CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	15 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of the small-scale project activity

A.1. Title of the small-scale project activity:

Micro-hydro Promotion

PDD version 05 as of May 6, 2008

A.2. Description of the small-scale project activity:

This project deals with the development and installation of micro-hydro power plants ranging from 5 to 500 kW with a cumulative capacity up to 15MW and is being promoted by the Alternative Energy Promotion Centre (AEPC) under the Ministry of Environment, Science and Technology (MOEST) of Government of Nepal (GoN). The implementation of these micro-hydro plants are being done through two of AEPC's projects namely; Rural Energy Development Program (REDP) and Minigrid Support Program (MGSP) of Energy Sector Assistance Program (ESAP).

In Nepal Micro-hydro has been defined as hydro power plants which have a capacity ranging from 5-500 kW. Micro hydro plant generates electricity by using the energy available in the falling water. Therefore the major parameters of a Micro-hydro will be the availability of head drop and water flow at the site; this will determine the size of the plant to be installed.

The project expects to reduce GHG emissions through the replacement of diesel fuel used for lighting and milling.

The project activities are targeted at poor communities across several regions of Nepal. This also supports the Government's objective of improving energy services in rural areas by developing a viable, market-oriented micro-hydro power system by offering support to both demand and supply sides.
The project provides subsidy as per the ***Subsidy Policy - 2006*** of Government of Nepal – which covers approximately 35-55% of the total investment for a plant. Aside from the financial subsidy the project also provides technical training, market information and business development support services to the communities and MHP entrepreneurs. Along with the support to users, capacity building activities are also provided to MHP construction and supply companies.

There are three types of ownership related to Micro hydro plants promoted by AEPC; community ownership, institutional ownership and personal/ private ownership. The most popular form is Community based ownership wherein the plant is operated, managed and owned by the community; therefore AEPC provides an intensive community mobilization package aside from its technical support to induce sustainability of the plants. Institutional and Private ownership lag far behind community ownership but is still being promoted by AEPC. In this type of ownership the plants are owned and managed by an institution or private entrepreneurs, they sell the electricity generated by the plant to the rural areas and generate revenue for themselves. It has been observed that regardless of the type of ownership without the subsidy given to the plant by AEPC the MHP would not have been realized, thus the CERs earned by the project will be utilized by AEPC to 1) fulfill the financial gap for installation of such plants and 2) for technical and ER monitoring of all the plants included in the project.

AEPC consolidates REDP and ESAP through the following key outputs:

- Policy, guidelines, manuals and technical specifications for Micro hydro design and installation.
- Quality control and monitoring of installations, after sales services for participating micro-hydro companies
- Financial support by providing a subsidy[1] of ~US$ 141 per HH but not exceeding US$ 1,197 per kW for the installation of new MHP. It also provides transportation subsidy for local transportation of MHP components from roadhead to plant site. This Transportation subsidy is only provided for MHPs located in the remote or very remote areas (there are different categories for the transport subsidy which is explained in the attached Subsidy Policy 2006). An end-use promotion fund of ~US$ 141 per kW of installed power (but not exceeding ~US$ 3,521) is also provided to the plants implemented through REDP for the promotion of electricity based end-use activities for the long term sustainability of the plant. Direct subsidy for end-use is not provided for ESAP supported projects but training and other support are provided.

Contribution to Sustainable Development

Off- grid power generated by MHPs provide a large number of rural households with electricity and power for lighting, milling and other needs. Such off-grid renewable energy systems not only help in poverty alleviation but also have direct local environmental benefits such as:

- Reduction in diesel consumption by replacing use of diesel power with electric agro-processing mills and household lighting.
- Reduction in use of dry cells used to operate radio, and torchlight (Flashlights), leading to reduced chemical pollution of the local environment and also reducing the heath hazard resulting from the exposure and contact with these chemicals.
- Reduction in pollution from Lead Acid Cell Battery, with proper electric supply households need not purchase a battery to supply electricity for lighting. Therefore charging practices will be eliminated hence eliminating the need for continuous transport of wet lead acid batteries from houses to charging stations.

Aside from environment benefit the MHP will benefit other areas of the Sustainable Development Agenda such as:

- Plants constructed under the project will be managed and operated by the community, institutions or private entrepreneurs leading to local empowerment.

- Adequate training for operation, repair and maintenance will be provided to the people for the smooth operation of plant, which will enhance the skill set of local people.
- Electrical end-use enterprises will be supported to increase plant factor which will lead to different opportunities for self employment at the local level.
- The market of MHP components will flourish due to a large number of installations increasing the number of local manufacturers, suppliers and installers whereby creating jobs for many and at the same time help to lower the cost of MHP components due to a competitive market mechanism.

A.3. Project participants:

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The following table provides information on the project participants.

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
Government of Nepal (Host)	Alternative Energy Promotion Centre, Nepal (AEPC)	No
The Netherlands	International Bank for Reconstruction and Development as the Trustee for the Community Development Carbon Fund (CDCF)	Yes

AEPC has received legal rights for transfer of ownership of CERs and other relevant rights from the owners of installed MHP and has made arrangements to receive the legal rights from all other MHPs which are at different phases of installation.

AEPC, the project proponent, is a government body under the Ministry of Environment, Science and Technology and oversees the policy design and promotion of the national renewable energy sector.

The IBRD as the Trustee of the CDCF will be purchasing emission reductions from this project.

Contact information of the project participants is given in Annex 1 of this document.

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

Nepal

A.4.1.1. Host Party (ies):

Government of Nepal

A.4.1.2. Region/State/Province etc.:

The project is expected to cover all rural hilly areas in Nepal where national grid electricity has not reached and will not in the foreseeable future.

A.4.1.3. City/Town/Community etc:

District Energy and Environment Section (DEES) are located at each headquarter of 40 districts to implement the REDP. Likewise, there are 8 Regional Renewable Energy Service Centres covering 4-5 districts each supported by ESAP in different locations in Nepal

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity(ies):

MHP installations are scattered throughout the country mostly in rural hilly settlements which do not have access to grid electricity or no chance of extension of the national grid in the near future. AEPC keeps a record of the addresses of all the households/communities that buy/install MHPs under its program for field surveys and monitoring and evaluation. AEPC has a database for identification of micro hydro plants under the CDM project; this will later be incorporated to a GIS-based module where latitude and longitude information for each MHP will be indicated. The GIS module will help in tracing the physical location of the MHP easier and dependable.

A.4.2. Type and category (ies) and technology of the small-scale project activity:

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According to Appendix B to the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, the proposed project falls under the following type and category.

