for the projects will be disbursed to the Local Electric Company based on the planned and completed implementation progress.
- The Local Electric Company, with technical assistance of the Program, will be responsible for all contracting and resident oversight of project implementation and

operation.

5. Reasons for external assistance

37. Despite past initiatives, it is clear that greater effort needs to be directed toward rural electrification if the ambitious goals of the country are to be achieved. The goal of the national program being initiated through this GEF Program is to remove the barriers which have been identified as preventing the replication of electrification using renewable sources. In addition, it will test a financing mechanism which, it is hoped, will enable many more households and communities throughout rural Bolivia to achieve their electrification objectives on a sustainable and renewable basis.

6. Special considerations

38. The Program has significant long-term innovative and demonstration value. Many of the components of the various projects of the Program will be unique in the Bolivian experience. These include:

- (a) a new approach to the capture and management of national funding for the financing of renewable rural electrification,
- (b) the development of local public-private sector companies which will assume the responsibility for the administration and long-term operation of the local systems,
- (c) the employment of decentralized, community level, small hydro systems in some communities and independent (PV) systems in others,
- (d) the demonstration of financial and economic advantages of the use of renewable energy-based electricity supply in contrast to the higher costs and longer implementation periods for central grid expansion to rural areas, and
- (e) the linkage of investments in power systems with investments in social and economic development.

39. The proposed GEF Program is, in effect, a pilot program which will lead to the development and implementation of larger scale efforts based on the demonstration of community-driven financing for the use of low-carbon energy technologies to support rural development. This technical assistance Program will have important ramifications in shaping future rural electrification projects being supported by other donors and multilateral development banks. The Vice Ministry of Energy and Hydrocarbons expects that the model being tested here will serve as the basis for all future rural electrification programs.

7. Coordinating arrangements

40. The Vice Ministry of Energy and Hydrocarbons (VMEH) anticipates the establishment of a small coordination group, the Project Facilitation Center (PFC), responsible for supporting the implementation phase of this Program, and other similar program related to rural electrification. The overall objective of the PFC is to coordinate the implementation of the Government's Rural Energy Strategy and facilitate the execution of rural electrification programs which the Central Government designs and to which the National Treasury assigns funds, either from its own sources, or from loan funds or donations from bilateral or multilateral entities.

41. The proposed structure of the PFC indicates that it will be mainly technical - basically made up of engineers, economists, financial specialists and trainers. It will contract other professional services in relation to the implementation requirements of the different rural electrification programs. The PFC will play two principal roles:

- first as the technical advisor to the Director General of Energy (DGE) of the VMEH for the diffusion and implementation of the Rural Energy Strategy; and
- second as the technical contact between the DGE, the departmental and municipal governments, the development funds, and the private sector.

The principal activities of the PFC are planned to be in the areas of:

- facilitation to insure the meeting of demanders and providers of services;
- facilitation of the implementation of rural electrification programs, as a result of either State or private initiatives;
- promotion of compliance with normative regulations by all involved agencies; and
- distribution of normative regulations as related to rural electrification.

Activities of the PFC during its first two years of existence include the responsibility to:

- prepare the Agents involved in rural electrification for the implementation of the Program of Rural Electrification with Renewable Energy Using the Popular Participation Law (UNDP/GEF) and assist the FNDR in the implementation of said Program;
- implement the training and technical assistance components of the Program during the years 1998-99; and
- prepare the rural electrification Agents for the implementation of the Program of Pilot Projects with the National Fund for Rural Development (FNDR);
- assist the FNDR in the implementation of the National Rural Electrification Program (PRONER);
- distribute normative information in the area of rural electrification.

8. Counterpart support activity

42. This program will leverage resources of the Government of Bolivia, international organizations, and other sources to support rural electrification and the use of renewable energy resources. Participation from these sources may be in the form of cash or in-kind contributions, including:

- equipment and materials;

- technical assistance;
- the establishment of the PFC;
- support in land, personnel and infrastructure; and
- one million dollars from FNDR for the revolving fund.

C. Development Objectives

43. The overall Program objective is to remove barriers to the successful implementation of rural electrification projects using renewable energy technology. Focusing on the financial, institutional, technical and human resource barriers, a program can be initiated which will be sustainable and replicable in other areas of the country.

D. Immediate Objectives, Outputs and Activities

44. Six Program objectives have been designed, five with the aim of removing the barriers to successful renewable rural electrification, and one objective to ensure adequate management of the overall program and detailed monitoring of Program activities.

Immediate Objective 1: Identify and Establish the Institutional Structures Required for the Implementation of Renewable-based Rural Electrification Projects.

Output 1.1: Institutional Options for Implementing Renewable-based Rural Electricity Companies Evaluated, Validated and Adopted for Implementation in Each Project Site.

Previous work in rural electrification has identified the need for a rural institution to serve as the basis for financing and implementing rural renewable electrification and maintaining the systems once installed. One such option, which has been evaluated as part of the PDF for this Program, is the Sociedad Anónima Mixta (SAM), a mixed public-private firm which would be the profit-making entity responsible for financing the rural electrification systems and organizing the maintenance contracts for those systems. However, other options-- such as a municipality-based system, a rural-energy service company approach (where the NGO or business owns the equipment and leases it to the users), and a system completely independent of debt financing where only technical assistance is provided--also exist. This activity, which will be undertaken with support of UNDP, is intended to evaluate these options for their viability, formulate contracts and rules of association which could be used to make them viable options, and identify ways in which funds made available from the Popular Participation Law can be channeled into renewable rural electrification.

Activity 1.1.1: Best practices in the water sector for mixed public-private enterprises working in rural development are identified and replicated to the energy sector.

This activity will be undertaken to evaluate the experiences that have been gained to date in Bolivia in undertaking mixed public-private enterprises for financing infrastructure development. It will be undertaken in close cooperation with work being funded by other donor agencies and by previous UNDP work.

in this sector.

Output 1.2: Options for Public-Private Financing Under the Popular Participation Law.

Activity 1.2.1: Viability, effectiveness and cost-effectiveness of public-private financing options available for financing and managing renewable electrification under the Popular Participation Law are identified and tailored to local conditions. This will include identification of best institutional modality for each technology proposed in concert with local communities.

In particular, the activity will consider what level of effort is necessary to make each option viable (given economies or diseconomies of scale); which institutional option is best suited to each potential technology; and what the strengths, weaknesses, costs and benefits are under each approach. The goal is to identify a number of viable options so that rural communities considering electrification have more than one choice of institutional arrangements which can be tailored to local conditions.

Output 1.3: Draft of Standardized Rules of Association and Contracts for Identified Local Institutions and Submission of Proposals to Municipalities and Central Government for Approval, so That the Resources of the Popular Participation Law can be Channeled Through Them.

Activity 1.3.1: *Following on the work undertaken as part of the PDF for SAM's and that accomplished in Activity 1.2.1 (above), this activity will draft standardized rules of association and contracts which can be used for all of the identified institutions to make them potential channels through which funding can be directed under the Popular Participation Law. These standardized contracts-- which will require vetting by Municipios and the National Government-- then can be used by the communities facing electrification so that they face competing institutional options.*

Immediate Objective 2: Removal of Barriers to the Efficient and Effective Operation of the Financing Mechanism for Renewable Energy-based Electrification Projects.

The management of funds and the placement of loans by the financial sector of Bolivia for the purpose of financing renewable energy-based electrification Programs in rural areas of the country requires a number of adjustments in order to insure the efficient and effective operation of the system and a sound financial position for credit recipients and financial institutions. At present, practically the whole of the existing financial sector is oriented toward dealing with urban, commercial and industrial accounts and with domestic investment and consumption. Additionally, the existing system still embraces many of the long-held traits related to the manner in which it deals with the terms of lending, i.e., interest rates, periods of loans, collateral, etc.

Output 2.1: Information on Rules and Procedures Hindering Loan Financing for Renewable Rural Electrification.

Within the wide range of rules, regulations and norms (either externally or internally created) which financial institutions must follow in the management of reimbursable and/or non-reimbursable financing of development Programs, several are of a nature that create barriers to effective and efficient operation. This activity will provide technical assistance in three specific areas which are important in order to make the financial system operate smoothly for the provision of credit to rural companies, NGOs, or micro-enterprises. These are: (1) the evaluation of current practices; (2) the suggestion of ways to modify practices and rules where possible; (3) the formulation, where possible and in consultation with financial actors, of alternative regulations and procedures for use under this Program. Each of these will require working with the local financial institutions in an effort to avoid problems in the implementation of the Program projects. This will include institutions in the private sector banking system, public sector financial funds, financial NGOs, and others.

Activity 2.1.1: Evaluation and Analysis of Current, Public and Private, Financing Practices and Mechanisms

The management of funds and the placement of loans by the financial sector of Bolivia for the purpose of financing renewable energy-based electrification projects in rural areas of the country requires a number of adjustments in order to insure the efficient and effective operation of the system and a sound financial position for credit recipients and financial institutions. At present, practically the whole of the existing financial sector is oriented toward dealing with urban, commercial and industrial accounts and with domestic investment and consumption. Additionally, the existing system still embraces many of the long-held traits related to the manner in which it deals with the terms of lending, i.e., interest rates, periods of loans, collateral, etc.

Activity 2.1.2: Formulation, in Consultation with Actors Involved in the Private Sector Banking System, Public Sector Financial Funds, Financial NGOs, of Recommendations for Modifications, including Alternative Regulations and Procedures for Use Under This Program.

Output 2.2: Strengthened Institutions.

Activity 2.2.1: Formulation of a Two-year Training and Technical Assistance Program in the Areas of Project Evaluation and Loan Approval, Including Monitoring and Supervision, to be Implemented for Selected Clearinghouse Institutions and Local Financial Operators.

In order to efficiently and effectively operate within this new area of project financing, both the clearinghouse institutions and the local financial operators will require institutional strengthening. Under this activity, the Program will provide technical assistance for a period of up to two years during the initial stages of the new operations; training of personnel to handle new activities and salary support for additional personnel to handle the added volume of work; and a limited amount of equipment (data processing and other office items). Training and technical assistance will concentrate in the areas of project

evaluation and the approval and supervision of loans. Salary support will be provided for a minimal number of employees directly related to Program activities and limited to a period of two years.

