United Nations Development Programme
GLOBAL ENVIRONMENT FACILITY (GEF)

file

2 December, 1998

Dear Mr. El-Ashry, Mohamed:

Subject: **PER/98/G31/A/1G/99 - Photovoltaic-based Rural Electrification in Peru**

I am pleased to enclose the project document entitled "**Photovoltaic-based Rural Electrification in Peru**" which was approved by the GEF Executive Council in April 1998.

As per paragraph 29 and 30 of the GEF Project Cycle, we are submitting this project to you for circulation to the Executive Council Members for comments and, subsequently, for your final endorsement.

Thank you in advance for expediting the review and approval of this project.

Yours sincerely,

Rafael Asenjo
Executive Coordinator

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Project Document

1. Identifiers:

Project Number:	PER/98/G32
Name of Project:	Photovoltaic-based Rural Electrification in Peru
Duration:	Five years
Implementing Agency:	UNDP
Executing Agency:	Ministry of Energy and Mines/Executive Bureau of Projects
Requesting Country:	Peru
Eligibility:	Peru ratified the Framework Convention on Climate Change on 7 June 1993
GEF Focal Area:	Climate Change
GEF Programming Framework:	OP #6: Promoting the adoption of renewable energy by removing barriers and reducing implementation costs

2. Summary:

The objective of the proposed project is to assist the Government of Peru in removing barriers to sustainable rural electrification using photovoltaic (PV) technology in remote rural areas, thereby reducing the long-term growth of the greenhouse gas (GHG) emissions. The project will demonstrate the viability of establishing micro enterprises to sell, maintain and operate the PV systems, as well as create incentives for increased public and private sector investment in photovoltaic-based rural electrification.

3. Costs and Financing (US$):

GEF	Full Project:	3,930,093
	[of which administrative costs are	*114,468]*
	PDF A:	25,000
	Subtotal GEF:	**3,955,093**
Co-financing:	IA (UNDP):	-
	Govt. of Peru (in cash):	3,846,000
	Govt. of Peru (in kind):	1,796,768
	User Contributions:	1,376,251
	Subtotal:	**7,019,019**
Total Project Cost:		**10,974,112**

4. Associated Financing (US$): 5,000,000 (PROER)

5. Operational Focal Point Endorsement: Mr. Gonzalo Galdos, President of the Council of Directors, CONAM, 26 January 1997

6. IA Contact: Lita Paparoni, Regional Co-ordinator, UNDP/RBLAC GEF Unit, Tel (212) 906 5468, Fax (212) 906 6998

ABBREVIATIONS

CONAM	National Council for the Environment (Consejo Nacional del Ambiente)
DEP	Executive Bureau of Projects/MEM (Dirección Ejecutiva de Proyectos)
ESMAP	Energy Sector Management Assistance Programme
GEF	Global Environment Facility
GHG	Greenhouse Gases
MEM	Ministry of Energy and Mines (Ministerio de Energía y Minas)
NGO	Non-governmental Organisation
PDF	Project Development Facility
PV	Photovoltaic
SENAMHI	National Service for Meteorology and Hydrology (Servicio Nacional de Meteorología y Hidrología)
UNDP	United Nations Development Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNISE	UNDP Initiative on Sustainable Energy
UNOPS	United Nations Office for Project Services

A. CONTEXT

A.1 Description of Sector

1. Peru covers 1,285,215 square kilometres and is the third largest country in South America. Its population is over 24 million almost half of which is concentrated in the narrow coastal desert. Lima alone has a population of almost six million while the second and third cities—Arequipa and Trujillo—also in the coastal region, have populations of about 900,000 each.

2. Forty-five percent of Peru's population live in poverty with 19% under the extreme poverty level. The critical linkages between energy, poverty and development include aspects like food security, employment, commercial balance, human health and degradation of the environment. It is evident that energy is not a sector issue but one that is vitally related to other dimensions of development.

3. The electrification coefficient in Peru was the lowest of South America in 1992: at the national level, 43% of the population and in rural areas only 12%, had access to electricity. Due to government efforts, the coefficient has reached 68% nationally and 19% in rural areas. It is estimated that 20% of the population currently without electricity live on the outskirts of large urban areas and could economically be supplied with electricity by extending the grid or by using small hydro or diesel generators. The remaining 80%—more than 6 million people—live mainly in small and remote rural settlements and in many cases the photovoltaic systems would be the least-cost option to provide them with electricity.

4. The installed electric capacity in the country is about 5,000 MW and consists of 49% thermal and 51% hydroelectric plants. However, the electricity is principally generated by hydroelectric plants. Only 20% of the generation is by thermal plants.

5. Total electricity production rose by 2.1% in 1996. Ninety-seven concessions and authorisations were awarded to different petitioners, raising the total awarded to more than 500. In accordance with the programmed projects, it is estimated that the generation capacity in the country will grow about 1,800 MW during the next five years. The projected growth in the supply is mainly by thermal plants; more that half is expected to be generated using natural gas.

6. Non-conventional renewable energy sources in Peru are remarkable, but inadequately harnessed. They include solar energy, wind energy, biomass including agricultural residues, geothermal energy and municipal and industrial waste. In the highlands, the average solar radiation reaches 5 $kWh/m^2/day$ with small seasonal variations; in the jungle the radiation varies between 2.5—4.5 $kWh/m^2/day$.

A.2 Host Country Strategy

7. The general policy of the mining and energy sector is defined within the government's general policy in the fight against poverty. It guides the state's efforts towards promotion of private investment in electricity, hydrocarbons and mining, acting directly in the expansion of rural electrification, promoting campaigns for the efficient use of energy and divulging the environmental norms.

8. The Ministry of Energy and Mines (MEM) as the ruling organisation in the energy and mining subsectors has established the following policies: i) to direct the efforts of the state to promote the private investment in the activities of the sector; ii) to intervene in the rural electrification and in the small-scale mining as support to the social improvement and the fight against poverty;

iii) to establish the norms and to oversee the producer/consumer relationship in a sound and competitive free market environment; iv) to help the development of efficient mining and energy production in harmony with the environment; v) to help generate direct and permanent employment in the sector through adequate orientation of the market forces; and vi) to continue assisting the privatisation process of the state-owned enterprises belonging to the sector.

9. It is government's priority to continue pursuing an aggressive modernisation of the country. This will be achieved by i) bringing up to date the norms; ii) modernising administrative processes; iii) continuing with the electrification; and iv) installing state-of-the-art technology through private investments in the electricity, hydrocarbon and mining subsectors.

10. To complement the actions of the private sector, the rural electrification plan implemented by the Executive Bureau of Projects (DEP) of MEM, has produced 350 electrification projects between 1993 and 1997. These include 6,605 km of transmission lines and 151 MW of newly installed capacity in isolated areas. The increase in the capacity is mainly due to the installation of various diesel generators between 100 and 25,000 kW. Apart from these, 51 small hydropower plants, a 250 kW wind turbine and more than 300 PV systems have been installed.

11. The main objective of the sector is to consolidate the already reached objectives and to start the actions needed for the pending-ones. This will be done taking into account the general policies of the state, the needs of sustainable development, the poverty eradication, the correlation between the national and international markets and the joining of all the efforts in favour of the most deprived social sectors in the country, without forgetting the conservation and defence of the environment within the scope of the sector's responsibility.

12. Peru ratified the United Nations Framework Convention on Climate Change (UNFCCC) in June 1993 and it came into force on 21 March 1994. The National Climate Change Committee was created in November 1993 in order to co-ordinate the implementation of the UNFCCC and the Montreal Protocol. This multisectoral committee is chaired by the National Council for the Environment (CONAM). The National Action Plan for Climate Change and the First National Communication are currently being drafted.

A.3 Prior or Ongoing Assistance

13. This project has been prepared with the help of GEF and UNDP using a Project Development Facility grant (PDF block A). Two consultants were hired and field visits to various ongoing PV projects in Peru were taken. The Ministry of Energy and Mines organised also a workshop "National Plan of Electrification and the Development of Renewable Energy" with the participation of various stakeholders (NGO's universities, private firms etc.).