Type I – RENEWABLE ENERGY PROJECTS

Category I. A. - Electricity Generation by the User

The proposed project activity falls under Type I of version 12 - the aggregated capacity of the bundled micro-hydro systems to be implemented under the project will not exceed 15 MW throughout the entire crediting period of the project.

Micro-hydro Technology: Micro hydro technology has been seen as a proven technology in Nepal for supplying electric power to the rural community where there is no access to the national grid. Due to the availability of water resources and the hilly terrain of the country Micro hydro plants have gained popularity as one of the best rural electrification technologies in Nepal

Micro-hydro power systems use potential energy stored in water to supply mechanical energy that can be used directly or be converted to electrical energy, through a generator, for use in lighting, refrigeration, milling or a number of other productive uses. The basic components of a micro-hydro system include:

- Inlet weir for diverting desired amount of water into the system,
- Inlet structure, where the diverted water enters the system,
- Headrace canal for carrying the water from the inlet to the different tanks which may either be the desilting tank and or the forebay tank
- Desilting tank if required is placed before the forebay tank and its main purpose is for the removing of fine grain contaminants in the water. This tank is incorporated with a flushing system so that the settled contaminant are periodically removed from the tank and system
- Forebay tank, this is the end point of the head race structure. The main purpose of this tank is to store enough water so that the there is always enough water flowing to the turbine when the plant is in operation. This tank also acts as a surge tank.
- Penstock to transport the water from forebay tank to turbine,
- Turbine to convert the Kinetic energy of the falling water into mechanical rotational energy,
- Alternator or a generator to convert the rotational mechanical energy to electrical energy
- Electronic Load Controller and ballast tanks inside the power house to control and regulate electricity supply and generation
- Transmission line to transfer power to load center (in most cases transformers are not used in a MHP but in case the settlement is very scattered then set up and set down transformers are used), and
- Tailrace where the water leaves the system and returns to the source or in some cases to irrigation canals.

Source: AEPC/ESAP documentations

Figure 2: Simple sketch of micro-hydro

Hydropower plants ranging between 5 to 500 kW, are considered as micro-hydro plants that supply power to participating communities through an isolated mini-grid for the purpose of bundled small scale CDM activity. Micro-hydro plants also supply electrical power to agro-processing units that generally use diesel fuel for operation.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

It is estimated that the proposed project activity will lead to the reduction of 252,466 tCO_2eq in the 7 year crediting period from July 2008 to July 2015. It should be noted that the actual CO_2 reductions will be based on the annual meter readings of each MHP. Section E provides further details of calculations.

Years	Annual estimation of emission reductions in tones of CO_2 e
2008	16,239
2009	27,470
2010	32,654
2011	39,134
2012	39,134
2013	39,134
2014	39,134
2015	19,567
Total estimated reductions (tones of CO_2e)	**252,466**
Total number of crediting years	**7**

A.4.4. Public funding of the small-scale project activity:

In addition to revenues from carbon finance, AEPC will require grant funding to cover upfront subsidy to micro-hydro systems. The following parties have been providing public funding for this activity:

- Government of Nepal
- United Nations Development Program (UNDP) through REDP
- The World Bank through REDP
- DANIDA/NORAD through ESAP

The above-mentioned donors do not lay any claim on the emissions reductions realized by AEPC in return for their public funding contributions to the project.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a larger project activity:

The proposed project activity is not a debundled component of a large project activity. According to Appendix C of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, a proposed small-scale project activity is considered a debundled component of a large scale project activity if there is a registered small-scale CDM project activity or an application to register another small-scale project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point

Since the above is not true for the proposed CDM project activity, it is not a debundled component of a large project activity.

SECTION B. Application of a baseline methodology:

B.1. Title and reference of the approved baseline methodology applied to the small-scale project activity:

The proposed project activity consists of developing and installing MHPs through REDP and ESAP to provide electricity to households and other electrical end-use enterprises like agro-processing mills. Use of clean electrical energy will displace conventional fuels such as diesel used by rural communities for lighting and agro-processing purposes.

The baseline approach adopted for the micro-hydro is based on the most recent list of the small-scale CDM project activity categories contained in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, i.e.,

Type I – Renewable Energy Projects

Category I. A. - Electricity Generation by the User (version 12)

See also http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html

B.2 Justification of the choice of the project category:

According to Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, Category I. A. Electricity generation by the user comprises renewable energy generation units that supply individual households or users with electricity. The applicability is limited to households and users that do not have a grid connection, except when a group of households or users are supplied electricity through an isolated mini-grid[2] where the capacity of the generating units shall not exceed 15 MW. These units include technologies such as solar power, hydropower, wind power, and other technologies that produce electricity all of which is used on-site by the user, such as solar home systems, and wind battery chargers. The renewable

[2] Not connected to the regional or national grids and not exporting and/or importing power from the national/regional grids

generating units may be new or replace existing fossil fuel fired generation. The capacity of these renewable energy generators shall not exceed 15 MW.

The proposed project activity involves hydropower technology to produce electricity for supply to households and other electrical end-use enterprises. Use of the generated electricity will replace fossil fuels such as diesel used in rural areas of Nepal for lighting and agro-processing needs.

The baseline for Category I. A. Electricity generation by the user of Type I – Renewable Energy Projects is given as:

"The energy baseline is the fuel consumption of the technology in use or that would have been used in the absence of the project activity. The project participants may use one of the following energy baseline formulae:

Option 1:

$E_B = \Sigma_i(n_i.c_i) / (1 - l)$

Where

E_B = annual energy baseline in kWh per year
Σi = the sum over the group of "i" renewable energy technologies (e.g. residential, rural health center,
rural school, mills, water pump for irrigation, etc.) implemented as part of the project
n_i = number of consumers supplied by installations of the renewable energy technology belonging to the group of "i" renewable energy technologies during the year
c_i = estimate of average annual individual consumption (in kWh per year) observed in closest grid electricity systems among rural grid connected consumers belonging to the same category. If energy consumption is metered, ci is the average energy consumed by consumers belonging to the same group of "i" renewable energy technologies. If energy consumption is metered, c_i is the average energy consumed by consumers belonging to the group of "i" renewable energy technologies
l = average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programs or distribution companies in isolated areas, expressed as a fraction

OR

Option 2:

$E_B = \Sigma_i O_i / (1 - l)$

Where
E_B = annual energy baseline in kWh per year
Σ_i = the sum over the group of "i" renewable energy technologies (e.g. solar home systems, solar pumps) implemented as part of the project

O_i = the estimated annual output of the renewable energy technologies of the group of "i" renewable
energy technologies installed (in kWh per year)
l = average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programs or distribution companies in isolated areas, expressed as a fraction

OR

Option 3:

A trend-adjusted projection of historic fuel consumption is acceptable in situations where an existing technology is replaced.