Activity 2.2.2: With Each of the Financial Institutions, Determine the Areas and Needs for Institutional Support (Equipment, Salaries, etc.)

Output 2.3: Revolving Fund Established.

Activity 2.3.1: *A Revolving Fund (GEF \$US 1.0 million and \$US 1.0 million from the FNDR) will be established for financing of 22 initial demonstration projects to assist in defraying the first high costs of renewable energy systems. Loan and repayment periods for proposed technology will be analyzed to maximize financial stability.
(See also Annex 3.)*

Output 2.4: Determination of Amortization Periods.

Activity 2.4.1: *Under this activity, the Program will evaluate loan periods as appropriate for the various renewable energy options and formulate a recommended plan for trying to extent those periods via experimentation, using the funds under this Program. Program personnel will work closely with the institutions involved in project financing. It is anticipated that the repayment periods for photovoltaic systems can be investigated for extension of periods of from one to ten years. For small hydro systems, the periods may range as long as 20 years. Two exercises have been performed to simulate the alternatives open to each project. These represent "extreme" cases for the execution of the projects.*

■ *First Alternative (60% Credit)*

The objective of this alternative is to present the project situation based on GEF financing conditions related to project replicability. This replicability will be accomplished through the guarantee of the recovery of at least 60 percent of the investment in the project. Under this alternative, the Tiquipaya project situation is presented as an example with the following financial structure:

-	<i>Credit</i>	<i>US\$ 47.253</i>	<i>60%</i>
-	<i>Other sources</i>	<i>US\$ 31.502</i>	<i>40%</i>
	<i>TOTAL</i>	<i>US\$ 78.755</i>	<i>100%</i>
	<i>AMOUNT WITH SOURCE</i>		
	<i>NOT IDENTIFIED</i>	<i>US\$ - 5.103</i>	

In the case of the credit, the simulation was performed based on the credit conditions currently used in FNDR. Taking into consideration the 60 percent credit and the amounts of the contributions from the sources mentioned above, there is an excess of US\$ 5,103 beyond that necessary to finance the project. In this case the Municipal Government could reduce its participation in the project, or the amount of credit financing could be reduced, improving the credit terms and the associated costs over the 20 years.

It should be mentioned that in this alternative, the analysis results in an estimated monthly energy rate of US\$ 16,00 per family, an amount which probably exceeds the capacity of the user population. The cash flow analysis for this alternative results in a Net Present Value (NPV) of US\$ 3,651 at a discount rate of 10.0 percent, and an Internal Rate of Return (IRR) of 11.15 percent. These data are evidence of the profitability of the project, at the cost of an elevated monthly cost to the consumer.

■ *Second Alternative (Minimum Rate)*

The objective of this second alternative is to establish a viable project situation from the perspective of the ability to pay of the population in terms of the energy rates and of the terms of credit and other sources of financing for the project. Again, using Tiquipaya as an example, this alternative contemplates the following financial structure:

-	<i>Credit</i>	<i>US\$ 23.627</i>	<i>30%</i>
-	<i>Other sources</i>	<i>US\$ 55.129</i>	<i>70%</i>
	<i>TOTAL</i>	<i>US\$ 78.755</i>	<i>100%</i>
	<i>AMOUNT WITH SOURCE NOT IDENTIFIED</i>	<i>US\$ 18.524</i>	<i>23,5%</i>

Taking into account the 30 percent credit and the contributions specified above, there remains a total of US\$ 18,524 (23.5 percent of the total investment) to be identified. The resulting monthly energy rate is US\$ 10.00 per family, considered more accessible for the users. The cashflow analysis results in a NPV of US\$ 4,481, at a discount rate of 10.0 percent, and an IRR of 12.7 percent. These show an acceptable profit margin at the cost of a significant percentage of sunk costs. Since these are analyses of extreme cases, the exercises provide the parameters within which the technicians in charge of the project implementation (and, in that sense, the verification and analysis of the final information and taking the final decision as to project configuration and form of financing), will have a good idea of the range of possibilities within which to work.

Output 2.5: Organization of Coverage in Rural Areas.

Activity 2.5.1: Contracting of Financial Services from Existing Local Capacities (Financial NGOs) to Provide the Loans, including the Provision of Technical Assistance and Other Services in the Long Term.

Opportunities for the implementation of replicable rural electrification projects depend to some degree on the presence of financial operators in rural areas. Due to the geographic nature of the country, most financial operators have no presence in the rural areas. This lack of presence and experience in financing rural development needs serves as a barrier to the successful deployment of renewable energy options in rural Bolivia. This barrier can be attacked in the

short-run through the contracting of financial services from existing local capacity. The Program would make funds available on a short-term basis to help in financing subcontracts with institutions which have existing facilities. On a longer horizon, the financial operators will establish their own agencies in areas where their existence can be justified on the basis of project concentration. The Program expects that the financial operator will open four new offices using the agencies' own funds. The Program will provide both technical assistance and small amounts of additional financing to assist in the strengthening of these and other additional offices.

Immediate Objective 3: Institutional Strengthening of Local Electric Utilities.

Limited familiarity with electricity, renewable energy, the installation and maintenance of renewable energy systems, the profitable operation of local electric companies (under any of the institutional options identified above), and the need for transparent governance of local electric supply services, all serve as barriers to the successful implementation of renewable rural electrification. The sustainability and duration of a rural electrification system depends to a large degree on the manner in which the users of that system are able to properly use and care for it. Additionally, most of the rural population of Bolivia have limited knowledge related to electrical energy and renewables.

This objective seeks to overcome these human capacity barriers by providing training at four different levels. As the Program will include the identification (or establishment) of some form of local electric company to utilize credit financing to obtain renewable electricity services and to ensure the day-to-day operation of the electrification system, the Program's success will require considerable training of all participants. It will be necessary to provide special training at four levels: the general population of project participants; nominees selected to serve on boards of directors; skilled and semi-skilled workers; and administrative and managerial staff. Additionally, the Program will provide technical assistance to the newly constituted firms as follow-up to the training activity.

Output 3.1: Trained Users, Beneficiaries and Nominees Selected to Serve on Boards of Directors

Activity 3.1.1: Development of Written educational Materials as Well as Radio Broadcasts and Institute Training for Project Participants in the Areas of Rural Electricity Company Governance, Use and Avoidance of Misuse of Electrical Energy from Renewable Sources, and in the Potential for Using Electricity Productively.

All project participants will have a role to play in the governance of the local electric utility being established. In many cases, project participants have never utilized electricity and will need to be taught about both its safe use (and potential misuse) and its potential for productive use. Therefore, this activity will develop materials and institute training for project participants in the areas of: Rural Electricity Company Governance; the Use and Avoidance of Misuse of Electrical Energy from Renewable Sources; and the Potential for Using Electricity Productively. Previous experience in Bolivia has shown that even in relatively technical areas like water, tailoring training to include women has

guaranteed that the training achieves its desired end as rural women frequently play a critical role in paying system costs, ensuring safe and productive uses, and maintaining the systems installed. Given the large distances and numbers of individuals involved, this activity will seek to develop both written materials and radio broadcasts to reach the disperse areas covered by the Program in a cost-effective manner.

Activity 3.1.2: Training of 500 People as Potential Participants in Decision-making on Boards of Local Supply Entities.

Under this activity, participating members nominated for the Boards of Directors of the local supply entities will be trained through both information dissemination and reflection workshops. It is anticipated that as many as 500 persons (20 per project site) will be trained for their responsibilities as rotating membership on the Boards of Directors. Again, care will be exercised to ensure that an adequate number of potential board members and trainees are women.

Output 3.2: Trained Persons to Fill Skilled and Semi-skilled Positions within the Local Electricity Entities.

Activity 3.2.1: Training of At Least 125 individuals for Skilled and Semi-skilled Positions within the Local Electricity Companies.

Personnel included in this segment of the training program are administrators, technical assistants and collections assistants. Separate training activities will be conducted for each level. Within each activity, two phases of training will be included - formal, specialized training for that position, followed by on-the-job training and evaluation. It is estimated that approximately 125 individuals will require training under this activity. All training will be accomplished by contracted training facilities on a cost-plus basis.

Output 3.3: Solidly Managed and Operated Local Electric Companies

Activity 3.3.1: Provision of Technical Assistance for the Constitution of New Firms (or Reinforcement of Existing Firms) in the Local Project Area.

To ensure the success of the local electric companies, the Program anticipates that the managers of the local electric company will require technical assistance in the areas of financial management, purchasing, contracting and system supervision. This will be accomplished on an ongoing basis and/or upon request from the local entity. At the same time, the Program will provide specialized assistance to the firms contracted to provide maintenance and technical support in order to insure that the personnel are prepared to provide the long-term support after assistance under the Program is phased out.

Immediate Objective 4: Installation of Twenty-two Community-level Rural Electrification Projects Using Public, Private and where Appropriate donor Financing in a Transparent and Carefully Monitored and Evaluated Environment.

The majority of the renewable energy facilities established in rural areas in the past have been either wholly donor-financed or purchased outright by the users. Only in Santa Cruz have a limited number of users been able to purchase renewable-generated electricity from a cooperative utility (CRE). There is little or no experience on financing renewable rural energy systems from either public or private sources. The purpose here is to facilitate the establishment of twenty-two community-level rural electrification projects using public, private, and where appropriate donor financing in a transparent and carefully monitored and evaluated environment. This will not only help provide data on repayment capabilities necessary for risk evaluation by private financiers, but also help evaluate the effectiveness of the proposed institutional arrangements for renewable rural energy provision.

Output 4.1: Twenty-two Operational Community-level Rural Electrification Projects.

The prefeasibility studies for each of the 22 projects as developed under the PDF will be finalized, including the development of the financial plans for each project given the different possible institutional configurations.