14. The joint UNDP/World Bank Energy Sector Management Assistance Program (ESMAP) published the document "Peru—Energy Sector Short and Middle Term Strategy" in December 1990. The chapter on renewable energy recognises the abundant renewable energy resources of Peru and analyses some of the problems that the renewable energy projects faced in the 70's and 80's. However, the macro-economic and political situation, as well as the maturity of the different renewable energy technologies today are very different from those presented in the report. The ESMAP is currently finishing studies on different forms of organisation for rural electrification.

15. Since 1994, the Executive Bureau of Projects (DEP) of MEM has been executing the project PER/94/028 "Non-Conventional Energy" funded by the Government. This project has a solar

photovoltaic and wind energy component. A 250 kW grid-connected wind turbine was installed in Malabrigo in April 1996 and 313 PV systems have been placed in various rural communities.

16. UNDP is helping Peru to formulate the national climate change policy through two GEF-financed projects. The global CC:TRAIN programme assists in promotion and in preparation of the strategy. The National Action Plan for climate Change and the National Communication are being formulated with the help of the project PER/97/G32 "Enabling Peru to Prepare its First National Communication in Response to Its Commitments to the UNFCCC".

A.4 Institutional Framework

17. The Legislative Degree 25962 given on 18 December 1992 determines and establishes the extent of the sector and the structure of its dependencies. The energy and mining sector consists of the Ministry of Energy and Mines as the central ruling organisation of the sector, the public decentralised institutions and the enterprises and individuals dealing with energetic and mineral resources or with any activity directed towards their use.

18. The article 5 of the Legislative Degree 25962 establishes that it corresponds to MEM to formulate—in harmony with the general policies and plans of the government—national policies in electricity, hydrocarbons and mining, as well as to supervise and evaluate their fulfilment.

19. The Executive Bureau of Projects (DEP) was created by the Supreme Degree 021-93-EM in May 1993 as a temporary organisation of the sector with technical, administrative and financial autonomy. Its objective is to increase the extent of electric frontier and to provide electricity to villages of rural and isolated zones as an element to promote development and to improve life quality.

20. The Electricity Concessions Law of 1992 regulates the activities related to generation, transmission, distribution and marketing of electric energy. The law creates a modern framework, permitting the generation, transmission, distribution and sale of electricity as a commercial business, within a market free of any restrictions and with minimum state intervention. The supply of electricity for public service — defined as consumers with a maximum demand less than 1 MW — has a tariff system established by law based on the marginal cost of supply, the efficiency of the electrical system, the level of market prices and a real rate of return of 12% annually. Electricity concessions and authorisations may be given to private persons or public or private companies, both local and foreign. A concession is required for:

    - Generation of electricity that uses hydraulic and geothermal resources whenever the installed capacity is above 10 MW;
    - Transmission of electricity whenever facilities affect state property and/or require rights of way to be granted by the state; and
    - Distribution of electric energy for public service whenever the demand is above 500 kW.

21. An authorisation is required to carry out thermoelectric, hydroelectric and geothermal generation activities that do not require a concession, whenever the installed capacity is above 500 kW. Generation, transmission and distribution activities that do not require a concession or authorisation may be freely carried out in compliance with technical regulations, environmental laws and laws of the Cultural Heritage of the Nation. Article 9 of The Electrical Concessions Law states: "The State promotes the conservation of the environment and the Cultural Heritage of the Nation, as well as the rational use of natural resources in the undertaking of activities

related to the generation, transmission and distribution of electric energy." Currently, there is no special law for renewable energy, save for geothermal energy.

B. PROJECT JUSTIFICATION

B.1 Problem to be Addressed and the Present Situation

22. The National Electrification Plan 1997—2000 is being executed by the Executive Bureau of Projects of the Ministry of Energy and Mines (MEM). The goal of the plan is to increment the electrification coefficient from 68% to 75% at the national level by the year 2000. A large part of the population (more than 6 million people) currently without electricity lives in small rural settlements, often very remote.

23. It is well known that in many cases the least-cost option to electrify rural isolated populations is through stand-alone PV systems or other renewable energy technologies. However, different barriers prevent these projects from being realised. It is necessary to remove these barriers in order to lay the foundation for increased public and private sector investments that also result in mitigating potential climate change.

24. In November 1997 the Ministry of Energy and Mines organised the workshop "National Plan of Electrification and the Development of Renewable Energy" financed by the GEF through a PDF Block "A" grant. The participation of organisations involved in renewable energy development, as well as field visits to different PV projects, were an invaluable resource in identifying the barriers against the optimal use of renewable energy.

Institutional Barriers

25. To date, there are few firms operating electricity systems of renewable resources in Peru. Communities have not set up local utilities to provide the services required and local entrepreneurs lack the skills and the incentives to begin operating in this area. This has served as a barrier to the widespread dissemination of renewable electricity in remote areas.

26. To surmount this barrier, rural communities wishing to electrify with renewable energy have organised small enterprises under MEM guidance. The goal of these enterprises is to assure sustainability of the project in the long term. The rates users pay will be clearly established and will take into account the costs of the equipment, service and the willingness and ability of the users to pay. Even though a number of ownership and financing models may be deployed (lease-hire; utility ownership; user ownership), the establishment of these organisations must be consistent with the concession law and its application to renewable electricity generation. The scale of the firms will be determined based upon demand, needs, and appropriate scale economies.

Financial Barriers

27. Even if the life-cycle cost of a PV system were lower than that of traditional energy sources (torches, candles, batteries etc.), the high up-front cost of the system would make it unaffordable to low income households. This high up-front cost is mainly due to low volumes and high transport and installation costs in remote areas and serves as a barrier to PV dissemination. In general, users lack credit histories, capital and credit warranties. Furthermore, the financing institutions have experience neither in renewable energy technologies nor in micro-finance management.

28. To overcome the barrier caused by high front-end costs, two steps are necessary. First, the volume of PV systems installed in the country must be increased to allow the industry to capture economies of scale. Second, reasonable financing or credit schemes must be established to help users spread their payments over a longer period of time. The rural electricity service companies will retain ownership of the PV systems and will be able to obtain financing. The project will ensure both the availability of finances from the financial sector and the soundness of the rural service companies' finances.

Technical and Information Barriers

29. Two types of technical information barriers hinder the growth of the nascent photovoltaic market in Peru. First, it lacks reliable and detailed solar radiation data. The existing data is collected and summarised only to the standards of meteorological data, not engineering data. Therefore, it is unclear to many where there is sufficient solar irradiation to allow successful electrification. Second, the overall endowment of renewable resources and the availability of renewable energy equipment are not generally known.

30. In response to these barriers, two types of activities are required. The first will involve the development and publication of a database of solar energy resources and markets in Peru. The second will involve the development and publication of database on photovoltaic equipment.

Normative Barriers

31. There are no technical norms and standards for PV equipment and components in Peru. Neither are there recommended practices for the installation and maintenance of PV Systems. This leads to a lack of consumer confidence in private installations and places a limitation on market growth.

32. In order to overcome this barrier, the photovoltaic industry in Peru needs to compare its practices with best international practice. As part of this project, a set of standards for panels, components, systems and installation practices will be established and publicised to ensure both the high quality of PV installations and consumer confidence. These standards will also include recommendations for the fluorescent bulbs to be utilised as part of the system as international experience has shown that the efficacy of the tubes can tremendously influence system cost and performance.

Human Resources Barriers

33. Only a few universities in Peru are involved in renewable energy research and development. The number of professors and instructors is small. Consequently, the number of well-trained technicians is very limited. In rural areas, there is an almost complete lack of technical capacity to build, install and operate PV systems. Users also lack information about the operation and maintenance of PV systems.

34. A wide-ranging training and capacity building program is required to overcome the human resource limitations found in the Peruvian PV and renewable energy sector. This will include support for technical courses at the polytechnic and university level, technician training for builders and installers of systems, certification training to familiarise the industry with the standards for systems and installation, and user training.