Micro-hydro is considered under the proposed CDM activity as explained in A.4.2.

Kind of Technology	Power Output (Range)	Applications
Micro-hydro	5 – 500 kW	lighting, small electric appliances, and agro-processing units

Measurement of power output is required as each MHP is likely to have a different combination of end-use applications of the generated electricity including agro-processing units. Option 2 as explained above is thus selected where annual output will be measured based on the installed kWh meter in the micro-hydro plant.

The emissions baseline is the energy baseline calculated in accordance with paragraphs above times the CO_2 emission coefficient for the fuel displaced. IPCC default values for emission coefficients may be used. A default value 0.8 $KgCO_2e$/kWh which is derived from diesel generation units, may be used. A small-scale project proponent may, with adequate justification use a higher emissions factor from Table I.D.1 under category I.D.

In the case of project activities adding renewable energy capacity, if the availability of renewable resources is limited, the impact of a decrease in electricity production from the units installed before the project implementation must be considered.

For the specific case of hydropower plants, this effect could be considered calculating the production of electricity that must be used for emission reduction calculation with the following procedure:

1) To estimate every year during the crediting period, the energy that would have been produced in the same hydrological conditions by the units installed before the project;
2) The electricity production EGy (MWh/ year) that must be considered to calculate emission reductions is calculated with the following formula:

B.3. Description of the project boundary

According to the project category I.A. Electricity generation by the user selected for the proposed project activity, the project boundary is the physical site of each MHP. The geographic project boundary selected for the project activity is the political boundary of Nepal where there is no access to the national grid.

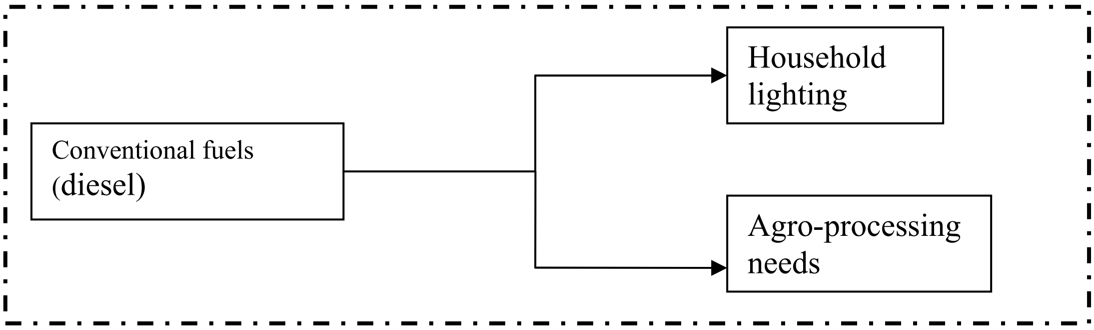

Figure 3: Baseline emissions project boundary

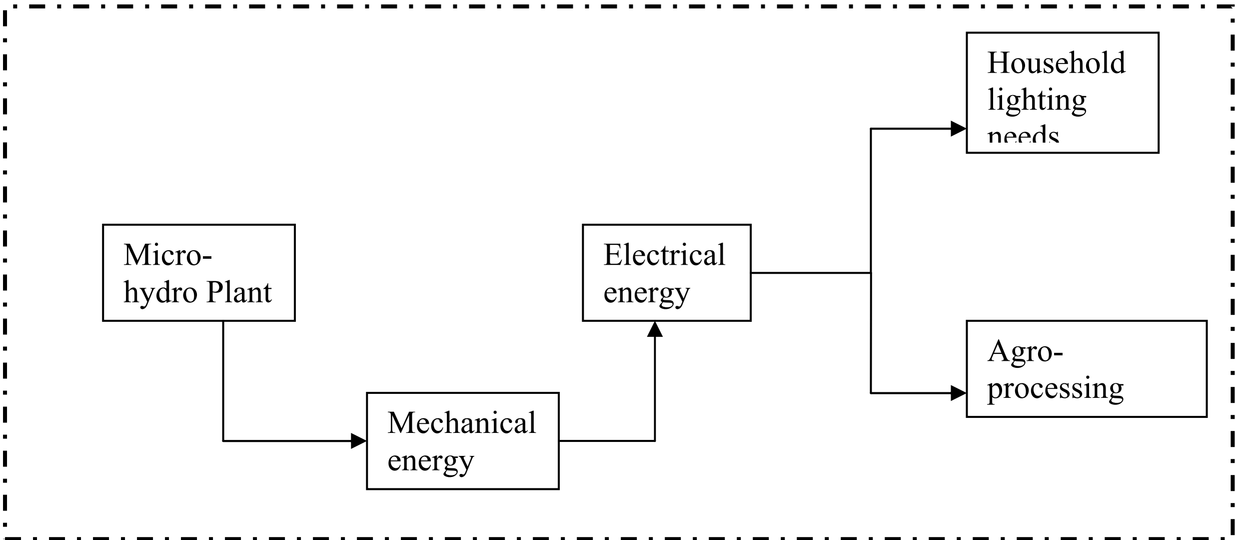

Figure 4: Project boundary

B.4. Description of baseline and its development:

As mentioned in Section B.2, Option 2 is chosen for the annual energy baseline calculation, as given in the methodology of the small-scale project category I. A. Electricity generation by the user. Thus,

$E_B = \Sigma_i O_i / (1 - l)$

Where
E_B = annual energy baseline in kWh per year
Σ_i = the sum over the group of "i" renewable energy technologies (e.g. solar home systems, solar pumps)
implemented as part of the project
O_i = the estimated annual output of the renewable energy technologies of the group of "i" renewable
energy technologies installed (in kWh per year)
l = average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programs or distribution companies in isolated areas, expressed as a fraction

For the proposed project activity,

O_i is taken as the estimated annual energy output of the micro-hydropower plant (in kWh) obtained from the annual meter reading of each MHP.

Average electricity consumption per household per month in three different rural areas of the mountain district of Kavre in central Nepal, is found to be 21.64 kWh, 18.90 kWh and 20.26 kWh according to data made available by the Nepal Electricity Authority[3]. A similar study in rural areas of Lamjung district in western Nepal shows that the average monthly electricity consumption per household is only about 18.15 kWh[4](Refer supporting document 10). The average of all these values is 19.72 kWh per household per month. Another study shows that the average monthly consumption per household in the domestic sector ranges from 15 kWh to 150 kWh and the weighted average of these is 27 kWh per household per month. It has also been mentioned based on field experiences that the monthly consumption of a 5-ampere meter holder (min. tariff block) increases to 20 kWh and then remains stagnant at that level[5] (Refer supporting document 11).

Considering the above mentioned sources, a conservative monthly consumption value of 18 kWh per household (i.e., 216 kWh per year) has been used for baseline calculations.