Activity 4.1.1: Finalization of Prefeasibility Studies for 22 Projects, Including the Development of Financial Plans for Each Project in Accordance with Identified Institutional Options.

Under the PDF, detailed plans for the projects utilizing photovoltaics have been developed under the assumption of SAM execution. Equivalent financial plans, consistent with the other operational options, will be drafted for presentation to the community participants. This activity includes the preparation of various implementation options for each of these projects.

For hydro and wind-hybrid projects developed under the PDF, detailed feasibility studies and financial plans remain to be prepared prior to drafting procurement specifications. Implementation options will be prepared for each.

Activity 4.1.2: Participatory Evaluation of Institutional and Financial Options with Each of the Communities of the Program.

This activity includes a participatory evaluation of the institutional and financial options open to each community. The different options will be presented and discussed with the project participants. This will provide them with a full range their options and a frank assessment of the advantages and disadvantages of each approach. In this manner they will be then presented all of the relevant facts and enabled to decide which approach they wish to pursue.

Activity 4.1.3: Assistance to Each Local Electric Utility in Preparing the Procurement Specifications for the Installation Bidding, Including the Selection of the Contractors to Carry Out the Installation of the Systems.

This activity covers the development of specifications for project installation, evaluation of bids, and selection of contractors for installations. After the communities have expressed their preferences and demonstrated their

willingness and commitment to meet their obligations under the project, the local electricity utilities will be assisted in drafting procurement specifications, putting them out to bid, and selecting the private contractors to carry out the installation of the systems. The goal of this activity is to assist each local electric utility in their first procurement process, ensuring that the process is carried out in a competent and transparent manner, according to the rules of the local electricity company. While in some instances, the installation and maintenance contracts may be combined, the flexibility to separate procurement and maintenance may be affected as appropriate.

Output 4.2: Project Installation

Activity 4.2.1: Supervision and Oversight of Project Installation

Under this activity, the Project Facilitation Center will provide for supervision and oversight of project installation to ensure that the companies perform according to their contracts. It will also involve ensuring that PV and wind-hybrid installations are undertaken according to the codes and standards agreed upon Objective 5. An additional US\$ 571,546 will be used as part of the monies required to finance local projects. These funds will be allocated to projects as the rate of US\$ 206,26 per solar PV system for the purpose of offsetting the incremental costs of renewable energy-based system installations.

Output 4.3: Specifications for Facility Maintenance Contracts and Selection of Maintenance Providers Developed

Activity 4.3.1: Assistance in the Bidding Process for Maintenance of Facilities

The final activity in the establishment of these twenty-two projects is the development and establishment of contracts for the maintenance of the facilities once they are established. The Project Facilitation Center will arrange for assistance in the drafting of the contracts, the obtaining of bids and the final negotiation of those contracts. While some firms may wish to respond to the request for contracts from more than one community, the options of individual contracts should be left open.

Immediate Objective 5: Development of Standards and Certification Procedures for Renewable Energy-based Commercial Electrification Systems.

Bolivia does not have national standards for any of the renewable energy-based commercial electrification systems or for system components. At the same time, at the local and regional levels in Bolivia the number of trained technicians and trainers in the area of renewable energy-based systems is insufficient to fulfill local needs. There are no certified technicians in the renewable energy sector. This lack of standards and installation certification procedures has been identified as another barrier to the widespread adoption of renewable energy.

Output 5.1: Establishment of Standards for Renewables.

Under the PDF activity of this Program, limited support was provided to the Bolivian National Institute of Standards and Quality (IBNORCA) in initiating

the process of evaluating international experiences of standards in the renewable energy arena. Under this activity, collaboration will continue in order to accumulate information and experiences from other countries with special attention to specific data related to Bolivian conditions.

Activity 5.1.1: Evaluation of International Experiences and Standards in the Renewable Energy Arena

Activity 5.1.2: Support the Establishment and Publication of Standards for Photovoltaic Domestic Installations.

To further support the implementation of the standards for photovoltaic (PV) domestic installations, a follow-up will be done with IBNORCA and the group of manufactures, installers, and providers of renewable energy components, to establish and publish the standards. The agreed-upon standards will be disseminated to all users. This will be done in two ways: 1) a special document will be published and send to all parties concerned and 2) through the certification procedure described in Output 5.2.

Output 5.2: Assistance for the Establishment of a Certification Program.

The Program will provide support for the establishment of a certification procedure using the standards as a baseline to ensure a proper installation for every solar system. This will include the following components:

Activity 5.2.1: *A certified instructor will be contracted from abroad by calling on a training center that has extensive experience in training for Photovoltaic installations.*

Activity 5.2.2: *The instructor will train ten experienced local PV installers on the correct installation procedures following the norms established by IBNORCA. This instructor will also train these individuals as "trainers", including certification procedures and training methods.*

Activity 5.2.3: *These local trainers then will train and certify less experienced technicians on installations procedures.*

Immediate Objective 6: Program Management, Supervision, and Monitoring

Given the innovative and experimental nature of the Program, a separate function of the PFC will be the monitoring and evaluation of Program activities. A major role of this activity will be to establish the relative operational success of the various pilot projects, the establishment of "best practices" with respect to rural electricity provision, and the maintenance of repayment schedules under each community-based project. This information will be essential not only for ensuring the effectiveness of the Program, but also in providing useful input to future renewable energy-based rural electrification initiatives. UNDP-Bolivia's extensive experience in monitoring large scale projects and programs will be drawn upon in establishing this unit.

Output 6.1: A Project Facilitation Center Established in the Vice Ministry of Energy and Hydrocarbons

Activity 6.1.1: Recruitment of a Project Technical Advisor

Activity 6.1.2: Recruitment of Administrative Support Personnel

Activity 6.1.3: Design and Implementation of an Information system on Rural Electricity Provision.

E. Inputs

1. Government Commitment

45. The Program has strong country support and is consistent with Bolivia's renewable energy development priorities. The Government of Bolivia has requested the assistance of UNDP/GEF in the preparation and financing of the proposed Program. The Program has the full support and approval of the Government through the Ministry of Economic Development and the VMEH.

46. The Ministry of Economic Development and the Vice Ministry of Energy and Hydrocarbons are important stakeholders. They are responding to a national commitment to supply electricity to 78 percent of the rural population by the year 2001. They also have a stake in providing such services at the lowest possible cost in view of the extremely low level of incomes in the rural areas of the country. Renewable energy-based electricity supply options are viewed as potentially superior to both grid-based supply options and decentralized (small-scale) fossil-fuel supply options in economic, environmental and logistic terms.

47. Direct technical support will be provided by the Vice Ministry of Energy and Hydrocarbons, through the Project Facilitation Center, and to the extent possible, by the private sector with financial support from the Government. Also through the PFC, the Program provide support to the VMEH in order to reinforce its internal capability for the purpose of inter-institutional and inter-project coordination. The Unit will provide support for completion and maintenance of the national-level renewable energy database, to be available for consultation by any interested party. At a minimum, this database should contain information related to the location and extension of the electrical grid in Bolivia, data related to on-going renewable energy projects and programs, directories of who is involved in what as it related to renewable energy, lists of commercial, technical and public entities in the area, etc. This activity should be developed in close coordination with UNDP's Sustainable Development Network (a program which provided linkage between developing country participants and the international electronic networks). The National Fund for Rural Development will contribute US\$ 1,000,000 to the Program for the endowment of the revolving fund.

2. Nongovernmental contributions

48. Local communities, beginning with the target projects in the five departments of the country, have a real stake in contributing to the implementation and protection of the renewable energy systems, and will benefit directly from their availability, not only for household uses of electricity, but for important community services (expanded potable and agricultural water supply, health posts, schools, lighting of streets and market places, etc.) and economically productive activities (especially in increased and improved agricultural and livestock production, artisan activities, small industry, and the like). It is expected that many of the local communities will contribute a important portion of the

equity in the electricity supply systems and that all will cover the operating and administrative costs of the service.

49. The local electricity company, with participation from the municipal government and oversight by the *Organización Territorial de Bases (OTB)*¹ will coordinate the effort to ensure that the Program and projects include activities aimed to help community residents understand how to use (and to not abuse) the energy systems, and to ensure that the community and each user of the service pay the agreed-upon fees. Under the Popular Participation Law, approximately US\$ 1,390,800 will be made available for the municipality-based projects. Users will be required to provide approximately US\$ 711,700 for project activities as a precondition for acceptance into the Program.

50. Local financial institution will provide substantial support through their contribution of infrastructure, personnel time, training, etc., in the establishment and operation of additional facilities to handle operations related to the management of financial flows related to the individual projects of this Program. The Bolivia private financial sector is expected to contribute approximately US\$ 603,750 to the Program as part of their activities.

3. UNDP/GEF support and financing

51. The UNDP Country Office in La Paz will provide support to the Program, including convening the Tripartite Reviews, providing assistance in the design and conduct of international competitive bids for equipment and services under ICB rules, in the procurement of expert technical assistance, and in the arrangements for in-country collaboration with international technical assistance sources

52. The estimated total Program costs are US\$ 228,000. The GEF is being asked to provide US\$ 4,217,719 (which includes US\$ 122,671 as executing agency support and US\$ 234,000 in preparatory costs) as support for the incremental costs of the Program. UNDP is providing US\$ 100,000 for Program activities relating to the institutional arrangements for accessing funds under the Popular Participation Law. Details of the estimated budget are shown in the attached tables.

F. Risks

53. The Bolivian private sector does not presently have the capacity to support implementation of the Program goals. There is a risk that the Program may not catalyze sufficient private sector participation to ensure in-country supply of equipment and associated services during the post-Program period. Special efforts will be made to provide information and training to qualified local companies, and to facilitate or broker international joint ventures with the private sector. Also, the government may need to devise a system of incentives and/or promote the establishment of international joint ventures to assure the success of this phase of the Program.