B.2 Expected End-of-project Situation

35. By the end of the project, it is expected that a sustainable PV rural service industry will have

been stimulated. At present, the PV market in Peru sells between 1000 and 2000 systems per year. With the help of this project—which will result in the installation of over 3000 systems per year for 4 years—it is expected that the market will grow to between 6000 and 7000 PV systems per year. With this increase in size, it is anticipated that the cost per system will fall to almost US$500 per system (excluding taxes). This places their cost at a level roughly equivalent to current average expenditure levels on kerosene, candles, and batteries in remote rural communities.

36. The standardisation of the system components and the increased market opportunities are expected to have a positive impact on the national industry of PV system components, as well as to make it financially interesting to install a PV-module assembling plant in Peru in the future. Government will also work to remove import duties on imported PV panels and balance of system components. With the rural energy service companies and the support provided through this project, it is anticipated that this industry will continue to operate profitably and grow in the future.

37. At the end of the project, the situation would have responded to the immediate need of providing electricity services to an isolated population but also have laid the foundation for expanded private investments in remote rural electrification through:

- Making renewable energy information widely available;
- Providing better solar radiation information for proper sizing of the systems;
- Establishing clear legal and institutional foundations for renewable energy in Peru;
- Enhancing the quality of PV systems, components and installations;
- Training technicians, professionals, and users in renewable energy;
- Creating the foundation for market-driven regional activities and initiatives; and
- Strengthening the national financial system for the expansion into renewable energy financing.

38. These results will have a sustained impact on the quality of life of the rural population, as well as on GHG emissions beyond the lifetime of the project.

B.3 Target Beneficiaries

39. The direct beneficiaries of the project will be the 250 communities (approximately 12,500 families or 60,000 personas) living in the surroundings of Pucallpa, Iquitos, Puerto Maldonado y Jaen, which will be electrified through the activities of the project. The beneficiaries are not passive recipients of assistance but active participants in the project, as they are involved in the project implementation and will pay fees for the services provided. Similarly, the persons and institutions participating in the training programmes in the different levels, as well as in other components of the project, will be directly benefited.

40. The indirect beneficiaries of the project will be all the users of the information system created by the project, the clients of the financial system strengthened by the project and all the individuals and institutions dedicated to rural PV electrification and benefited by the standards and enabling regulatory framework. It is estimated that the project will have a positive impact on the PV market, which will grow substantially, and thus benefit a large part of the rural population actually lacking electricity.

B.4 Project Strategy and Implementation Arrangements

41. The National Electrification Plan is the framework for the proposed project. The existence of market and non-market barriers, however, prevents the full potential of PV's as a source of rural electricity from being achieved. By removing the identified barriers, this project will establish the necessary conditions to integrate solar photovoltaic systems into the plan in a sustainable manner.

42. The project is designed to remove barriers to remote electrification using photovoltaics in stand-alone and micro-grid installations. The focus on the PV technology arises from the successful experiences with these systems in rural Peru. Market opportunities for renewable energies will be created by improving the access to credit, by facilitating the creation of rural PV service companies, and by creating greater consciousness of the benefits and possibilities of PV electrification. The goal is the development of a sustainable PV market relying upon rural electricity service companies. Seven project components have been designed with the aim of removing the barriers to the successful photovoltaic-based rural electrification.

Component 1: Development of renewable energy data and databases

43. The aim of this component is to remove the barrier of lack of Solar Radiation Resource information and the lack of information about solar resources, technologies, and market opportunities in Peru. Solar radiation information is essential for the proper sizing of photothermal and photovoltaic devices. Ground data on solar energy and sunshine has been collected by a SENAMHI (Servicio Nacional de Meteorología e Hidrología) with approximately 110 instruments (90 solarimeters, 15 actinographs and 5 black and white piranometers) scattered in Peru. SENAMHI was responsible for providing solar energy information until very recently. Because of its nature, the information gathered has been processed for meteorological purposes instead of energy purposes. This component will provide SENAMHI the necessary means of processing the existing information, producing new information on solar energy and making it freely accessible through Internet. In addition to the Web page, a Solar Radiation Data Manual for solar thermal and PV applications will be produced and updated. The database (to be developed with GIS) will also help characterise the potential market for PV's in Peru.

Component 2: Standards for PV systems and certification of installations

44. The aim of this component is to remove the barrier of poor quality components—like charge/discharge regulators, ballast, fluorescent tubes and batteries—that have often led to malfunction and poor performance of PV systems. Standards and recommended practices are important issues that could prevent the use of poor quality elements and the operation of poor installations, and are essential to keep maintenance work and the O&M costs as low as possible. Many countries in the region are facing the same problem: costly foreign-made solar modules imbedded in a system often unbalanced, with bad components, and poorly installed. The standards developed (or adopted) should be fulfilled by the suppliers as a bid condition and be able to verification by local labs (like solar laboratories), and further certification of the product. All efforts will be made to incorporate international best practice and experience in the PV sector, drawing upon experience from elsewhere in Latin America.

45. The installation is a service provided by the supplier of the PV systems or the regional PV dealer/operator. No matter if the rural electricity company does the installation itself or if they subcontract for the task, systems should be installed following the installation guidelines.

Installation technicians and contract supervisors must be trained in these installation guidelines. Randomly selected installations will be inspected to ensure that they are consistent with the guidelines.

Component 3: Establishment of model rural electricity concessions and local companies

46. Based upon the legal and regulatory framework established under the Electrification Law, the experience of other Latin American countries with renewable electrification and the ongoing Technical Assistance of ESMAP, a model for concessionaire operators for remote rural electrification will be established. The model will allow for flexible arrangements and ownership patterns, but should be designed to give a secure basis for future investment for both operators and consumers, while maintaining consistency with the electricity laws and providing for the requisite economies of scale to make electricity provision economically attractive.

47. Communities in Peru have different degrees of organisational development. A number of options for the provision of renewable electricity will be developed and evaluated based upon the experience in other Latin American countries. The main issues should be the goal of the company, the associative form, rights and responsibilities of members, management fees, tariffs to be charged and fines, when necessary. Local communities will be helped to establish their own rural electric utilities, where appropriate.

Component 4: Strengthening of financial institutions for renewable electrification

48. In the first instance, this component will select and work with a set of financial institutions (banks, development banks or second story financial institutions) to ensure adequate financing for the companies being established to provide the electricity services to remote rural areas under Component 3. Initially, the goal will be ensuring that the money paid into the company is well-managed. Through time, the goal is for these financial institutions to begin on-lending for renewable energy activities with their own resources.

49. Based upon the experiences with the financing of renewable energy systems elsewhere in Peru, this component will work with selected financial institutions and second-story financial institutions to establish a framework for the financing of renewable electrification. This will involve not only work to identify appropriate loan qualification standards but also focus on increasing credit availability and lengthening payback terms for small-scale remote rural electrification. This component will also work with the rural electrical companies or concession operators to ensure that their fee structure is sufficient to guarantee their long-term sustainability.

Component 5: Installation of PV systems

50. For the PV market to become sustainable and cost-effective, it will be important that it develop to a size where it can begin capturing economies of scale. To achieve this goal, the project will concentrate its efforts and systems mainly in the hinterlands surrounding four towns: Pucallpa (Departmento de Ucayali); Iquitos (Dpto de Loreto); Puerto Maldonado (Dpto. De Madre de Dios); and Jaen (Dpto. De Cajamarca). A few systems will be installed in other regions according to the government's regional and poverty eradication policies. Within these regions, a total of 250 small communities of about 50 households willing to purchase PV systems have been selected for inclusion in the PV electrification program. This will result in the introduction of more than 3000 PV systems in each of the four regions, which is expected to generate sufficient local demand for spare parts, replacements and maintenance services to make each region a

worthwhile market for further investment.

51. The communities selected for the program, apart from satisfying the basic requirement of having sufficient solar irradiation, have met a set of minimal participation criteria. First, they are not to be part of the expansion program of the grid during the next 5 years at least. Second, the number of potential users in the community should be relatively high, at least 50. Third, the users must be capable of paying the set monthly fees.