In addition to this, a study based on actual field findings from 13 agro-processing units in rural areas of Nepal found that an average household requires about 9 kWh per month for milling purposes[6].

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[3] Field visit to Nepal Electricity Authority Office in Kavre in March, 2003.
[4] Winrock International Nepal, 2003 "Business Plan: Assessment of Financial Viability of the South Lalitpur Rural Electrification Cooperative" Winrock International Nepal, Kathmandu
[5] Woorley International, 1999 "TA No. 2911 - NEP: Rural Electrification and Distribution Improvement Project" Final report prepared in association with Shah Consult International (Pvt) Ltd and NEA counterpart team for Asian Development Bank and Nepal Electricity Authority, Kathmandu.
[6]Source: Micro-Hydro in Nepal: Development, Effects and Future Prospects with Special Reference to the Heat Generator. A study Prepared for Arbeitsgemeinschaft Kirlicher Enwicklungsdienst Stuttgart, West Germany, Daniel. E. Jantsen and Kiran Koirala; Bikash Enterprises, Inc, with No-Frills Development Consultants, Kathmandu, Nepal, January 1989.

Thus, the average monthly electricity consumption per household will be 18 kWh for lighting and 9 kWh for milling, which gives a total monthly value of 27 kWh (i.e., 324 kWh per year).

Average technical distribution losses (l), is taken as 10% for calculations since this is the maximum limit for losses set by AEPC for plants constructed under its programs.

The default carbon dioxide emission coefficient for the fuel is taken as 0.8 kg CO_2eq/kWh. As per the methodology of the project category I. A. Electricity generation by the user version 12 in Appendix B of the Simplified Methodologies and Procedures for Small-Scale CDM Project Activities.

Thus emissions baseline is actually the energy consumption baseline calculated as described above times the carbon dioxide emission coefficient for the fuel displaced.

The baseline was developed by Winrock International, Nepal which is not a project participant, and was completed on 10/10/2006. Contact information is provided below:

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

There are investment and technology related barriers to the proposed project activity which otherwise present obstacles to the development of such projects. This project reduces emissions beyond those that would have occurred had it not considered carbon finance; these barriers and how they are overcome are explained below.

a) Investment Barrier:

The proposed project activity faces an investment barrier at two levels that hinder the promotion and installation of MHPs that can lead to reduced emissions. The first level examines additionality at the individual plant level. The second level examines barriers at the program level with the funding gap to provide subsidy to the individual MHPs.

Investment barrier at the level of individual plant: The proposed micro hydro activity is demand driven with communities making the final decision on whether or not to invest in a Micro Hydro Scheme. The construction of a MHP requires a considerable amount of upfront capital and investment in addition to the subsidy provision from the Government of Nepal. The high upfront investment cost of a MHP is thus a barrier for the adoption of the technology by rural communities in the country. Size of MHPs range from 5-500 kW however most common plant size in practice is 15 and 30 kW. Each kW of installed micro-hydro capacity can serve at most 10 households. The installation cost per kW of MHP ranges from US$ 1,900 to US$3,521 depending on the size of the plant, geographic remoteness and specific characteristics of the plant & its design. The government subsidy at $141 per household but not exceeding $1,197/kW covers 35% to 55% of the installation cost and the community has to invest the remaining amount. An additional transport subsidy of upto $423/kW is provided to very remote locations to cover the high transport cost of MHPs parts during construction period. In addition, the annual project operation and maintenance costs are estimated to be 3% of the total capital cost.

Communities therefore have to manage the remaining 45% to 65% of the installation cost. The Agricultural Development Bank of Nepal (ADB/N) is the primary financial institution involved in financing the micro-hydro sector in the country and provides loan at the commercial rate of 12-13% interest per annum. Using this benchmark to represent standard returns in the market, the financial analysis to assess 15-year Financial Internal Rate of Return (FIRR) without subsidy shows a very low FIRR value for 16 to 75 kW plants. However, the FIRR is adequately attractive with the government subsidy, ranging from 11 % to 21% for typical projects. The FIRR for various size plants with or without subsidy is depicted in Table B3.3 below.

Table B.3.3: IRRs for various size plants with and without government subsidy:

	Without Govt. Subsidy			With Govt. Subsidy		
Plant Size	Pay back Period in years	NPV	IRR	Pay back Period in years	NPV	IRR
16 kW	45.70	(1,733,885)	-0.41%	3.57	135,597	11%
25 kW	32.39	(2,473,038)	-0.04%	3.45	621,010	15%
50 kW	16.15	(3,248,313)	3.94%	3.02	2,593,817	19%
75 kW	29.50	(6,201,046)	0.77%	3.01	3,455,647	21%

Source: REDP supported micro-hydro projects. Please refer attachment for detail information.

Before communities start investing in micro-hydro projects, a substantial community mobilization effort is necessary to generate solidarity of the communities. If this community mobilization cost were to be borne by the community, the IRR becomes lower which would make it more difficult for the community to install micro-hydro. The community mobilization cost is about US$400 per kW which is covered by the REDP and ESAP project in the proposed project activity.

Once the micro hydro is constructed, the community in charge of the installed micro hydro collects revenues by selling electricity to participating households. The electricity is used for household lighting and productive uses (agro-processing). Average household electricity consumption is estimated to be 27 kWh/month, out of which 18KWh is used for lighting and 9 kWh for productive uses. While the average lighting tariff is US$ 0.09/kWh, the tariff for productive uses is US $0.1/kWh. Depending on the capital cost of installation, these tariffs are likely to fluctuate. For example, communities that manage to install micro hydro at less cost can accordingly distribute electricity at lower tariff rates. On the other hand, if the installation cost is high without the subsidy, users have to pay more per unit of the electricity use. As the government is providing 35 to 55% of the installation cost as subsidy, in absence of the subsidy the electricity price is expected to increase by similar rate. Users cannot afford 54% to 122% increase in their investment burden which would result in tariff more than two to three times as high as on the national grid.

MHP construction without the subsidy amount is thus not a financially attractive course of action for rural communities in Nepal and they will opt for diesel power in the absence of the proposed CDM project activity.

Barrier at the Program level: AEPC has been promoting micro-hydro technology in order to increase the access of rural communities in Nepal to distributed forms of renewable energy. The proposed CDM activity aims to expand micro-hydro installations nation-wide up to a maximum capacity of 15 MW with the integration of CDM revenues.

The implementation of the proposed activity requires a considerable amount of upfront capital for which a basket funding approach has been adopted. In order to install 15MW by 2011, the AEPC MHP program will require total funds of $59.270 million. This includes the costs of management of the AEPC program, grant subsidies to communities to buy down capital cost, and investments in plants made by users, local government entities (District Development Committee - DDC and VDC) and financing institutions.