54. The proposed Program activities are intended to remove barriers to the widespread adoption of renewable-energy based rural electrification. As pointed out by the technical reviewer, the one barrier which may not be removed through this Program is the low-volume, high production cost barrier. Because of the relatively low annual turn-around of the Bolivia producers for PV's and small-hydro systems, the production costs of these technologies may still be higher than that found in other countries. While this may be less of a problem for small hydro systems (which are compared to the decentralized diesel electrification baseline), for PV systems (which are considered to demonstrate a positive incremental cost when viewed against the baseline of continued kerosene, candle and battery

¹ OTBs are composed of members of the community, responsible for the verification of the use of funds distributed under the Popular Participation Law.

purchases), some incremental costs will remain. Industry analysts expect the costs of the Bolivian produced components of PV systems to fall due to the increased turnover brought about by this Program. Whether the incremental costs of PV systems will approach zero, or whether they will justify additional support, can only be determined by constant monitoring and continual re-evaluation.

55. The use of rapidly evolving commercial equipment, such as PV systems and small hydroelectric plants, requires considerable technical capability and experience. Without this support, there is a strong risk of technical problems delaying project implementation and limiting project effectiveness. The program has been designed to ensure that the necessary in-country technical expertise will be established, and that the implementing organizations have full technical support from collaborating institutions.

56. Sustainable provision of electricity services in rural areas generally requires that energy services be provided by an energy service company (either public or private), rather than expecting rural communities to own and operate the equipment. The suppliers of energy services must establish partnerships with local communities to ensure that the equipment is not abused or misappropriated. Lastly, local communities must be willing and able to pay for the full-cost of energy services for these to be sustainable. To date, most renewable energy projects in Bolivia have neither attempted to incorporate available local financial resources into project financing nor have they required users to pay for the services.

57. It is evident from the studies that local communities often have the financial resources to pay for operation and maintenance, if the infrastructure is available.

G. Prior Obligations and Prerequisites

1. Prior obligations

None.

2. Prerequisites

- The Program will be signed by UNDP, and UNDP assistance to the Program will be provided, subject to UNDP receiving satisfaction that the prerequisites listed below have been fulfilled or are likely to be fulfilled.
- The Government of Bolivia will arrange timely appointment of counterpart staff prior to the commencement of the Program so that the Program schedules will not be delayed.
- The Government of Bolivia will arrange for timely availability of offices and facilities that are accessible to all Program staff.
- The Government of Bolivia will formally constitute and establish the Project Facilitation Center and its Directorate, as outlined in the Program document.
- The Government of Bolivia will commit a contribution to the revolving fund of \$US 1 million from the National Rural Development Fund.

H. Program Review, Reporting and Evaluation

58. The Office of the United Nations Development Program in Bolivia will, in due course, provide guidelines in order to ensure that the tripartite review, project performance evaluation reports (PPERs) and the midterm evaluation give due consideration to assessment of global impact in accordance with GEF criteria.

- The Program will be subject to tripartite review (joint review by representatives of the government, the executing agency and the UNDP) at least once every 12 months, the first such meeting to be held within the first 12 months of the start of full implementation.
- The National Program Coordinator and-or the senior project officer of the implementing agency shall prepare and submit to each tripartite review meeting a PPER. Additional PPERs may be requested, if necessary, during the life of the Program.
- A midterm evaluation will be conducted during the third year of the Program.
- A Program terminal report will be prepared for consideration at the final tripartite review meeting. It shall be prepared in draft in advance and be distributed to all parties to allow review and technical clearance by the executing agency four months prior to the final tripartite review.
- Quarterly implementation progress reports will be completed by each of the implementing entities.
- Technical reports will be produced by all institutions which are subcontracted to carry out a specific activity as outlined in the Program document.

I. Legal Context

59. This program document shall be the instrument referred to as such in Article 1 of the Standard Basic Agreement between the Government of Bolivia and the United Nations Development Programme.

60. The following types of revisions may be made to this program document with the signature of the UNDP resident representative only, provided he or she is assured that the other signatories of the program have no objections to the proposed changes:

- revisions in, or addition of, any of the annexes of the program document;
- revisions which do not involve significant changes in the immediate objectives, output or activities of the program but are caused by the rearrangement of inputs already agreed to or by cost increases due to inflation; and
- mandatory annual revisions which rephrase the delivery of agreed program inputs, reflect increased expert and/or other costs due to inflation or take into account agency expenditure flexibility

BOL/97/G31 - Rural Electrification with Renewable Energy

Budget "A"

SBLN	Description	Implement. Agency		Total	1999	2000	2001	2002
010.	PERSONNEL							
013.	Administrative Support							
013.01	Administrator	VMEH	Cont. Neta	63,000	9,000	18,000	18,000	18,000
			M/T	42.0	6.0	12.0	12.0	12.0
			Total	63,000	9,000	18,000	18,000	18,000
013.02	Administrative assistant	VMEH	Cont. Neta	4,800	4,800	-	-	-
			M/T	8.0	8	0.0	0.0	0.0
			Total	4,800	4,800	-	-	-
013.99	Total Administrative Support		Cont. Neta	67,800	14,800	18,000	18,000	18,000
			M/T	50.0	14	12.0	12.0	12.0
			Total	67,800	14,800	18,000	18,000	18,000
015.	Travel							
015.01	Local Travel	VMEH	Cont. Neta	80,000	20,000	20,000	20,000	20,000
			Total	80,000	20,000	20,000	20,000	20,000
015.99	Total Travel		Cont. Neta	80,000	20,000	20,000	20,000	20,000
			Total	80,000	20,000	20,000	20,000	20,000
016.	Mission Cost							
01	International Missions	VMEH	Cont. Neta	60,000	15,000	15,000	15,000	15,000
			Total	60,000	15,000	15,000	15,000	15,000
016.99	Total Mission Cost		Cont. Neta	60,000	15,000	15,000	15,000	15,000
			Total	60,000	15,000	15,000	15,000	15,000
017.	Local Personnel							
017.01	General Coordinator (EFP)	VMEH	Cont. Neta	147,000	21,000	42,000	42,000	42,000
			M/T	42	6.0	12.0	12.0	12.0
			Total	147,000	21,000	42,000	42,000	42,000
017.02	GEF Coordinator (EFP)	VMEH	Cont. Neta	120,000	30,000	30,000	30,000	30,000
			M/T	48	12	12.0	12.0	12.0
			Total	120,000	30,000	30,000	30,000	30,000
017.03	Engineer (EFP)	VMEH	Cont. Neta	105,600	26,400	26,400	26,400	26,400
			M/T	48	12	12.0	12.0	12.0
			Total	105,600	26,400	26,400	26,400	26,400
017.04	Economist (EFP)	VMEH	Cont. Neta	105,600	26,400	26,400	26,400	26,400
			M/T	48	12	12.0	12.0	12.0
			Total	105,600	26,400	26,400	26,400	26,400
017.05	Sociologist (EFP)	VMEH	Cont. Neta	92,400	13,200	26,400	26,400	26,400
			M/T	42	6	12.0	12.0	12.0
			Total	92,400	13,200	26,400	26,400	26,400
017.06	Consultant 1 (act.5)	VMEH	Cont. Neta	5,000	-	5,000	-	-
			M/T	5	-	5.0	-	-
			Total	5,000	-	5,000	-	-
017.07	Consultant 2 (act.5)	VMEH	Cont. Neta	5,000	-	5,000	-	-
			M/T	5	-	5.0	-	-
			Total	5,000	-	5,000	-	-
017.08	Consultant 3 (FNDR)	VMEH	Cont. Neta	21,600	21,600	-	-	-
			M/T	12	12	-	-	-

BOL/97/G31 - Rural Electrification with Renewable Energy

Budget "A"

SBLN	Description	Implement. Agency		Total	1999	2000	2001	2002
017.09	Consultant 4 (FNDR)	VMEH	Total	21,600	21,600	-	-	-
			Cont. Neta	21,600	10,800	10,800	-	-
			M/T	12	6	6.0	-	-
			Total	21,600	10,800	10,800	-	-
017.50	Mid term Consultant, 1 - 6 month	VMEH	Cont. Neta	200,000	50,000	50,000	50,000	50,000
			Total	200,000	50,000	50,000	50,000	50,000
017.97	Short term Consultants, < 1 month	VMEH	Cont. Neta	20,000	5,000	5,000	5,000	5,000
			Total	20,000	5,000	5,000	5,000	5,000
017.99	Total of National Personnel		Cont. Neta	843,800	204,400	227,000	206,200	206,200
			M/T	262	66.0	76.0	60.0	60.0
			Total	843,800	204,400	227,000	206,200	206,200
019.	Total of Personnel		Cont. Neta	1,051,600	253,200	280,000	259,200	259,200
			M/T	312	80	88	72	72
			Total	1,051,600	253,200	280,000	259,200	259,200
020.	SUB-CONTRACTS							
021.	Subcontracts(A)							
021.10	Auditing	VMEH	Cont. Neta	10,000	2,500	2,500	2,500	2,500
			Total	10,000	2,500	2,500	2,500	2,500
021.20	Evaluation	VMEH	Cont. Neta	10,000	-	-	10,000	-
			Total	10,000	-	-	10,000	-
021.99	Total Subcontracts (A)		Cont. Neta	20,000	2,500	2,500	12,500	2,500
			Total	20,000	2,500	2,500	12,500	2,500
022.30	Revolving Fund (FNDR)	VMEH	Cont. Neta	1,000,000	500,000	300,000	200,000	-
			Total	1,000,000	500,000	300,000	200,000	-
022.40	Oper. Rules. Amortization Period	VMEH	Cont. Neta	20,000	20,000	-	-	-
			Total	20,000	20,000	-	-	-
022.99	Total Subcontracts (B)		Cont. Neta	1,020,000	520,000	300,000	200,000	-
			Total	1,020,000	520,000	300,000	200,000	-
023.	Subcontracts (C)							
023.10	Cap. users, cand. Direction	VMEH	Cont. Neta	76,000	50,000	26,000	-	-
			Total	76,000	50,000	26,000	-	-
023.20	Cap. Managers, technicians	VMEH	Cont. Neta	275,000	75,000	137,000	63,000	-
			Total	275,000	75,000	137,000	63,000	-
023.30	Colaboration to companies	VMEH	Cont. Neta	300,000	75,000	75,000	75,000	75,000
			Total	300,000	75,000	75,000	75,000	75,000
023.99	Total Subcontracts (C)		Cont. Neta	651,000	200,000	238,000	138,000	75,000
			Total	651,000	200,000	238,000	138,000	75,000
024.	Subcontracts (D)							
024.10	Conclusion of project studies	VMEH	Cont. Neta	340,000	110,000	120,000	110,000	-
			Total	340,000	110,000	120,000	110,000	-
024.20	Project Execution	VMEH	Cont. Neta	470,000	117,500	117,500	117,500	117,500
			Total	470,000	117,500	117,500	117,500	117,500
024.30	Maintenance framework	VMEH	Cont. Neta	30,000	-	-	20,000	10,000
			Total	30,000	-	-	20,000	10,000