52. Current users of PV systems are invited to participate in the program and should be able to pay the fees required to ensure the enterprises' long-term sustainability. The contribution of the government to the rural electric service companies can be viewed as an equity investment made on behalf of the communities.

53. When applicable, the use of PV Battery Chargers can also be considered as an alternative for communities with limited income, but with sufficient willingness to pay to cover the costs. This system is very valuable as a marketing tool to be applied in sceptical communities as a previous stage for single PV Systems. It also applies as an answer to provide basic services to poorer communities.

54. The electrification of rural community centres may be considered under the project. However, the challenge will involve working with the local communities to ensure the financial viability and sustainability of these projects. Around such a facility, electricity can be made available for other services provided by other Government institutions, like radio telecommunications and health care.

55. Operation and maintenance is to be paid through the monthly fees paid by the users and collected and administrated by the local or regional company. The purpose of the fees is to assure the supervision of the systems, availability of spare parts like fluorescent lamps and battery replacements. Fees need to be structured to cover the cost of the systems (adjusted according to Governmental cost-sharing priorities) plus operation and maintenance costs. The fees collected by the companies will be managed to ensure the long-term sustainability of the project, in conjunction with the assistance of the financial sector. Furthermore, periodic inspections undertaken by the regional suppliers of PV services will be undertaken to ensure continuing product quality.

Component 6: Training program development

56. In order to strengthen the human resource base, three sets of training activities are envisioned. The first is training at the polytechnic and university level for the principles of renewable energy and the operation of renewable energy businesses. While the latter type of course will be instituted for non-traditional students, the former is expected to focus on current engineering and economic students. This program will ensure that current students and owners of renewable businesses have sufficient technical and business skills to work in the renewable energy field.

57. The second training program will be to train installation technicians so that they understand the new PV standards and how to comply with them. It will certify their proficiency with a "Qualified PV Installation Technician Certification". Trained Qualified Official Inspectors should be able to supervise (and inspect, if necessary) the quality of the installation of the contractors.

58. The third training program will focus on the PV users. It will inform them of concerns and precautions in the operation and maintenance of PV systems. This is more an informative

component, properly documented with printed/other visual material and understood as a service of the supplier. It may be undertaken through both written and broadcast media in order to maximise its reach.

Component 7: Co-ordination and monitoring

59. This component ensures the adequate co-ordination and management of the project and the monitoring of the project activities. The monitoring team will report periodically to the Co-ordination Committee in charge of the general supervision of the project. The co-ordination committee will designate a working to be responsible for this task. They in turn may hire external consultants to carry out the monitoring activities.

60. The UNDP office in Lima will support the program by administrating the project funds and by making direct payments to other parties for goods and services provided to the project upon request of the executing agency. Upon request, UNDP also provides assistance in the identification and recruitment of project personnel, in the procurement of technical assistance and in the arrangements for in-country collaboration with other national and international organisations. Assistance in the design and conduct of international competitive bids for equipment and services can be provided through United Nations Office for Project Services (UNOPS). A separate fee is charged by UNOPS for its services.

61. Each community will obtain electricity services through a local or region-based company as an essential element for the success and sustainability of the project. One of the issues to be examined through the project will be that of the willingness of villagers to pay for the service provided by the PV systems over time, even though they will not own the systems. The communities must be involved in identifying the appropriate financing arrangements.

B.5 Reasons for Assistance from UNDP/GEF

62. UNDP's mandate is sustainable human development and it concentrates its efforts in four key areas: i) eradication poverty; ii) increasing women's role in development; iii) providing people with income earning opportunities and livelihoods; and iv) protecting and regenerating the environment. Energy production and consumption are closely linked to these issues as stated by the UNDP Initiatative on Sustainable Energy (UNISE) and in the recent UNDP publication "*Energy after Rio: Prospects and Challenges*". UNDP is focusing on energy as an essential instrument for socio-economic development and it strongly emphases the efficient use of energy, as well as the use of renewable sources of energy.

63. One of the co-operation areas of UNDP in Peru, according to the Country Co-operation Framework, is Sustainable Development and Conservation of the Environment and the Natural Resources. The Programme Outline referring to this area mentions the assistance for the Ministry of Energy and Mines in establishing a sound base for sustainable energy sector development as one of the priorities.

64. The Global Environment Facility has included this project into its Work Programme in March 1998 under the Operational Programme number 6: "Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs". The project is in line with the guidance of the Conference of the Parties of the UNFCCC provided to GEF, as well as with the objectives of the mentioned Operational Programme. The project will install 12,500 PV systems, which will avoid approximately 55,800 metric tons of CO_2 emissions over the 20-year lifetime of the systems. As the project is expected to have a sustained boosting impact on the

Peruvian PV market, the total reductions of GHG gases will be substantially greater.

B.6 Special Considerations

65. The environmental impacts of this project are generally positive. The substitution of PV systems for fossil fuels reduces the emissions of CO_2, CO, particles etc. Likewise, it reduces the transport of fuel and lubricants, which in the case of Peruvian jungle is mainly by rivers, where accidents are common. A major risk of a negative impact for the environment could be the increased use of batteries containing lead and sulphuric acid and their improper displacement. To impede this to happen, it will be necessary to strengthen the existing systems of recycling or to create new ones.

66. A due attention is also to be paid to the special population dynamics of the jungle. The migration from the highlands towards the jungle is one of the principal causes of the deforestation—the most important single source of GHG emissions in Peru. It is therefore necessary to guarantee that the project will not strengthen this phenomenon, as it would be counterproductive both to the global objective of the project, as well as to the sustainable local development.

67. To guarantee the success of the project, the active participation of the communities involved is crucial. Any community or inhabitant that will be involved in the project has to understand the consequences and explicitly express its interest to participate. The change in the way to provide energy services in rural communities, which in this case are often indigenous, may cause changes in the way of living, including redistribution of the tasks between the genders. These socio-cultural aspects have to be carefully considered in the studies to be realised by the project.

68. The project should end up in a situation, where the environment and the general conditions for a private enterprise interested in electrification rural using PV systems are improved. For this to happen, the participation of the private sector in the project is important. This will be done through the Advisory Board of the project (see co-ordination arrangements). However, this should not affect negatively the transparency and neutrality of the project in respect to the bidding and other commercial relations the project will have with the private sector.

B.7 Co-ordination Arrangements

69. This project has political support from the highest levels of the environmental and energy authorities in the country. The workshop organised during the project preparation mission was closed by the Minister of Energy and Mines, who is also the President of the Council of Ministers (Prime Minister). He emphasised the importance of this project and called for broad involvement and participation in this common task.

70. The Executing Agency of the project is the Executive Bureau of Projects of the Ministry of Energy and Mines. It will nominate an official as the National Director of the project. The National Director has the right to sign contracts and payment orders for the project and he/she is responsible for the efficient execution of the project according to the standard procedures of UNDP. The responsibility of the tasks is defined according to Annex II, which is an integral part of this Project Document. The project will contract a Project Co-ordinator to carry out day-to-day management under the direction of the National Director. The Terms of Reference of the Co-ordinator are presented in Annex VIII.

71. As the project will be executed by the government, any claims raising from the fulfilment of the contractual obligations or unforeseen circumstances will be responsibility of the Executing

Agency.

72. A Project Co-ordination Committee was established in September 1997 in order to support the project execution and guarantee that the project activities are in line with both the National Electrification Plan and the National Climate Change Strategy. The Co-ordination Committee consists of representatives of MEM, National Council for the Environment, National Climate Change Committee and UNDP. The Project Co-ordinator participates in the meetings without vote.

73. An Advisory Board for the project will be established with the representatives of the relevant stakeholders including universities, NGO's, financial institutions, private enterprises, and community representatives. The purpose of the Advisory Board is twofold. First, it gives technical advice to the project in specific questions of implementation. Second, it guarantees the transparency and the dissemination of the project outcomes and lessons-learned in the country.