Table B.3.2: Project costs and source of financing

Project Cost	**In US$ million**	**Status of Commitment**
Development cost (subsidy, technical assistance)	28.609	
Installed costs (plant investment, etc)	26.933	
Other costs (contingency)	3.542	
Total	**59.085**	
Project Financing		
The World Bank UNDP Government of Nepal DANIDA & NORAD	5.513 1.573 2.265 14.314	Committed
World Bank additional funding till 2009 UNDP for REDP III after 2006	4.000 2.000	This is an approximate figure. On the final stage of conformation
Farmers DDC VDC	25.057 0.938 0.938	Committed
Carbon Financing	1.952	Approximate figure
Total	58.551	Committed plus final stage of conformation
Gap (Project cost minus total financing)	0.534	

Subsidy to users totals $20.619 million, which equals $1,383 per kW of installations on an average. Without subsidies, users would not be able to afford the MHP installations. Plant investment contributed by farmers through their labor and in kind contribution, loans from banks; and interest-free equity investment from DDCs and VDCs amount to $26.933 million. The rest of approximately $12.753 million is AEPC's operational expenses for managing and monitoring the program.

Through the basket funding approach, the World Bank and UNDP have contributed a total of US$7.086 million through REDP of the AEPC MHP program. GoN has confirmed a contribution of $2.265 million. DANIDA and NORAD are together providing an additional contribution of US$14.314 million through the 2nd phase of ESAP. In addition to these additional funding of US$ 4 million from World Bank and US$ 2 million from UNDP for REDP III is expected and the negotiation is in the final stage. Financing gap of US$ 2.486 still remains for the proposed activity.

At prices of approximately $9 per tCO_2eq, CDM is expected to bring total carbon revenues of approximately $1.952 million in the 7-year project period; this will fill a majority of the financing gap.

The development of the program under the CDM would contribute to the program sustainability by fulfilling the financing gap for developing and installing 15 MW of micro-hydro project providing electricity to about 135,000 rural household and enhance the overall quality of the sector. All the donors have recognized the CDM potential of this project and have considered to provide grants to cover the unfilled gap if the project is approved by the CDM Board.

Technology barrier:

Although micro-hydro technology was introduced in Nepal in the early '60's, it still remains a non-commercial activity. During the period of 1960 and 1990 only few schemes were built and those that were built were built with full aid of foreign agencies and to some extent from loans from the Agricultural Development Bank.

To better support the successful installation of MHPs, communities will have to have a strong monitoring, repair and maintenance mechanism, vital for the uninterrupted operation of the micro-hydro schemes throughout its life. This aspect of technology promotion was absent during the technology transfer. The plants were handed over to the community without proper training to the operator and there wasn't any accountability from the installer once the site had been electrified. Therefore due to these aspects the MHP built in this time generally had a life of three to five years, where in a small defect or a minor maintenance problem could shut down the plant.

Due to this unreliability of rural electrification, the communities were not motivated towards installing MHPs, they were content with using traditional means of lighting (kerosene lamps) and milling (manual milling).

From the 1990s, the government saw the need of rural electrification with a sustainable approach and at the same time different programs started supporting the installation of micro hydro schemes as well. Unlike before the major thrust of the programs were not to only build and install MHPs but to make it sustainable both technically and financially, for this different programs used different methods.

Among the different programs dealing with MHPs, REDP and ESAP are two major programs for the sectorial development under AEPC. REDP has adopted a successful decentralized approach, whereas ESAP has adopted a successful sector approach, both of which include outreach and awareness programs, quality control, subsidy, etc.

The present project activity has a strong quality control and assurance framework whereby only high quality products are delivered to investing communities. Since rural communities cannot discern the quality of the technology on their own, AEPC undertakes technical reviews of all plants to be constructed before approving them for subsidy and will also allow only pre-qualified companies to undertake design, manufacture, installation and supply of the MHP in the villages. Aside for technical assurance AEPC within its programs provides technical trainings to the operators and managers of the MHP.

Also, with the support of CDM, community will get technical support for operation of its MHP for the whole duration of the crediting period. Previously, the plants were only getting support for one year after installation. Thereby, adding weight to the sustainability aspect of the system.

In the face of the investment and technological barriers described above, communities would likely continue using traditional lighting and milling technology if it were not for the CDM project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The above choice of a monitoring methodology where electricity generated by all micro-hydro systems is metered requires a slight modification to the existing monitoring procedure of AEPC.

The existing monitoring plan of AEPC is as follows:

After commissioning of the project, the entrepreneur or the community responsible for the project will request to get the output of the project verified through AEPC pre-qualified and trained power output verification inspectors. The verification inspector will submit a Power verification report to AEPC, stating the amount of kW generated at the powerhouse of the site. Aside form the power verification the inspector also verifies the exact number of household connected to the plant. After the verification is complete the plant is officially handed over to the people though the plant is already the property of the community from the inception.

Existing monitoring procedures of AEPC need to be modified for the proposed CDM project activity and to verify and claim the CER, some of the modifications are as follows:

Metering all micro-hydro systems - At present, there is no requirement to install a kWh meter at the power house in any of the installed MHPs. All the micro-hydro systems to be installed under the project activity will now be required to install a kWh meter.

The installed meter will be certified, calibrated and sealed by the authorized organization of Nepal. The meters will be periodically checked for equipment performance and maintenance.

The user committee of the MHP will set up a procedure to record and maintain a log wherein the daily kWh readings are maintained. For a more systematic approach to the data keeping and logbook keeping AEPC shall make a log book and distribute it to all the MHP, it shall also provide training to the operators of the MHP for proper method of maintaining the log book and meter reading.

AEPC will also set up an annual monitoring plan to check the logbooks maintained by the MHPs. The meter readings will be monitored annually in at least 10% of the MHPs.

Sales registration - Micro-hydro installed by pre-qualified companies will become eligible as soon as they are registered in the AEPC database. AEPC will report this through its "Annual System Installation Report" noting all the eligible micro-hydro plants have actually been sold/installed, which is necessary for CER calculations and for verification. AEPC has abundant experience in verifying sales records of participating micro-hydro companies. Under this CDM project, AEPC will continue to monitor and verify at least 10% of the systems sold/installed in that year.

A GIS module for MHP registration is also being implemented by AEPC, this will record the latitude and longitude of each installed system and will be used for plant verification.

Monitoring of the performance of the system - Since CERs can only be claimed on the basis of realized emission reductions, the monitoring parameters needed are:

- the number of kWh generated at each MHP measured by the installed kWh meter

REDP and ESAP are responsible for carrying out detailed quality assurance and monitoring visits in their respective areas. Aside from this AEPC will produce an ER report annually, which shall be done through its programs at the district level coordinated by REDP and ESAP.