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Budget "A"

SBLN	Description	Implement. Agency		Total	1999	2000	2001	2002
024.99	Total Subcontracts (D)		Cont. Neta Total	840,000 840,000	227,500 227,500	237,500 237,500	247,500 247,500	127,500 127,500
025.	Subcontracts (E)							
025.10	Renewable energies norms	VMEH	Cont. Neta Total	25,000 25,000	10,000 10,000	15,000 15,000	- -	- -
025.20	Certification Program	VMEH	Cont. Neta Total	20,000 20,000	10,000 10,000	10,000 10,000	- -	- -
025.99	Total Subcontracts (E)		Cont. Neta Total	45,000 45,000	20,000 20,000	25,000 25,000	- -	- -
029.	TOTAL SUB-CONTRACTS		Cont. Neta Total	2,576,000 2,576,000	970,000 970,000	803,000 803,000	598,000 598,000	205,000 205,000
030.	TRAINING							
032.	Group Training							
032.01	Training on	VMEH	Cont. Neta Total	17,000 17,000	5,000 5,000	6,000 6,000	6,000 6,000	- -
99	Total Training by Group		Cont. Neta Total	17,000 17,000	5,000 5,000	6,000 6,000	6,000 6,000	- -
034.	Meetings							
034.01	Workshop 1	VMEH	Cont. Neta Total	10,000 10,000	10,000 10,000	- -	- -	- -
034.02	Workshop 2	VMEH	Cont. Neta Total	10,000 10,000	- -	10,000 10,000	- -	- -
034.03	Workshop 3	VMEH	Cont. Neta Total	10,000 10,000	- -	- -	10,000 10,000	- -
034.04	Workshop 4	VMEH	Cont. Neta Total	12,000 12,000	- -	- -	- -	12,000 12,000
034.99	Total workshops		Cont. Neta Total	42,000 42,000	10,000 10,000	10,000 10,000	10,000 10,000	12,000 12,000
039.	TOTAL TRAINING		Cont. Neta Total	59,000 59,000	15,000 15,000	16,000 16,000	16,000 16,000	12,000 12,000
040.	EQUIPMENT							
045.	Local Purchase of Equipment							
045.01	Equipment, local purchase	VMEH	Cont. Neta Total	20,000 20,000	20,000 20,000	- -	- -	- -
045.99	Total Local Purchase of Equipment		Cont. Neta Total	20,000 20,000	20,000 20,000	- -	- -	- -
046.	International Purchase of Equipment							

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Budget "A"

SBLN	Description	Implement. Agency		Total	1999	2000	2001	2002
046.01	Equipment, international purchase	VMEH	Cont. Neta	25,000	25,000	-	-	-
			Total	25,000	25,000	-	-	-
046.99	Total International Purchase of Equipment		Cont. Neta	25,000	25,000	-	-	-
			Total	25,000	25,000	-	-	-
049.	TOTAL EQUIPMENT		Cont. Neta	45,000	45,000	-	-	-
			Total	45,000	45,000	-	-	-
050.	Miscellaneous							
051	Various							
051.01	Miscellaneous	VMEH	Cont. Neta	30,000	8,000	8,000	7,000	7,000
			Total	30,000	8,000	8,000	7,000	7,000
051.99	Total, Various		Cont. Neta	30,000	8,000	8,000	7,000	7,000
			Total	30,000	8,000	8,000	7,000	7,000
052.	Costs of Reports							
052.01	Reports, publications	VMEH	Cont. Neta	80,000	20,000	20,000	20,000	20,000
			Total	80,000	20,000	20,000	20,000	20,000
99	Total, Cost of Reports		Cont. Neta	80,000	20,000	20,000	20,000	20,000
			Total	80,000	20,000	20,000	20,000	20,000
053.	Miscellaneous							
053.01	Sundries	VMEH	Cont. Neta	19,448	4,448	5,000	5,000	5,000
			Total	19,448	4,448	5,000	5,000	5,000
053.99	Total of Miscellaneous		Cont. Neta	19,448	4,448	5,000	5,000	5,000
			Total	19,448	4,448	5,000	5,000	5,000
054.	Direct Costs							
054.01	Project Support Services	VMEH	Cont. Neta	122,671	41,314	35,805	29,031	16,521
			Total	122,671	41,314	35,805	29,031	16,521
054.99	Total Direct Costs		Cont. Neta	122,671	41,314	35,805	29,031	16,521
			Total	122,671	41,314	35,805	29,031	16,521
059.	TOTAL MISCELIANEOUS		Cont. Neta	252,119	73,762	68,805	61,031	48,521
			Total	252,119	73,762	68,805	61,031	48,521
099.	TOTAL BUDGET		Cont. Neta	3,983,719	1,356,962	1,167,805	934,231	524,721
			M/T	312	80.0	88.0	72.0	72.0
			Total	3,983,719	1,356,962	1,167,805	934,231	524,721

Table 1. Global Program Budget (US\$)

Objectives	Output	Popular Part.	User	UNDP	GEF	Other	Total
1. Evaluation of Institutional Options	1.1			25,000			25,000
	1.2			25,000			25,000
	1.3			50,000			50,000
Subtotal Objective 1		0	0	100,000	0	0	100,000
2. Removal of Barriers in Financing Mechanism	2.1				48,000	36,650	84,650
	2.2				261,600	469,500	731,100
	2.3				1,000,000	1,000,000	2,000,000
	2.4				25,000		25,000
	2.5				177,600	97,600	275,200
Subtotal Objective 2		0	0	0	1,512,200	1,603,750	3,115,950
3. Strengthening Local Utility Companies	3.1				74,600		74,600
	3.2				275,000		275,000
	3.3				300,000		300,000
Subtotal Objective 3		0	0	0	649,600	0	649,600
4. Installation of 22 Rural Electrification Projects	4.1			0	340,000		340,000
	4.2	1,390,800	711,700		692,248		2,794,748
	4.3				30,000		30,000
Subtotal Objective 4		1,390,800	711,700		1,062,284	0	3,164,748
5. Development of Standards and Certification Procedures	5.1				25,000		25,000
	5.2				60,000		60,000
Subtotal Objective 5		0	0	0	85,000	0	85,000
Program Management, Supervision and Monitoring	6.1	0	0	0	780,000	250,000	1,030,000
Subtotal Objective 6					780,000	250,000	1,030,000
SUBTOTAL		1,390,800	711,700	100,000	3,861,048	1,853,750	8,145,298
EXECUTING AGENCY SUPPORT COSTS (3%)					122,671		122,671
TOTAL		1,390,800	711,700	100,000	3,983,719	1,853,750	8,267,969

Source: UNDP/GEF (NY) and Solsticio, SRL.

(* PDF B - 234,000 not included)

Table 2. GEF Budget (US\$)

Objective	Output	Personnel	Subcontracts	Equipment	Transport	Other	Total
1. Evaluation of Institutional Options	1.1 1.2 1.3						
Subtotal Objective 1		0	0	0	0	0	0
2. Removal of Barriers in Financing Mechanism	2.1 2.2 2.3 2.4 2.5	46,000 150,000 14,400 210,400	 72,000 25,000 115,200 212,200	 33,000 1,000,000 8,000 1,041,000		2,000 6,600 40,000 48,600	48,000 261,600 1,000,000 25,000 177,600 1,512,200
Subtotal Objective 2					0		
3. Strengthening Local Utility Companies	3.1 3.2 3.3		74,600 275,000 300,000 649,600				74,600 275,000 300,000 649,600
Subtotal Objective 3		0		0	0	0	
4. Installation of 22 Rural Electrification Projects	4.1 4.2 4.3		340,000 692,248 30,000 1,062,248				340,000 692,248 30,000 1,062,248
Subtotal Objective 4		0		0	0	0	
5. Development of Standards and Certification Procedures	5.1 5.2		25,000 25,000 50,000	25,000 25,000			25,000 60,000 85,000
Subtotal Objective 5		10,000 10,000			0	0	
6. Program Management, Supervision and Monitoring	6.1	300,000 300,000	0	150,000 150,000	205,000 205,000	125,000 125,000	780,000 780,000
Subtotal Objective 6							
SUBTOTAL		520,400	1,974,048	1,216,000	205,000	173,600	4,089,048
EXECUTING AGENCY SUPPORT COSTS (3%)		15,612	59,221	36,480	6,150	5,208	122,671
TOTAL		536,012	2,033,269	1,252,480	211,150	178,808	4,211,719

Source: UNDP/GEF (NY) and Solsticio, SRL.