74. As expressed in the Instrument of the Global Environment Facility, in the event of disagreements between UNDP and any entity concerning project preparation or execution, UNDP or the concerned entity may request the GEF Secretariat to seek to resolve such disagreements.

B.8 Counterpart Support Capacity

75. The project will be executed by the Executive Bureau of Projects (DEP) of the Ministry of Energy and Mines. Since its creation in 1983, the DEP has executed various projects in co-operation with different governmental and non-governmental organisations, universities, institutes of investigation and community organisations. It has the responsibility of providing electricity to isolated, dispersed and very low-income communities in Peru as well as the responsibility to increase the rural electrification coefficient in the country.

76. The Government of Peru participates in the project with an in-kind counterpart of US$ 1,796,768, which consists mainly of already acquired PV-systems, the existing meteorological data and logistic and administrative support to the project. The Ministry of Energy and Mines will also contribute with an equity investment of US$ 3,846,000 for the acquisition and installation of PV systems.

C. DEVELOPMENT OBJECTIVE

77. The development objective of the project is to improve the quality of life of the rural population through providing it with sustainable electricity service. The global objective of the project, which justifies the participation of GEF is to assist the Peruvian government in reducing the long-term growth of the GHG emissions from the burning of the fossil fuels needed to satisfy the needs of the rural sector.

D. IMMEDIATE OBJECTIVES, OUTPUTS AND ACTIVITIES

D.1 Immediate Objective

To establish in the Ministry of Energy and Mines the technical and normative basis to promote the photovoltaic energy and to design and implement an initial programme for the electrification of 250 rural communities using PV systems.

Output 1 Information system on renewable energy resources in Peru is developed

Activity 1.1 Elaboration of a contract between MEM and SENAMHI to develop a solar radiation database

Activity 1.2 Purchase of equipment to process the solar data

Activity 1.3 Compilation and processing of the information and elaboration of a solar energy manual as detailed in Annex X

Activity 1.4 Measurement programme for solar resource evaluation

Activity 1.5 Selection of the entity to develop the Geographic Information System

Activity 1.6 Compilation of the socio-economic, cultural and environmental information important to the use renewable energy sources in Peru and elaboration of the Geographic Information System according to the preliminary plan of Annex XI

Activity 1.7 Development of a Web page on renewable energy

Activity 1.8 Dissemination of the project's products through distribution and selling of printed and electronic publications according to the preliminary plan presented in Annex XII

Activity 1.9 Organisation of events to diffuse, discuss and publicise (Annex XII)

Activity 1.10 Awareness campaigns through radio, written media etc. (Annex XII)

Output 2 Standards for PV systems, installation and certification are developed

Activity 2.1 Selection of the entity to develop the technical guidelines for PV systems

Activity 2.2 Compilation of the existing information in other countries of the region

Activity 2.3 Development of the technical guidelines for selecting the PV system components in different regions of the country (Annex XIII)

Activity 2.4 Development of the technical guidelines for the installation of the PV systems in Peru (Annex XIII)

Activity 2.5 Development of the technical guidelines for the maintenance of the PV systems in Peru (Annex XIII)

Activity 2.6 Design and establishment of a quality control system

Activity 2.7 Design of an installation supervision system

Output 3 Legal/regulative framework and concessionaire models for renewable energy have been established

Activity 3.1 Study on the concessionaire models and other mechanisms to operate PV systems in Peru and other Latin-American countries

Activity 3.2 Study on the national regulatory framework and its application on the rural electrification using renewable energy

Activity 3.3 Training of the regional distribution companies and other institutions interested in concessionaire mechanisms

Output 4 **Financial Institutions are trained to manage financing and sustainability of PV operations**

- Activity 4.1 Elaboration of the detailed Terms of Reference for the Programme "Strengthening of the Financial Institutions in Renewable Energy Operations"
- Activity 4.2 Selection of the institutions interested in financing rural electrification based on renewable energy
- Activity 4.3 Study on comportment patterns and risks and design of loan qualification standards
- Activity 4.4 Training programme for the financial institutions
- Activity 4.5 Training programme for the concessionaires and other system operators

Output 5 **PV Systems are installed and operational in selected rural communities**

- Activity 5.1 Acquisition of 12,500 PV systems to be installed in four predetermined areas
- Activity 5.2 Signing up contracts between the operating companies and the MEM
- Activity 5.3 Installation of the PV systems according to the preliminary plan in Annex XIV
- Activity 5.4 Supervision of the accomplishment of the contracts and technical and administrative backstopping to the companies operating and maintaining the systems
- Activity 5.5 Study on the project's impact on the PV and spare-part market in the four areas

Output 6 **Training programme developed and implemented to develop stakeholder skills in PV energy development, installation, maintenance and operations**

- Activity 6.1 Design of the training programme in professional, technical and operative levels according to the preliminary plan in Annex XV
- Activity 6.2 Selection of the training institutions in all three levels
- Activity 6.3 Manufacturing or acquiring the teaching materials
- Activity 6.4 Implementation of the Professional Training Programme
- Activity 6.5 Implementation of the Technical Training Programme
- Activity 6.6 Implementation of the User Training Programme

E. INPUTS

78. The Global Environment Facility by including this project in its work programme has accepted to finance the incremental cost of the project. The Government of Peru will complement the project with the baseline costs in cash and in kind. Finally, the beneficiaries will participate in the project by initial and monthly quotas paid for the electricity service. The incremental cost matrix

is presented in Annex IV.

79. To achieve the anticipated results of the project, the following inputs have been considered:

• Personal	US$	682,000
• Subcontracts	US$	139,000
• Training	US$	743,000
• Equipment	US$	5,675,606
• Miscellaneous	US$	539,952

F. RISKS

80. The major risk associated to the proposed project emerges from the nature of a barrier removal project. For a barrier removal project, it is essential that all the existing barriers be addressed, either by the project itself or by associated projects. This risk will be minimised by maintaining a close working relationship with other actors and other projects working on similar topics. During the project preparation mission to elaborate this proposal, a barrier identification workshop with about 40 participants from NGO's, universities, government agencies, financial community, and entrepreneurs was organised. The results of the workshop as well as those of the various bilateral meetings, field trips, and results of existing studies have been incorporated in this proposal to eliminate this risk.

81. Another risk relates to the long-term sustainability of the project. The project has been designed to build toward sustainability and cost recovery has been built into the project. GEF subsidies will decrease throughout the project's duration and the project's support is expected to grow the PV market in Peru, thereby decreasing costs. Moreover, the training and capacity building components of the project have been designed with special emphasis on sustainability and replication. Central issues for sustainability are the quality of the PV Systems and components, the proper installation and use of the systems, responsible financial arrangements, and full participation. The establishment of qualified service companies will guarantee that the project lays the foundation for the sustainable development of the PV subsector.

82. A basic assumption of the project is that there are interesting and commercially viable possibilities to invest in renewable energy in Peru. However, different barriers prevent the realisation of these possibilities. This proposal has analysed the existing barriers for the penetration of PV systems in rural Peru and proposed a systematic process to remove then. In addition, other on-going projects and initiatives related to this project have been analysed in terms of their interactions with this project. Mechanisms for the effective participation of all stakeholders in the project have been provided for in the formulation and implementation of this proposal.

G. PRIOR OBLIGATIONS AND PREREQUISITES

83. The ratification of the United Nations Framework Convention on Climate Change is a prerequisite to obtain climate change -related financing from the GEF. Peru ratified the Convention on 7 June 1993, and it entered into force on 21 March 1994.

84. According to the established mechanisms of UNDP, The Ministry of Energy and Mines will contribute the counterpart funding needed for the project's implementation once the project has been approved according to the calendar of payments presented in Annex I.

H. PROJECT REVIEW, REPORTING AND EVALUATION

85. The project will be subject to tripartite review by the government, executing agency and UNDP at least each 12 months; the first of such reviews will be held within the first 12 months after the beginning of the project execution. The project co-ordinator will prepare and present an evaluation report for each review. During the execution of the project, additional reports may be requested when necessary.

86. In the end of the project, the National Director will prepare and present to UNDP the final report on the activities and results of the project.