***B* B.6.2. Data and parameters that are available at validation:**

(Repeat this table for each data and parameter)

Data / Parameter:	Default emission factor per kWh
Data unit:	tCO_2eq/kWh
Description:	
Source of data used:	IPCC default emission factor
Value applied:	0.8
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default value mentioned in the small scale methodology I. A.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The formula given in Appendix B has been used to calculate energy baseline. The calculation of GHG emissions reduction has been presented below.

$E_B = \Sigma_i O_i / (1-l)$

Where
E_B = annual energy baseline in kWh per year
Σ_i = the sum over the group of "i" renewable energy technologies (e.g. solar home systems, solar pumps) implemented as part of the project
O_i = the estimated annual output of the renewable energy technologies of the group of "i" renewable energy technologies installed (in kWh per year)
l = average technical distribution losses that would have been observed in diesel powered mini-grids installed by public programs or distribution companies in isolated areas, expressed as a fraction

The total CO_2 reductions can be calculated after obtaining the annual kWh meter reading of the micro-hydro systems and multiplying by a CO_2 emission coefficient. A default value of 0.8 kg CO_2eq/kWh has been assumed for calculations. The energy meter reading obtained will have incorporated 10 % transmission losses in the mini-grid.[7]

Based on the monitoring figures, the annual baseline emissions and emission reduction are calculated as shown below:

Baseline Emissions (tCO_2/yr) = E_B (kWh) * 0.8 kg CO_2eq/kWh * 1/1000

B.6.4 Summary of the ex-ante estimation of emission reductions:

>>

Year	Baseline Emission in t CO_2 eq	Project Emission in t CO_2 eq	Emission Reductions due to the Project Activity in t CO_2 eq
2008	16,239	0	16,239
2009	27,470	0	27,470
2010	32,654	0	32,654
2011	39,134	0	39,134
2012	39,134	0	39,134
2013	39,134	0	39,134
2014	39,134	0	39,134
2015	19,567	0	19,567
Total in the 7 year crediting period	**252,466**	**0**	**252,466**

[7] Assuming that this the losses are similar to that of diesel generators, the assumption is 1 = 0.

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

>>

Data / Parameter:	Energy supply
Data unit:	Metering/kWh
Description:	Certified energy meter will be installed in each plants and daily meter reading will be registered.
Source of data used:	Meter reading logbook
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Option 2 of baseline energy formula is used that seems more practical and cost effective.
Any comment:	

Data / Parameter:	Number of MH installed
Data unit:	Number in terms of kW
Description:	
Source of data used:	Annual installation report
Value applied:	
Justification of the choice of data or description of measurement methods and procedures actually applied :	Though micro-hydro projects are installed throughout the year with capacity ranging 5-500 kW, annual installation report is published compiling all installation data.
Any comment:	

Monitoring of performance of the system

The following table shows the system performance-monitoring plan.

ID number	Data type	Data variable	Data unit	Measured (m), calculated (c) or estimated (e)	Recording Frequency	Proportion of data to be monitored	How will the data be archived? (Electronic/ paper)	For how long is archived data to be kept?	Comment
1	MHP registration	No. of MHP sold	Registration of sales	M	Continuous	100%	Electronic and Paper	Crediting period plus 2 years	Data is annually reported in the annual installation report
2	Meter reading	kWh	kWh reading	M	Annually	10%	Electronic and Paper	Crediting period plus 2 years	Data is annually reported

B.7.2 Description of the monitoring plan:

>>

The monitoring methodology given in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, relevant to this project is given as:

I. A. Electricity Generation by the User version 12

"An annual check of all systems or a sample thereof to ensure that they are still operating (other evidence of continuing operation, such as on-going rental/lease payments could be a substitute).

OR

Metering the electricity generated by all systems of a sample thereof."

Looking at the nature of the technology, its use, and other local conditions/practices, *the second option of metering the electricity generated has been proposed for all micro-hydro systems to be installed under the project activity.* Detailed justification of the choice of the approved methodology, taking into account the existing national monitoring methodology has been presented below.

Project Implementation:

AEPC is responsible for ensuring the overall implementation of the proposed project activity. Under the supervision of the Technical Review Committee of AEPC, ESAP and REDP will ensure the management and operation of the MHPs installed as part of the proposed project activity.

Execution of Monitoring Plan

AEPC will carry out the above-mentioned monitoring of quality control and quality assurance procedures through ESAP and REDP.

Organisational Structure of Micro-Hydro Implementation

The figure below illustrates the management structure for REDP and ESAP under AEPC for the dissemination of the MHPs targeted for the proposed project activity.