Annex 1

PROJECTION OF CARBON EMISSIONS AVOIDED

Case 1: Emission Reductions Directly Attributable to Project

Average Emissions Avoided per Year, per Project (MT of carbon)	13.79
Projects in the Program (No.)	22
Years of Project Operation during a 20-year Period (No.)	417
Emissions Avoided by 22 Projects of the Program (MT)	21,100
Additional Projects Financed with Funds Recovered from the Revolving Fund (No.)	44
Years of Project Operation during a 20-year Period (No.)	308
Emissions Avoided by the 44 Additional Projects (MT of Carbon)	4,262
Total Emissions Avoided by the 69 Projects (MT of Carbon)	10,017

Case 2: Total Emission Reduction Potential Through Total Replication in Bolivian Rural Market

Estimated Rural Population of Bolivia (No.)	2,726,000
Estimated Rural Population with Electricity (%)	25
Estimated Rural Population without Electricity (No.)	2,044,500
Estimation of the Rural Population in the Area of Influence of the NIS (%)	20
Estimated Rural Population without Access to the NIS (No.)	1,635,600
Estimated Average Population per Project (No.)	2,490
Projects Necessary to Cover the Rural Area which does not have Access to the NIS (No.)	657
Total Emissions Avoided in 20 Years (MT of Carbon)	181,296

Annex 2

INCREMENTAL COSTS

Broad Development Goals

The broad development goal being pursued by this Program is the provision of basic electricity services to the remote rural population of Bolivia. At present, approximately 25 percent of the rural population has access to electricity. The Government has goal of ensuring that 78 percent of the rural population gains access to electricity over the coming ten years. However, such a goal can only be achieved if the private sector is mobilized to provide these electricity services on a sustainable basis using both public and private resources.

To achieve its objective, the Government contracted the consulting company, Solsticio, SRL., to provide, "Assistance in the Preparation of a Rural Electrification Program with Renewable Energies, using the Popular Participation Process". The purpose of the technical assistance was to prepare a Program Document, culminating in the design of 22 rural electrification projects at the municipal section level, in five Departments of Bolivia. One of the tasks included in this effort was the estimation of incremental costs for the execution of the projects and for the overall Program.

Incremental costs are those additional costs associated with the execution of the rural electrification projects in municipal sections which have their own renewable energy resources and which can be utilized as an alternative to the use of traditional energy sources. The calculation of incremental costs is based on a "reference case", from which is calculated additional costs.²

The original version of the present document was prepared in February 1997 in cooperation with consultants of the New York Office of UNDP/GEF. In the course of the subsequent three months, as a result of a series of telephone conversations between personnel of the consulting company and the consultants and based on the advance of the preparation of the project documents and the Program, the content of this document has undergone a series of modifications. The present version of the document reflects these modifications. As a result of these modifications, the information is more current and the results reflect as nearly as possible the reality of the situation.

² The "reference case" refers to a situation in which the "Rural Electrification Program Using Renewable Energies" does not exist, with the result that the communities, using their own resources, attempt to accomplish electrification using conventional forms of energy or through extensions of the National Interconnected System.

Baseline:

Under the baseline, there will be some investment in rural electrification. A large number of communities have placed a high priority on rural electrification. However, the larger part of this investment will be in decentralized small diesel generating sets and in connection to the grid. Even so, insufficient resources are available to meet the financing needs of these conventional projects. As a result, there is significant pent-up demand for electricity in rural areas. The problem becomes one of helping rural communities muster the resources and obtain the financing to implement these projects. This means that conventional rural electrification is liable to continue. Communities with financing under the Popular Participation Law will be able to invest using those resources. However, those investments will be unlikely to extend to renewable electricity as most electrification involves either grid extension or decentralized diesel generation.

For some of the communities of the 22 projects initially targeted for support under this program, the baseline extends only to a continuation of the current use of kerosene, candles and batteries for lighting and electricity needs. For others, the baseline will likely be a small diesel generating set. The differences depend upon the nature of the community, its settlement pattern, the local resource endowment, and the financial resources available to the community.

Global Environmental Objectives

The global environmental objective being pursued is the reduction of present and future greenhouse gas emissions through the expanded utilization of renewable energy. The municipal-level projects proposed as part of this program are envisaged as being profitable and sustainable once certain barriers are removed. This Program is therefore consistent with GEF Operational Program 6 to Promote the Adoption of Renewable Energy through Removing Barriers and Reducing Implementation Costs.

GEF Program Activities

The GEF Program activities are described in considerable detail in the text. They have been designed to overcome five barriers encountered in the provision of rural electrification services through renewable energy. These barriers include: (1) the lack of a responsible institution to serve as the financial base for the investments which will make use of both private and public funds; (2) the limited experience and background of the financial sector for dealing with rural renewable energy; (3) the high capital cost or "first-cost" barrier of renewable energy where it is more expensive in the short-run but more economical over the medium to long-run; (4) the lack of technical standards and codes of conduct in the renewable energy industry; and (5) the limited human resource base for undertaking a widespread deployment of renewable energy. As a result of these barriers, rural communities either get no access to electricity, or they gain access to electricity through either diesel gen-sets or grid connection. Unless these barriers are systematically removed through the activities proposed in this Program, the market for renewable energy will remain limited.

Through the activities proposed in this program, these barriers will be removed through a number of technical assistance activities and through the initiation of 22 community or municipality-based renewable energy electrification projects. These small projects will make use of a revolving fund

mechanism which will facilitate the expansion of the project to additional communities. This mechanism is intended to ensure that the market for renewable energy in Bolivia grows and that the experiences of one community are used to benefit those of other communities.

System Boundary

The system being discussed in this case is the Bolivian energy system. The incremental costs presented below represent the costs of removing the specified barriers to renewable energy-based rural electrification.

Additional Domestic Benefits

The activities to be undertaken as part of this Program will lead to few additional domestic benefits. There will be a very small reduction in emissions from diesel generating sets and a small reduction in CO₂ emissions from kerosene from the 22 community-based projects to be undertaken as part of this Program. Once the barriers are removed and renewable energy is able to be disseminated throughout rural Bolivia, the quantity of local emissions reductions will be larger. However, they are not considered as a benefit against the account of this Program.

Incremental Cost Matrix

The incremental costs of Program activities are summarized in the incremental cost matrix. Objective 1, which is the evaluation rural electrification institutional options, is considered to be a baseline Objective, and so it is being supported by funds from UNDP's IPF. Objective 2, focusing on the needs of the financial sector to be able to finance renewables, is described in more detail below. Objective 3 focuses on training the participating population, technicians, and members of the rural electricity companies in the building, operation, and maintenance of renewable energy systems. Without the Program, none of these activities will be undertaken. Objective 4 focuses on implementing the initial 22 community-based projects identified as part of this Program preparation. The baseline financing from the communities own contribution will be combined with revolving-fund resources to ensure adequate financing of these activities. The GEF resources are used for technology assessments and the participatory appraisal of each community's options. Objective 5 seeks to allow the completion of the establishment of renewable energy standards and codes of practice. Although some work has already been done on this task, without the support of this Program, the process would not be completed in a participatory and transparent manner, and the results would not then be widely publicized. Objective 6 focuses on Program management. The Vice Ministry of Energy and Hydrocarbons is making an in-kind contribution of office space and support.

Objective 2 focuses on the removal of barriers in the financial sector to the expanded financing of renewables. In addition to technical assistance activities directed at the financial sector, this will involve the creation of a revolving fund mechanism using both GEF and non-GEF resources. In addition to technical assistance activities to remove barriers, there are two separate financial requirements involved under this Objective. The first of these has to do with the incremental costs of the proposed projects, particularly for solar photovoltaic systems. The second focuses on the need to establish a revolving fund to overcome the "first-cost" barrier.

With respect to the incremental costs of the proposed projects, three types of projects are envisioned.

- First are the projects in which Small Hydroelectric Plants (SHP) will be installed. There are three of these projects in the Program.
- Second are the photovoltaic (PV) systems, totaling 15 in all.
- The final group are the hybrids. The combinations included in the Program are:
 - one PV + Wind project;
 - two projects which include water pumping + Pico Hydroelectric Plant (PHP) + PV; and
 - one project utilizing PHP + SHP + PV.

For the case of the PV + Wind projects, the incremental costs include a portion related to the wind components which is calculated to be zero. For the villages which will be electrified via the harnessing of small-scale hydro resources, in the baseline, it is assumed that they would obtain electricity from a decentralized diesel mini-grid. Approximately 1,087 households are expected to be served by the small-hydro mini-grids. Over a twenty-year period, the costs of installing and operating the small hydro systems comes to about US\$ 3.3 million. The costs of providing the same households with identical quantities of electricity from diesel mini-grids is estimated at US\$ 3.6 million. Since the cost of the small hydro facilities is less than the cost of providing the same quantity of electricity through diesel generating sets, there are no incremental costs associated with the small hydro installations.

Among the PV systems, the Program expects to install approximately 2,771 photovoltaic-based systems. For the households that will utilize these systems, the baseline would not involve electrification beyond that which is currently available. Energy needs would continue, as at present, to be met through the use of kerosene, candles, and batteries. Expenditure surveys show that rural households in project areas spend approximately US\$ 7.10 per month (US\$ 85 per year) on kerosene, candles and batteries (excluding equipment costs but including VAT). Excluding the 13 percent VAT, the annual expenditure on batteries, candles and kerosene comes to US\$ 74.00 per year. Over the course of 20 years, the present value of these expenditures comes to approximately US\$ 631.04.

At current prices, a 45 W PV system costs about US\$ 850 in Bolivia. The market price of the PV panel is about US\$ 450 and is subject to a 15 percent import duty and a 13 percent VAT. Removing these costs from the c.i.f. value of the PV gives a net value of US\$ 332. The remaining components of the system account for the remaining half of the value of the PV system (US\$ 425), and is subject to a 13 percent VAT. (These components, including deep-cycle batteries, are entirely produced locally in Bolivia). The value of these components, net of VAT, comes to US\$ 376. The value of the capital cost of the system comes to US\$ 708.

For the system to last 20 years, batteries must be replaced twice (years 8, and 16) and cost

about US\$ 80 each time (about US\$ 71 excluding VAT).

The total costs of the PV system is in the range of US\$ 755.46. Therefore, the incremental cost per 45 W PV system comes to US\$ 124.40. Since the projects plan to install 2771 of these, the total incremental costs of the PV systems comes to approximately US\$344,712. This amount represents an incremental cost payment for the households purchasing a PV system under the Program.

Although estimates are not firm, it is anticipated that the local price of PV systems will decrease through the sector growth experienced as a result of this Program. Industry analysts estimate that the price decline may be expected to run as high as US\$ 50 per system. However, Bolivia may still face the low-volume, high-cost trap endemic to countries with incipient PV markets with low annual inventory turn-around.