87. The Project will be monitored by the DEP experts selected by UNDP/GEF working with the Co-ordination of the Program or by a contracted supervising firm. UNDP's extensive experience in monitoring large projects will be drawn upon to ensure that the project activities are monitored and properly documented. In this program the repayment records of the communities etc., is of particular importance. This is essential for sustainability of the PV Systems, and for future expansion of the systems. The project-planning matrix with the monitoring indicators is presented in Annex V.

I. LEGAL CONTEXT

88. This project document shall be the instrument envisaged in the Supplemental Provisions to the Project Document, attached hereto. The host country executing agency shall, for the purpose of the Supplemental Provisions to the Project Document, refer to the government co-operating agency described in the Supplemental Provisions.

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

- Revisions in, or additions to, any of the annexes of the project document with the exception of the Standard Legal Text for non-SBAA countries which may not be altered and the agreement to which is a pre-condition for UNDP assistance;
- Revisions which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of inputs already agreed to, or by cost increases due to inflation;
- Mandatory annual revisions which rephase the delivery of agreed project inputs, or reflect increased expert or other costs due to inflation, or take into account agency expenditure flexibility.

J. BUDGET

90. The detailed project budget is presented in Annex I. The project will be financed by different sources according to the following table (only the GEF and the government cash contribution are included in the detailed budget):

	GEF Contribution	Government (in cash)	Government (in kind)	Users
Component 1	140,000	0	144,000	0

Component 2	253,000	0	0	0
Component 3	275,000	0	50,000	0
Component 4	300,000	0	150,000	0
Component 5	1,827,625	3,733,981	1,302,768	1,376,251
Component 6	450,000	0	0	0
Component 7	570,000	0	150,000	0
Sub total	3,815,625	3,733,981	1,796,768	1,376,251
Adm. Support (3%)	114,468	112,019	0	0
PDF-A	25,000	0	0	0
TOTAL	**3,955,093**	**3,846,000**	**1,796,768**	**1,376,251**

ANNEXES

Annex I	Incremental Cost Matrix
Annex II	Project-Planning Matrix
Annex III	Institutional Arrangements
Annex IV	Terms of Reference: Project Co-ordinator
Annex V	Terms of Reference: Co-ordination Committee

ANNEX I

INCREMENTAL COSTS

I.1 Broad Development Goal

The broad development goal of this project is the provision of basic services through renewable based electricity to remote rural population of Peru and the removal of barriers to boost the use of renewable energy for electricity supply. Presently, the electrification index of the country is 66%, meaning that nearly 8 million people have no access to electricity. The goal of the government in the next 4 years is to increase this index to 75%. Taking into account a population of 24 million, the goal is to supply electricity to near 2.16 million people or approximately 432,000 families in this short period. Such a tremendous governmental effort can only be achieved if the private sector is mobilised to participate in this effort on a sustainable basis. The proposed project would directly contribute 2.8% of this goal (with 12,500 families of 432,000). With the proceeds from those initial households, it is expected that another 4688 households can also be electrified.

Another way to view the Peruvian PV market is to consider that of the households without electricity (1.6 m), about 600,000 cannot be economically connected to the grid or mini-grids drawing from small diesel or hydro generating sets. These 600,000 households can be considered to be the potential market for solar home systems, and their number might be increasing as rapidly as 12,000 households per year, if it keeps pace with population growth.

I.2 Baseline

Under the baseline, DEP will invest in rural electrification using three alternatives: grid extension, small diesel gensets and PV systems. For the most, the baseline considers the continuation of use of kerosene, candles and non-rechargeable batteries for lighting and other basic electricity needs. PV systems might be used in isolated and dispersed communities not covered by the grid extension program for the next five years, if the barriers identified in this proposal did not exist, and where the operation of small-grid, interconnected, medium size diesel gensets are cost-prohibitive.

I.3 Global Environmental Objectives

The global environmental objective is the reduction of present and future greenhouse gas emissions through the use of renewable energy. The proposed Rural Electrification Program is profitable and sustainable in the long term, once barriers are removed. This program is therefore consistent with GEF Operational Program 6, "Promoting the Adoption of Renewable Energy through Removing Barriers and Reducing Implementation Costs".

I.4 GEF Project Activities

GEF activities have been described in the body of the project brief. The activities have been designed to overcome the barriers encountered in Peru in the development of electricity supply based on photovoltaic systems. In terms of electrification, the final result would be 12,500 rural homes electrified with solar energy from PV's. Another 4688 households may be electrified with the repayments from the initial household installations. In terms of development, the project will lead to the expansion of market niches for PV based rural electrification. At the end of the project, it is anticipated that the PV market in Peru will have grown from its current immature state of installing between 1000 and 2000 solar home systems per year to installing nearly 7000 solar home systems per year on a sustainable basis.

I.5 System Boundary

The incremental cost analysis presented below represents the barrier removal costs associated with renewable energy electrification in Peru.

I.6 Additional benefits

The Rural Electrification Program here proposed means a small reduction in CO_2 emissions from kerosene burning for lighting. Other emissions reductions, not accounted for this project, arise from the future penetration of PV Systems in the rural areas of Peru. As a consequence of this project, significant quantities of diesel oil used for electricity generation will be saved which will result in the reduction of sulphur and nitrogen oxide emissions.

I.7. Incremental cost matrix

Table 1.2 summarises the incremental costs of the activities of the project. Activity 1, focusing on the lack of information on solar resources, takes advantage of the information made available by SENAMHI and provides for its transformation to a useful form. Without the project, the information would remain meteorological information. This activity will also create a widely-accessible energy resource and technology information base that would not be available in the absence of the project. Activity 2 will develop the standards for PV Systems and components, and the installation of these systems. It will benefit other projects in the region facing the same barrier. Activity 3 will provide an institutional basis for remote rural electrification by creating a model for rural, community-based utilities and helping to organize the participating communities into those companies. Activity 4 focuses attention on enabling financial institutions to evaluate and finance renewable energy investments and on strengthening the local electrification companies to ensure their financial viability and management.

Activity 5 is the budget item, accounting for nearly 90% of project funds. The project will install 12,500 PV Systems over 5 years. The baseline for participating families is the continued use of kerosene, candles and batteries. Rural households in the project areas spend approximately S/.20 monthly (US$7.55/month, or US$76.80 /yr., excluding 18% VAT) on kerosene, candles and batteries (excluding equipment costs). This figure of US$76.80 per year is in line with the findings of several World Bank studies. Over a period of 20 years, the present value (discounted at 12%) of these expenditures amounts to US$580.90.

At current prices, a 50 W peak PV system (including a 50 W peak module, charge regulator, battery and 3 fluorescent lamps) cost about US$900 (retail) in Peru. Generally, the PV is module is imported while the BOS (Balance of System) is assembled in Peru (value is split at about 50:50). Imported goods pay a 18% import duty. Excluding the VAT and the customs duty, the present value for the module is US$331.60. For the BOS, present value amounts to US$381.40, for a sub-total of US$713, excluding replacements. However, to evaluate the full cost of the system, replacements must be taken into account. A battery suited for PV Systems costs US$100 (US$84.80 excluding VAT). If replacements occur after year 7 and 14, the present value of battery replacements is US$65.80. The total present value of the PV System including battery replacements comes to approximately US$778.80 (over 20 years discounted at 12%).

In summary, the incremental cost estimation for the PV System including battery replacement comes to US$778.80 (-) US$580.90 = US$197.90. Thus, at the beginning of project implementation, the incremental cost can be considered as US$200 due to the nascent status of the Peruvian PV market. However, as the market grows toward its annual target rate of 7000 systems/year, the price per PV system is expected to decline to roughly the cost that is currently

being paid for the energy services in these remote rural areas. From an initial high of about US$713 per system, the price is expected to decline in increasing steps to about $513 (*ex*-duty and VAT) at the end of the project. In keeping with this expectation, the incremental cost subsidy to be given under the project for a PV system will decrease throughout the project's five-year duration. This means that the incremental costs to be paid through the project per PV installation will behave as in the following table. The incremental costs of the 12,500 PV systems comes to US$1,827,625 over the five year period. The total incremental cost for the installation of the PV systems, US$1,827,625 is reflected in the matrix.