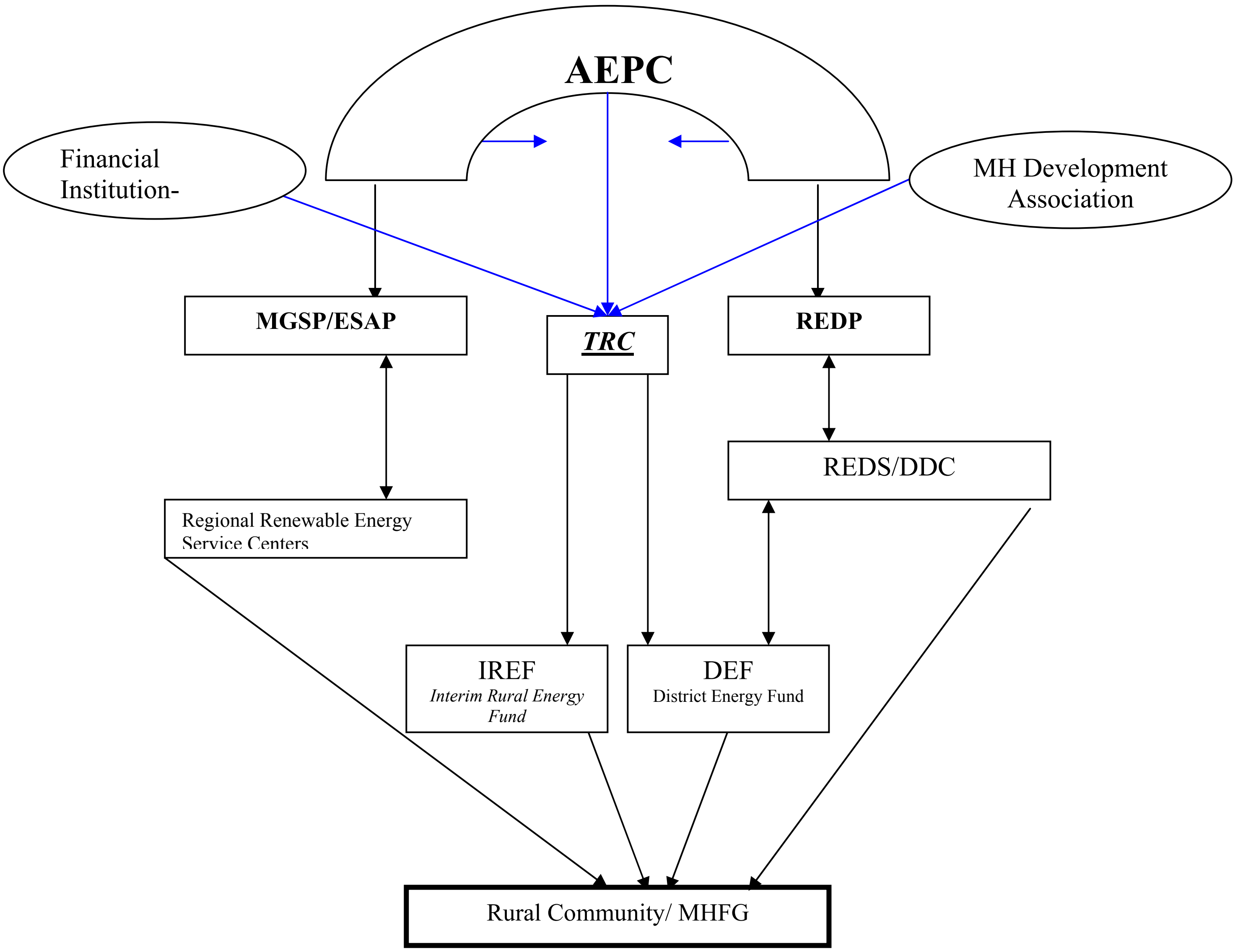

Figure 5: Management Structure of AEPC for the Micro-Hydro Support Programs

AEPC: is the apex body for the implementation of Micro-hydro, as a government entity it is responsible for the overall planning, implementation and monitoring of the RETs sector in the country. In the case of Micro hydro AEPC has two programs under its wings for the implementation of micro-hydro in the country, they REDP and MGSP-ESAP.

REDP: REDP is a program, which was established in 1996 with funds from UNDP, at the present REDP is funded by UNDP and World Bank for the implementation of micro-hydro to enhance the livelihood of rural communities. At the present REDP is working in 25 remote hilly districts of the country and 15 districts will be added to the REDP portfolio from July 2007. The main thrust of REDP program is to support community owned Micro-hydro schemes and bring about a holistic change within the community.

MGSP-ESAP: ESAP is a program, which was established in 1999 with funds from DANIDA. MGSP has no restriction for its support, as it will support micro-hydro plant throughout the country. Unlike REDP ESAP will also assist private entrepreneurs to set up a micro-hydro along with community owned plants.

TRC: The Technical Review Committee (TRC) is the formal quality control for design and is based within AEPC. The members of the TRC consists of people from AEPC, REDP and ESAP aside from in house members there are members from the Agricultural Development Bank, which is one of the major financial institution providing loans to micro-hydro and a member from the Micro-hydro Development Association, which is an association of manufacturers pre-qualified by AEPC to fabricate and install micro-hydro plant.

It is the responsibility of the TRC to check the technical, socio-economic, environmental and financial portion of the Detail Project report submitted for implementation. The TRC has the authority to either approve or disapprove any schemes that does not match or conform to the standards laid out by the Micro-Hydro Design Guideline and the Micro hydro Quality Standards. If the scheme is approved then the TRC sends a formal letter to release the subsidy to either the REF in case of MGSP project or DEF in case of REDP projects.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

>>
The Monitoring methodology is determined by Winrock International, Nepal. Contact information is given below.

Mr. Bikash Pandey
1103/68 Devkota Marga, Baneshwor,
P.O. Box 1312, Kathmandu, Nepal.
Tel: 977-1-4467087,
Fax: 977-1-4476109
bpandey@winrock.org.np

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:
>>

C.1.1. Starting date of the small-scale project activity:
>>
22/02/2003

The starting date for the project activity is 22 February 2003 but the ERs will be credited only after this project has been registered. The plants will start operation as soon as the installation is complete.

C.1.2. Expected operational lifetime of the small-scale project activity:
>>
The operational lifetime of the MHPs is 15 years.

C.2. Choice of crediting period and related information:
>>

C.2.1. Renewable crediting period:
>>
Yes

C.2.1.1. Starting date of the first crediting period:
>>
01 July 2008, or the date of registration

C.2.1.2. Length of the first crediting period:
>>
7 years

C.2.2. Fixed crediting period:
>>
NA

C.2.2.1. Starting date:
>>
NA

C.2.2.2. Length:
>>. NA

SECTION D.: Environnemental impacts:

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity::

>>

The penetration of micro-hydro power reduces the consumption of diesel for household lighting and milling, and dry-cell batteries at the household level. This reduces GHG emissions and improves air quality indoors and reduces health and odour problems associated with indoor air pollution.

According to the National Environment Protection Act and Rule, Initial Environmental Examination is required for Hydro projects ranging from 1 to 5 MW and Environmental Impact Assessment is required for all Hydro projects larger than 5 MW. The Act and the Rule do not have any provision for environment assessment for Hydropower projects less than 1 MW, which includes micro-hydro.

However, AEPC has recognized the importance of Environmental Assessment to identify possible impacts due to the implementation of micro-hydro and recommend appropriate mitigation measures to make the project more sustainable and improve the environment of the surroundings. Under REDP, an Environmental Assessment (EA) is undertaken for all micro hydro projects that are proposed for implementation in its program areas. For this purpose, AEPC/REDP has developed Environment Assessment Guidelines for MH Schemes, which is attached. This study is integrated in the Detail Project Report submitted to the TRC for its approval.

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>>

Environmental impacts are not considered significant.

SECTION E. Stakeholders' comments:

E.1. Brief description of how comments by local stakeholders have been invited and compiled:

>>

REDP and ESAP conduct regular users' survey, field visits, and training by which comments by local stakeholders have been invited and compiled. Aside from this AEPC with the coordination with the DNA also scheduled a Stakeholders consultation meeting at the DNA to get comments from the various stakeholders in the Micro-hydro field as well as Rural Energy Field. Also two consultative meeting were conducted to receive the comment and feedback of the micro hydro users. 36 users from different micro hydro projects installed in the 13 districts of all development regions participated in the said two meetings.