In addition to these incremental costs, funds will be made available for the projects under the popular participation law (about US\$ 1.39 million) and from the users themselves (US\$ 711,700). However, in order to overcome the "first-cost" barrier and make adequate funds available for implementing the projects, additional contributions of US\$ 2 million are required to provide a revolving fund to meet the full cost of projects identified (total requirements about US\$ 4.67 million). Of this required amount of US\$ 2 million, one half (US\$ 1 million) is requested from GEF and one half (US\$ 1 million) is being requested from other sources, either bilateral donor funds or commercial funds. These will be repaid according to the terms agreed upon. The remaining US\$ 2.67 million will represent down payments made either by the municipality or the users and, therefore, will not be repaid.

The implementation of the 22 projects identified for initial inclusion in this program will result in the avoidance of approximately 5,064 metric tons of C over a 20-year lifespan. However, assuming that all funds are paid back into the revolving fund, an additional 44 projects can be implemented over 25 years. The total quantity of carbon avoided by these 69 projects will amount to approximately 10,017 m t of C over 25 years. If it were possible to provide electricity with renewable electrification at low load levels to all Bolivians living in rural areas outside the economic reach of the electricity grid, the total potential for carbon emission avoidance has been estimated to be in the range of 181,350 metric tons over 20 years.

Table 3. Incremental Costs Matrix

<i>Component</i>	<i>Cost Category</i>	<i>Costs</i>	<i>National Benefits</i>	<i>Global Benefits</i>
Objective 1: Evaluation of Rural Electricity Institutional Options	Baseline	\$100,000	Development of institutional framework for financing rural energy & development, using popular participation law funds	Institutional Options for renewable and conventional renewable electrification are identified
	Program Case	\$100,000		
	Increment	0	Institutional Framework Developed	
Objective 2: Financial Sector Mobilization and Strengthening	Baseline	\$1,603,750	No financing of renewable energy	Funds under Pop. Participation Law available but not used for renewables
	Program Case	\$3,115,950	Financial institutions strengthened to handle renewable energy projects	Funds under Pop Part Law combined w/ GEF resources to reduce incremental costs and remove first-cost barrier
	Increment	\$1,512,200	Strengthening financial organizations	Renewable energy financing can take place
Objective 3: Training for Local Electricity Companies	Baseline	-0-	Limited personnel familiar with renewable energy	No renewable energy training
	Program Case	\$649,600		Training lays foundation for future renewable energy deployment
	Increment	\$649,600		Human resource barrier removed
Objective 4: Development & Installation of Rural Renewable Projects	Baseline	\$2,102,500	Communities invest resources in conventional electricity	
	Program Case	\$2,937,915	Communities invest in renewable energy	Market for small hydro, PV's and wind expands
	Increment	\$835,415	Communities obtain electricity through sustainable financial avenues	Renewable energy projects established--Bolivia renewable energy market expands
Objective 5 Standards & Certification	Baseline	-0-	Lack of standards hinders renewable market	
	Program Case	\$85,000	Standards developed	
	Increment	\$85,000	Consumer confidence in renewables increases	Installers and manufacturers produce better quality product
Objective 6: Program Management and Supervision	Baseline	\$250,000 (in-kind)	Limited project management skills	
	Program Case	\$1,030,000	Project management implemented	Monitoring of project experience needed
	Increment	\$780,000	Project is carefully managed	Accurate record of project experiences obtained
Total	Baseline	\$4,056,250		
	Program Case	\$7,918,465		21,100 MT of CO ₂ avoided by 22 initial projects alone
	Increment	\$3,862,215		Revolve fund leads to total avoidance of 37,795 MT of CO ₂

Source: UNDP/GEF (NY) and Solsticio, SRL.

ANNEX II

PROJECT PLANNING MATRIX

PROJECT DEVELOPMENT GOAL	OBJECTIVELY VERIFIABLE INDICATORS	MEANS OF VERIFICATION	ASSUMPTIONS
<p>To Develop The Conditions Under Which Bolivia Can Successfully Implement Rural Electrification Projects Using Renewable Energy Technology.</p> <p>PROJECT PURPOSE</p> <p>Remove barriers to the successful implementation of rural electrification projects using renewable energy technology. It is hoped that by focusing on the financial, institutional, technical and human resource barriers, a program can be initiated which will be sustainable and replicable in other areas of the country. Because of the diversity found in rural Bolivia, the institutional uncertainties, and the innovative nature of the Program, the experiences in each community will be carefully documented and evaluated in order to identify the best possible solutions to meet the goals of renewable rural electrification. In this way, it is hoped that this small Program will pave the way for future, investment-scale projects.</p>	<ul style="list-style-type: none"> - Institutional and operational delivery systems for renewable energy development are in place along with supportive regulatory frameworks and incentive systems. - Financial mechanisms to ensure user access and renewable energy sustainability are developed and tested. - Technical capacity of national and local users in strengthened to assume responsibilities of renewable energy related operations. - Renewable energy information is updated and made widely available to planners, users and investors to encourage & facilitate development replication, and future investment. 	<ul style="list-style-type: none"> - Number of institutions established or participating in renewable energy related operations. Implementation & adoption of legal frameworks and incentive systems. - Revolving funds, credit lines and other supportive financing options are available at FNRD and other financial institutions. - Institutions, technicians and users have participated in training programs and are applying received knowledge in renewable energy related operations. - Renewable energy info/data systems in operation, mechanisms by which this information is disseminated to government, private sector, etc., surveys with relevant stakeholders, renewable energy assessing utility and application of data. 	<ul style="list-style-type: none"> - Government and user commitment is reflected in rapid endorsement and adoption of enabling institutional structures and legislative frameworks and incentive systems. - Financial institutions are receptive and proactive in engaging into new financing schemes and options for renewable energy development. - Wide variety of national and local stakeholders activity participate and apply renewable energy related skills - Renewable energy information and data systems effectively used and applied by planners, users and potential investors.
<p>OUTPUT 1 :</p> <p>Identify and Establish the Institutional Structures Required for the Implementation of Renewable-based Rural Electrification Projects.</p>	<ul style="list-style-type: none"> .1 Institutional Options for Implementing Renewable-based Rural Electricity Companies Evaluated, Validated and Adopted for Implementation in Each Project Site. .2 Options for Public-Private Financing Under the Popular Participation Law. .3 Draft of Standardized Rules of Association and Contracts for Identified Local Institutions and Submission of Proposals to Municipalities and Central Government for Approval, so That the Resources of the Popular Participation Law can be Channeled Through Them. 	<ul style="list-style-type: none"> - Instruments for evaluation of Mixed Public-Private Enterprises are used by the financial institutions. - Popular Participation Law is applied in evaluation of Public-Private Financing. The Municipalities use of approximately 20% of their coparticipation resources of last three (3) years, to cover counterpart's financing requirement for the project. - Rules of Association and Contracts – use and application. 	<ul style="list-style-type: none"> - Government decision – makers, private sector investors, etc. are applying instruments and information provided in rules of association and contracts models.
	<ul style="list-style-type: none"> .1 Information on Rules and 	<ul style="list-style-type: none"> - Service in technical assistance in: evaluation 	<ul style="list-style-type: none"> - Consolidate work with the local

<p>OUTPUT 2: Removal of Barriers to the Efficient and Effective Operation of the Financing Mechanism for Renewable Energy-based Electrification Projects.</p>	<p>Procedures Hindering Loan Financing for Renewable Rural Electrification.</p> <ol style="list-style-type: none"> .2 Strengthened Institutions. .3 Revolving Fund Established. .4 Determination of Amortization Periods. .5 Organization of Coverage in Rural Areas. 	<p>of current practices, the suggestion of ways to modify practices and rules where possible, the formulation of alternative regulations and procedures.</p> <ul style="list-style-type: none"> - Provision of technical assistance for a period of up to two years, training of personnel, salary support for additional personnel. - Incorporation of revolving fund; overcome of "first cost" barriers. - For each project, identification of amortization periods. - Financial operators establish their own agencies in areas where their existence can be justified on the basis of project concentration. 	<p>financial institutions.</p> <ul style="list-style-type: none"> - Inclusion of institutions in the private sector banking system, public sector financial funds, financial NGOs's and others. - Training and technical assistance will concentrate in the areas of project evaluation and the approval and supervision of loans. - Salary support will be provided for a minimal number of employees directly related to Program activities and limited to a period of two years. - Government and GEF give to the revolving fund their compromised participation. - FNDR will operate the revolving fund. - At the end of the Program period, the funds will be used as capitalization for the national rural electrification fund. - Program personnel will work closely with the institutions involved in project financing. - Financial operator will open four new offices using the agencies' own funds.
<p>OUTPUT 3: Institutional Strengthening of Local Electric Utilities.</p>	<p>1 Trained Users, Beneficiaries and Nominees Selected to Serve on Boards of Directors</p> <ol style="list-style-type: none"> .2 Trained Persons to Fill Skilled and Semi-skilled Positions within the Local Companies. .3 Solidly Managed and Operated Local Electric Companies. 	<p>of current practices, the suggestion of ways to modify practices and rules where possible, the formulation of alternative regulations and procedures.</p> <ul style="list-style-type: none"> - Provision of technical assistance for a period of up to two years, training of personnel, salary support for additional personnel. - Incorporation of revolving fund; overcome of "first cost" barriers. - For each project, identification of amortization periods. - Financial operators establish their own agencies in areas where their existence can be justified on the basis of project concentration. 	<p>financial institutions.</p> <ul style="list-style-type: none"> - Inclusion of institutions in the private sector banking system, public sector financial funds, financial NGOs's and others. - Training and technical assistance will concentrate in the areas of project evaluation and the approval and supervision of loans. - Salary support will be provided for a minimal number of employees directly related to Program activities and limited to a period of two years. - Government and GEF give to the revolving fund their compromised participation. - FNDR will operate the revolving fund. - At the end of the Program period, the funds will be used as capitalization for the national rural electrification fund. - Program personnel will work closely with the institutions involved in project financing. - Financial operator will open four new offices using the agencies' own funds.