Table I.1 Projected Price and GEF Support for PV Units

Year	PV Units Installed under Project	Projected PV Price (*ex* import duty)	Incremental Cost per Unit (US$)	Total Incremental Cost Subsidy (US$)
1	-			
2	3125	713	200	624,500
3	3125	688	175	546,875
4	3125	653	140	437,500
5	3125	583	70	218,750
6 (post project)	-0-	513	-0-	-0-
Total	12,500	8,240,625		1,827,625

The CO_2 emission reduction benefits can be estimated as follows. Assuming a household-level consumption of 6 kg/month of kerosene for lighting, a household will generate 18.6 kg CO_2/month (223.2 kg/year, 4464 kg during 20 years). The implementation of the 12500 PV Systems will result in the avoidance of 55,800 metric tons of CO_2 emissions over the 20-year period of the project. If it is assumed that another 4688 systems are purchased with the payments of the participants, then another 20,927 metric tons of CO_2 would be avoided, for a total of 76,727 metric tons CO_2 avoided. As the local market develops further, this figure would be even greater.

The training targeted under Activity 6 would be unlikely to take place in the absence of the project and is therefore, fully incremental. Activity 7, Co-ordination, Monitoring and Evaluation is an inherent cost of the project and has been considered fully incremental, excluding the in-kind contribution of the DEP for US$150,000.

ANNEX I (cont.)

INCREMENTAL COST MATRIX

Component	Cost Category	Costs	Domestic Benefits	Global Environmental Benefits
Activity 1 National Solar Energy Data Base	Baseline	(in kind) $ 144,000	Solar energy info not available–no info on solar resource & systems	Only meteorological info available
	Alternative	$ 140,000 (in kind) $ 144,000	Solar information available	Resource & market info available
	Increment (Alternative – Baseline)	$ 140,000	Better utilization of solar resources	Info on solar energy in Peru widely available
Activity 2 Standards for PV Systems Installations and Certification	Baseline	$ 0	Lack of standards increase O&M costs of RE Energy systems	None
	Alternative	$ 253,000	Standards developed/adopted	Better product and better installations
	Increment (Alternative – Baseline)	$ 253,000	Higher consumer confidence in RE products	Decreasing of O&M costs and increased profit of RE firms
Activity 3 Development of Models for Concessions & Companies	Baseline	(in kind) $ 50,000	No institutions able to carry out renewable electrification	None
	Alternative	$ 275,000 (in kind) $ 50,000	Institutions established	PV dissemination possible
	Increment (Alternative – Baseline)	$ 275,000	Sustainable PV companies suppiy energy to rural areas	Companies can profitably provide PV's

Activity 4 Strengthening Financial Institutions for Renewable Electrification	Baseline	(in kind) $ 150,000	Financial Institutions unable to loan for PV's & renewables	Market limited to cash sales
	Alternative	$ 300,000 (in kind) $ 150,000	Financial institutions process PV loans	Market opened to credit sales
	Increment (Alternative – Baseline)	$ 300,000	Financing for PV's available	PV Market expands
Activity 5 Installation of PV Systems	Baseline	$ 6,413,000 Government: $ 3,733,981 (in kind) $ 1,302,768 Users $ 1,376,251	Some electricity provided through grid extension—HH's use kero, candles, etc.	None
	Alternative	$ 6,937,857 (in kind) $ 1,302,768	12,500 PV systems installed	CO_2 reduction-- Dev't of PV market
	Increment (Alternative – Baseline)	$ 1,827,625	Households get electricity through PV	Market for PV expanded
Activity 6 Training Programme Development	Baseline	$ 0	Human resource barrier remains	None
	Alternative	$ 450,000	Suppliers, technicians and Users trained in PV systems/standards	Technical skills increased
	Increment (Alternative – Baseline)	$ 450,000	Further expansion of PV market	Potential further expansion of global benefits
Activity 7 Co-ordination, Monitoring and Evaluation	Baseline	(in kind) $ 150,000	Limited management skills for renewable energy projects	

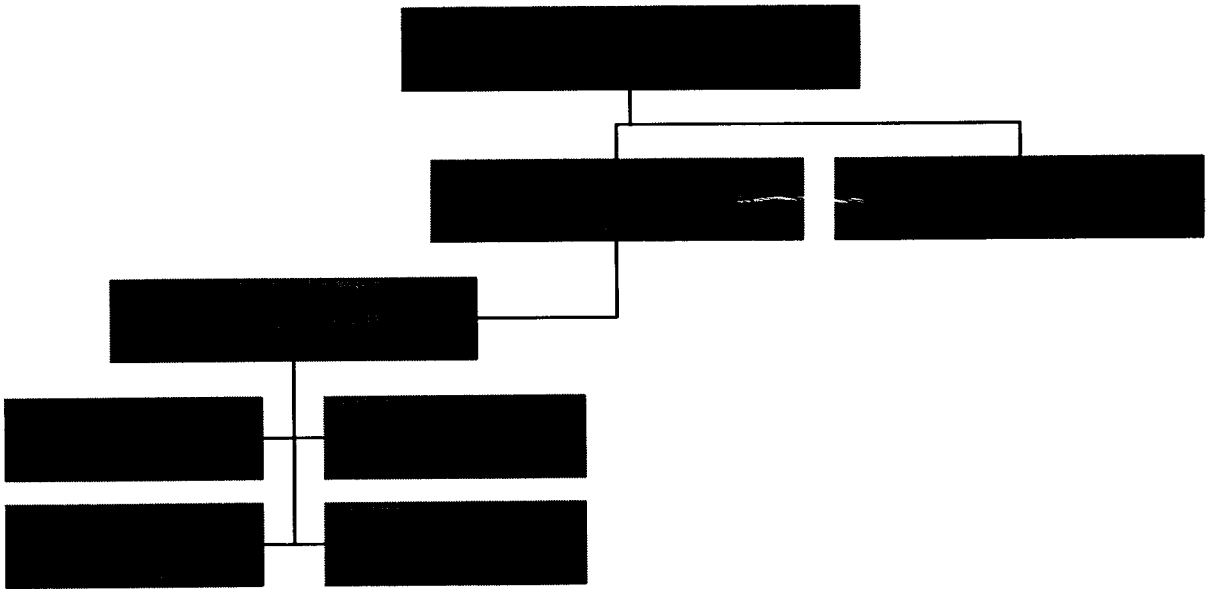
	Alternative	$ 570,000 (in kind) $ 150,000	Improvement of project management	Monitoring experience gained
	Increment (Alternative – Baseline)	$ 570,000	Project is carefully conducted and monitored	Comprehensive follow-up of the project
TOTAL	Baseline	(gov. + users) $ 5,110,232 (in kind) $ 1,796,768	Continued use of kerosene, candles & ltd access to conventional electricity	None
	Alternative	$ 8,925,857 (in kind) $ 1,796,768	12,500 users gain access to PV systems	CO_2 emissions reduced by 55,800 tonnes
	Increment (Alternative – Baseline)	$ 3,815,625	PV Market expanded, continues to grow	Potential further expansion