<p>OUTPUT 4: Installation of Twenty-two Community-level Rural Electrification Projects Using Public, Private and where Appropriate donor Financing in a Transparent and Carefully Monitored and Evaluated Environment.</p>	<p>.1 Twenty-two Operational Community-level Rural Electrification Projects. .2 Project Installation. .3 Specifications for Facility Maintenance Contracts and Selection of Maintenance Providers Developed.</p>	<p>- Prefeasibility studies for each of the 22 projects finalized, including the development of the financial plans for each project given the different possible institutional configurations. Drafting procurement specifications of detailed feasibility studies and financial plans, for micro-hydro and wind-hybrid projects. - Presentation and discussion of the different institutional and financial options open to each community, done. - Assistance to each local electric utility in their first procurement process, ensuring that the process is carried out in a competent and transparent manner, according to the rules of the local electricity company, done. - Program Coordination Group overseeded project installation. Incremental cost funds used. - Contracts for the maintenance of the facilities, developed and established.</p>
<p>OUTPUT 5: Development of Standards and Certification Procedures for Renewable Energy-based Commercial Electrification Systems.</p>	<p>.1 Establishment of Standards for Renewables. .2 Assistance for the Establishment of a Certification Program.</p>	<p>- Technical standards for equipment, project implementation, training, and evaluation related to these renewable energy systems, developed and placed in. - Support for the establishment of a certification procedure using the standards as a baseline to ensure a proper installation for every solar system is provided. Ten local PV installers trained on the correct installation procedures following the norms established by IBNORCA.</p>
		<p>- Bolivia does not have national standards for any of the renewable energy-based commercial electrification systems or for system components - At the local and regional levels in Bolivia the number of trained technicians and trainers in the area of renewable energy-based systems is insufficient to fulfill local needs. - There are no certified technicians in the renewable energy sector. - IBNORCA is accumulating information and experiences from other countries with special attention to specific data related to Bolivian</p>

<p>OUTPUT 6: Program Management, Supervision, and Monitoring.</p>	<p>.1 A Project Facilitation Center Established in the Vice Ministry of Energy and Hydrocarbons.</p>		<ul style="list-style-type: none"> - Program Support Unit established. Timely and cost-effective implementation ensured. - Program activities monitored and evaluated. - Relative operational success of the various pilot projects, "best practices" with respect to rural electricity provision, and the maintenance of repayment schedules under each community-based project, established. 	<ul style="list-style-type: none"> - The agreed-upon standards is disseminated to all users. - Activity established in association with a local technical training institution. 	<ul style="list-style-type: none"> - Organizational structure for program management known. - Accessibility to information of program management, monitoring and evaluation. - The Viceministerio de Energía e Hidrocarburos is the executing agency for this Program, in collaboration with UNDP.
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Annex 3

REVOLVING FUND AND PROJECT FINANCING

In order to carry out the twenty-two municipally-based projects identified as part of this Program, it will be necessary to establish a revolving fund to overcome the “first-cost” barriers which prevent renewable energy investments from being undertaken. The total amount of funding necessary for carrying out these projects is estimated at approximately US\$ 4,67 million. Part of these funds will represent initial down-payments from either public or private sources. Another portion will represent a revolving fund loan which will be repaid according to the credit terms established as part of the Program. A final portion of the financing will be limited to photovoltaic installations and will represent a one-time, initial grant made to compensate for the incremental costs of PV systems (about US\$ 206,26 per system). The sources of this financing are listed in the table below.

The revolving fund will be supervised by the Project Facilitation Center, but will be managed by a designated financial entity, possibly a second-story financial institution. Payback periods, interest payments, and administrative payments will be specified by the PFC keeping in mind the barriers targeted as part of project implementation. At the end of the Program period, the funds will be used as capitalization for the national rural electrification fund, as considered appropriate by the Project Facilitation Center.

Table 5. Sources of Capital for the 22 Projects

Source	Amount (US\$)	Term of Repayment
1) Popular Participation Law Funds	1,390,800	Grant from Municipality - not repaid.
2) User Contribution from Households	711,700	User fee - treated like a down payment.
3) Revolving Fund		
a) GEF Contribution	1,000,000	Repaid into the revolving fund - no interest, but covers administrative cost
b) FNDR Contribution	1,000,000	Repaid into revolving fund - terms dictated by donor or financier
c) GEF PV Incremental Cost Contribution	571,546	Only for PV households - grant funds
TOTAL	4,674,046	

Source: UNDP/GEF (NY) and Solsticio, SRL.

The financial structure of the projects of the Rural Electrification Program has not yet been fully defined. The GEF will finance incremental costs based on the need to generate the effective conditions to guarantee Program success, as well as the incremental costs which results from investment in photovoltaic projects. In the latter of these cases, the GEF will contribute approximately US\$ 206.26 per panel. In addition, it is envisioned that the GEF will contribute about US\$1,000,000 through the Program as a base for the establishment of a revolving fund - a fund to be utilized for the partial funding of all projects. At the same time, the Government will contribute US\$ 1,000,000 through the FNDR, in order to insure that the revolving fund reaches the level required for the financing of each of the projects. For the financial analysis of the projects, it is assumed that the revolving fund exists with sufficient funds to cover credit financing of the projects. In addition to the GEF financing, the Program expects counterpart contributions from the Municipal governments and a form of "down payment" from the individual users.

During the last few years, the municipal governments have received coparticipation funds from the Popular Participation Law. The amounts vary based on the population of the *Municipio*. As an approximation of the possibility for this type of financing, the analysis uses an average of the funds received by the municipal government during the last three years (1994-1996). Taking this as a starting point, it is assumed that the Municipality will be able to earmark 20 percent for the financing of its project, with a limit set at 20 of the total costs of the project. As an example, the *Municipio* of Tiquipaya, in the Province of Quillacollo, Department of Cochabamba will be used. The average coparticipation funding received during the last three years was US\$ 251,191. The government will earmark 6 percent of this amount to cover the counterpart required for financing its project. This amount (US\$ 15,751) is 20 percent of the total investment required for the project.

Because the PV systems being installed contain an incremental cost, the financing available to them is somewhat different from that for small hydro systems. The user contribution will be a requirement for project participation. For PV systems, the approximate breakdown of costs is estimated as follows:

Table 6. Percentage Contribution Toward Financing for PV Systems

Source	Percent
1) Popular Participation Law Funds	20.0
2) User Contribution from Households	10.0
3) Revolving Fund	
a) GEF Contribution	27.5
b) FNDR Contribution	27.5
c) GEF PV Incremental Cost	15.0
TOTAL	100.0

Source: UNDP/GEF (NY) and Solsticio, SRL.

For the small hydro facilities, the financing mix will be slightly different. The approximate breakdown of these costs is as follows:

Table 7. Percentage Contribution Toward Financing for non-PV Systems

Source	Percent
1) Popular Participation Law Funds	20.0
2) User Contribution	10.0
3) Revolving Fund	
a) GEF Contribution	35.0
b) FNDR Contribution	35.0
TOTAL	100.0

Source: UNDP/GEF (NY) and Solsticio, SRL.

For their part, the beneficiaries of the project will contribute approximately US\$ 100 per panel installed. Among the 60 users in this project, it is expected that some 68 panels will be installed between domestic and productive uses. The total of the "down payments" will come to US\$ 6,800. On the other hand, the GEF contribution mentioned earlier, will result in a total of US\$ 14,054.

Summing these three sources of funding, the total comes to US\$ 36,605 (46,5 percent of the total investment). The detail of this is:

- Municipal Government	US\$ 15.751
- Beneficiaries	US\$ 6.800
- GEF Funds	US\$ 14.054

CONTRIBUTION WITH IDENTIFIED SOURCE	US\$ 36.605
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TOTAL INVESTMENT	US\$ 78.755
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Annex 4

INDICATIVE WORKPLAN

Tasks Against Time

Activity / Quarter	Year 1				Year 2				Year 3				Year 4			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Program Signature	-															
Management, Supervision and Monitoring - Objective 6	-															
Constitution of PFC	■															
Program coordination	■															
Project monitoring	■															
Develop Standards & Certification Program - Objective 5	■															
Evaluate Institutional Options - Objective 1	■															
Eliminate Financial Barriers - Objective 2																
Strengthening Local Utilities - Objective 3																
Preparation of Training	■															
Group I projects ³	■															
Group II projects	■															
Group III projects	■															
Installation of Projects - Objective 4																
Group I projects	■															
Group II projects	■															
Group III projects	■															

³ Projects will be assigned to one of 3 geographic groups to take advantage of economies of scale and lower operation costs.

Annex 5

SCHEDULE OF PROGRAM REVIEWS, REPORTING AND EVALUATIONS

<u>Activity / Quarter</u>	Year 1				Year 2				Year 3				Year 4			
	1	2	3	4												
Quarterly Implementation Report	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Technical Report	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■
Project Performance Evaluation Report (PPER)				-				-				-				-
				■				■				■				■
Tripartite Review				-				-				-				-
				■				■				■				■
Midterm Evaluation									-	-						
									■	■						
Terminal Report																-
																■

Annex 6

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¹ OTBs are composed of members of the community, responsible for the verification of the use of funds distributed under the Popular Participation Law.

¹ The "reference case" refers to a situation in which the "Rural Electrification Program Using Renewable Energies" does not exist, with the result that the communities, using their own resources, attempt to accomplish electrification using conventional forms of energy or through extensions of the National Interconnected System.

¹ Since market prices include a 13 percent VAT, to obtain the net price without the VAT, an inverse calculation should be effected. For this purpose a factor of 11.504 percent is used here.

¹ Since market prices, net of VAT, include a 15 percent import duty, to obtain the net price without this duty, an inverse calculation should be effected. For this purpose a factor of 13.043 percent is used here.

¹ Projects will be assigned to one of 3 geographic groups to take advantage of economies of scale and lower operation costs.