ANNEX II
PROJECT PLANNING MATRIX

Project Development Goal: Energy needs in remote rural communities are satisfied by PV electrification program with positive reductions on GHG emissions	**Objectively Verifiable Indicators**	**Means of Verification**	**Assumptions**
Project Purpose: Government, private sector and rural stakeholders are empowered to engage in PV renewable energy development through the removal of institutional, financial, technical, organizational and information barriers currently impeding renewable energy use and investment.	• Institutional and operational delivery systems for PV development are in place along with supportive regulatory frameworks and incentive systems. • Financial mechanisms to ensure user access and PV system sustainability are developed and tested. • Technical capacity of national and local users in strengthened to assume responsibilities of PV-related operations. • PV information is updated and made widely available to planners, users and investors to encourage & facilitate development replication, and future investment.	• Number of institutions established or participating in PV related operations. Implementation & adoption of legal frameworks and incentive systems. • Revolving funds, credit lines and other supportive financing options are available at financing institutions. • Institutions, technicians and users have participated in training programmes and are applying received knowledge in PV related operations. • PV info/data systems in operation, mechanisms by which this information is disseminated to government, private sector, etc. surveys with relevant stakeholders, PV assessing utility and application of data	• 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 PV development. • Wide variety of national and local stakeholders activity participate and apply PV-related skills • PV information and data systems effectively used and applied by planners, users and potential investors.
OUPUT 1 : Renewable energy data and databases exists	1.1 Data base available by the end of the first year 1.2 Manual of Solar Radiation Data available by the end of the first year	1.1 Database info is used by government planners, private investors, and resource users 1.2 Availability of Manual of Solar Radiation	• Government decision –makers, private sector investors, etc. are applying information provided in data bases to advance PV development.
OUTPUT 2: Standards for PV systems, installation and certification are developed	2.1 Standards for PV installation, maintenance and; operations is available; and disseminated.	2.1 Availability of standards in printed form	• Standards are effectively applied by diverse stakeholders and relevant operators.
OUTPUT 3: Legal/regulative framework for	3.1 Proposal of a law for Renewable Energy to be discussed by the	3.1 Workshops and public discussions	• Relevant government and private stakeholders actively participate in

Renewable Energy have been established	end of the first semester	3.2 Presentation of a proposal to the Government	developing a renewable-based legislation framework. Government commitment reflected in adoption of framework.
OUTPUT 4: Financial institutions are capacitated to manage financing and sustainability of PV operations.	4.1 Financing institutions develop and implement financing modalities and credit operations supportive of PV development and operations in rural areas.	4.1 Record of participating financing institutions, financing modalities in place, surveys assessing user satisfaction and accessibility to credit lines.	• Institutions and selected staff attend training seminars and effectively apply financing options to facilitate PV operations and development.
OUTPUT 5: PV systems are installed and operational in select rural communities.	5.1 Evaluation of Demonstrative PV Projects by the first semester 5.2 Evaluation and negotiation with PROER's additional funding, by the first semester 5.3 Development of a Concession model by the first semester 5.4 Installation of 3125 PV systems by end of 2nd and each additional year 5.5 Installation of additional 12500 PV systems by end of year 5	5.1 Evaluation of Demonstrative PV Projects, Concession model made available 5.2 Negotiation with PROER leads to new funding 5.3 1000 PV systems installed by the first year 5.4 Control of the development of the acquisition and installation of the proposed number or PV systems	• The systems supplied to the users are not oversold : they supply the services they are able to. Installed PV Systems have been properly installed. • There is a positive climate with peasants and communities to value the PV option and to adopt it. • Communities accept and adopt the developed Concession Model • Users are confident with the PV systems • Fully understanding in the communities of their commitment to the sustainability of the project • Local regional companies are formed to attend the service needs of the Communities
OUTPUT 6: Training programme developed and implemented to develop stakeholder skills in PV renewable energy development, installation, maintenance and operations	6.1 Based on needs assessment, government and non-government actors are trained in principles of PV installation, maintenance and overall operations	6.1 Record of training programmes developed, list and attendance record of trainees maintained, frequency of training timeframe.	• Targeted stakeholders and institutions effectively apply skills related to PV maintenance and overall operations.
OUTPUT 7: Coordination and monitoring programme established and implemented.	7.1 Programme impact is maximized through monitoring and coordination arrangements.	7.1 Review of TORs for monitoring and coordinating groups, including composition, frequency of meetings, minutes of meetings, reports of best practices.	• Key players related to monitoring and coordination are available to meet on a regular basis and actively participate in project related discussions.

ANNEX III
INSTITUTIONAL ARRANGEMENTS



ANNEX IV

TERMS OF REFERENCE

PROJECT CO-ORDINATOR

The Project Co-ordinator shall be chosen by the Co-ordinating Committee from a short list of candidates put forward by the Project National Director. The co-ordinator will be responsible for the due execution of the project activities in line with Terms of Reference agreed upon, and the corresponding schedules. For that purpose, the Co-ordinator has the below-mentioned essential responsibilities for the execution of the project. In the execution of his/her activities the Co-ordinator will maintain a close and constant communication with and will report to the National Director.

The Project Co-ordinator shall:

1. Be familiar with the guidelines and operational principles of GEF (Operational Strategy of GEF), especially with regard to the Operational Programme #6;
2. Be familiar with the UNDP procedures in order to manage the various activities of the project;
3. Ensure that the consultants, subcontracted institutions and other entities will comply with their tasks within the set timeframe and without deviating from the objectives of the project;
4. Ensure throughout the project a systematic co-ordination of the various consultants, subcontracted institutions and other entities in order to guarantee that the resulting materials/reports will be made with the greatest degree of co-ordination and completeness to reach the project's objectives within the agreed schedule;
5. Organise meetings and workshops for the implementation of the project in order to permit an orderly and logical organisation of the objectives, activities, and results of the project, as well as identifiy and hire the facilities required for that purpose with co-ordination with the National Director;
6. Maintain a close and permanent communication with the main participants from the universities, NGO's and other public and private institutions which are linked with the development of photovoltaic energy and organise workshops or meetings with them to obtain feedback and inform on the progress of the project;
7. Define together with the National Director and UNDP the forms of execution and implementation for the project and obtain the official support of the Focal Point of GEF in Peru when necessary;
8. Draft project reports for tripartite reviews, Co-ordinating Committee meetings and when otherwise necessary;
9. Execute any other relevant tasks entrusted by the National Director of the project

ANNEX V

TERMS OF REFERENCE

CO-ORDINATION COMMITTEE

ARTICLE 1

These rules will govern the operation of the Co-ordination Committee, hereinafter called THE COMMITTEE.

ARTICLE 2

THE COMMITTEE comprises:

- One representative from the Ministry of Energy and Mines/Executive Bureau of Projects (MEM/DEP), who will chair THE COMMITTEE;
- One representative designated by the National Council of Environment (Consejo Nacional del Medio Ambiente — CONAM);
- One representative designated by the National Climate Change Committee;
- One representative from the United Nations Development Program (UNDP);
- The Project Coordinator, who can express his opinion but does not participate in the decision-making.

In case that there are changes in the persons or institutions, these will be notified to MEM/DEP, the presiding body of the Committee.

If one of the members is absent from a COMMITTEE meeting, in order not to detain its activities, the decisions adopted by the members present at the meeting will be considered valid.

ARTICLE 3

THE COMMITTEE will be chaired by the National Director of the Project. If he/she is absent the meeting will be presided by his surrogate representative.

The National Director of the Project will report to THE COMMITTEE on the development of the Project activities before each invitation to a meeting.

The Secretariat of THE COMMITTE will be in charge of the representative from UNDP, who will be in charge of drawing up and custody of the corresponding Minutes. In his absence, the Secretary will be the Project Coordinator.

ARTICLE 4

THE COMMITTEE will initally meet at least once a month; further on in accordance with the requirements of the Project. The meetings take place at the Main Offices of MEM/DEP.

ARTICLE 5

The meetings of THE COMMITTEE will be by invitation from the Chairperson and/or THE COMMITTEE. The Agenda on the matters to be dealt with in the meeting will be attached. to the

invitation.

ARTICLE 6

At the beginning of each meeting the Minutes corresponding to the previous meeting will be approved and signed, handing over one copy of them to each of the members of THE COMMITTEE.

ARTICLE 7

The agreements arrived at by THE COMMITTEE will be unanimous. THE COMMITTEE wil develop its actions in the framework of the Agreement signed by the Government of Peru, the Ministry of Energy and Mines and UNDP.

TRANSITORY PROVISION

To the functions of THE COMMITTEE may be added others which according to its judgement are deemed necessary for obtaining the objectives of the Project.

These Rules were approved in the Installation Meeting of THE COMMITTEE on 30 September 1997.