E.2. Summary of the comments received:

>>

The following comments and issues were raised from the consultation with stakeholders:

1. Benefit from Micro hydro Project

Most of the users viewed that 2-3 people have received direct employment from the project. In addition, diesel mills are replaced after the installation of the project, which has been used for household lighting and milling. They also noticed a positive difference in social, environmental and economic benefits from the electricity generated by the plant. More that 95% participants reported that the plants have been functioning well while the other 5% mentioned that regular repair and maintenance was needed.

2. More Data gathering:
According to the users there is no real disadvantage of their plant being included in the CDM project. Some think that with the CDM will come more hassle, particularly in terms of additional book-keeping (log book maintenance, meter checks, and overall monitoring of household users). This will increase the burden on the operator and manager and the same will not be receiving any direct benefit in terms of salary or other compensation form the management.

3. Technical Backstopping:

The present operational modality of Micro-hydro implementation has been to provide technical support and backstopping for the first year of operation only. After the first year there is hardly any technical backstopping and the plant is the full responsibility of the users. According to the users, there is very little problem during the first year, but after a couple of year some problems may arise and this is not being dealt with by the developers, e.g. AEPC/ESAP, REDP. Users expect backstopping support from AEPC at least during the project crediting period in terms of operation and management training/refresher training, project rehabilitation support, support for sick plants etc.

4. Enterprise development

CERs will be claimed from the total energy (kWh) supplied by the plants. This includes both lighting as well as other uses. But due to the lack of facilities and finances, management has not been able to introduce or convince people to use the daytime energy for productive use. Therefore to maximize the CERs developers will need to help the plants to set up new ventures in the areas, which will lead to better income generation, and livelihood enhancement in the plant areas.

5. Rehabilitation of Sick Plants

As mentioned before after the first year the plant is in total control of the users. Therefore if a sudden natural calamity strikes the plant and destroys some of its major components then it will be up to the users to come up with a solution and rectify it. The major hurdle for the users will be to organize the finances for the rectification. As per the present subsidy policy a plant will only be eligible for rehabilitation subsidy after five years of operations, therefore if major rehab is needed before this period then the users have to finance it themselves. Therefore the plant will need assistance for this rehab and the CDM revenue needs to be channeled in this direction as well.

E.3. Report on how due account was taken of any comments received:

>>

Relevant comments received will be integrated into the monitoring plan, and to the extent possible, AEPC will incorporate the same into overall project management plans.

ANNEX 1: CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Alternative Energy Promotion Centre (AEPC)
Street/P.O.Box:	GPO Box 6332
Building:	
City:	Kathmandu
State/Region:	
Postcode/ZIP:	
Country:	Nepal
Telephone:	+977 1 5539390 / 5539391
FAX:	+977 1 5539392
E-Mail:	baikalpikurja@wlink.com.np
URL:	www.aepcnepal.org
Represented by:	
Title:	Executive Director
Salutation:	Mr.
Last Name:	Pokharel
Middle Name:	
First Name:	Govind Raj
Department:	Alternative Energy Promotion Centre (AEPC)
Mobile:	
Direct FAX:	+977 1 5539392
Direct tel:	+977 1 5539390 / 5539391
Personal E-Mail:	govind.pokharel@aepc.gov.np

Organization:	World Bank Carbon Finance Unit
Street/P.O.Box:	1818 H Street, NW
Building:	MC4-414
City:	Washington DC
State/Region:	DC
Postcode/ZIP:	20433
Country:	USA
Telephone:	1 202 473 9189
FAX:	1 202 522 7432
E-Mail:	IBRD-carbonfinancecfcontacts@worldbank.org
URL:	www.carbonfinance.org
Represented by:	
Title:	Manager
Salutation:	Ms.
Last Name:	Chassard

Middle Name:	
First Name:	Joelle
Department:	ENVCF
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

ANNEX 2: Information regarding public funding

Sources of finance identified	Financing Plan (other than the CFB) including names of sources of debt and equity to be sought or already identified, contribution of each, and status of commitment (please provide any letters of intent or any other evidence of interest from financiers):		
Project Cost	**In US$ million**	**Status of Commitment**	**Project Cost**
Development cost (subsidy, technical assistance)	28.609		Development cost (subsidy, technical assistance)
Installed costs (plant investment, etc)	26.933		Installed costs (plant investment, etc)
Other costs (contingency)	3.542		Other costs (contingency)
Total	**59.085**		**Total**
Project Financing			**Project Financing**
The World Bank UNDP Government DANIDA & NORAD	5.513 1.573 2.265 14.314	Committed	The World Bank UNDP Government DANIDA & NORAD
World Bank new funding till 2009 UNDP for REDP III after 2006	4.000 2.000	This is an approximate figure. On the final stage of conformation	World Bank new funding till 2009 UNDP for REDP III after 2006
Farmers DDC VDC	25.057 0.938 0.938	Committed	Farmers DDC VDC
Carbon Financing	1.952	Approximate figure	Carbon Financing
Total	58.551	Committed plus final stage of conformation	Total
Gap (Project cost minus total financing)	0.534		Gap (Project cost minus total financing)

ANNEX 3: BASELINE INFORMATION

A study report titled "Assessment of Financial Viability of the South Lalitpur Rural Electrification Co-operative" prepared by Winrock International, Nepal is used for base line information. (The report is attached)

The main objective of this study is to try to develop the most feasible and sustainable *economical business plan* for the South Lalitpur Rural Electrification Cooperative (SLREC) and to make some suggestions/recommendations for this new enterprise based on the existent factors.

Though numerous books, reports and data bases have been reviewed during this study, the main reports that form the base of this study are:

- Assessment of Existing Infrastructures, Human Resources and Financial Viability for Rural Electrification Program for SLREC report by the Lamjung Electricity Development Company (LEDCO), February 2003
- Study for Promotion of Electricity Distribution by Cooperatives, BPC, 2001
- Rural Electrification Project in Kanchanpur and Kailali Districts, Nepal: Overall Plan for Co-operative Formation, Balslev, January 2002

Similarly, Winrock staff visited the Lamjung Electricity Users Association (LEUA) in Besisahar, Lamjung to gather insight of rural electrification through a cooperative/NGO. The team also made an analysis of LEUA's existing financial situation

A day trip to SLREC project areas and discussions with members of the cooperative and local people provided supplementary information about the existing situation.

The report prepared by LEDCO anticipates the following subscription of electricity for future consumers of SLREC: 70 % of the consumers will consume up to 20 kWh, 20% will consume an average of 40 units and the remaining 10% will consume up to 200 units. Thus, the average consumption unit per/ household is expected to be 42 kWh.

Another example is from the techno-feasibility study for rural electrification of the Melamchi Valley (April 2003). In this case, every household was assessed and revised during the field study. The households in each load centre were divided into 3 different categories depending on their energy consumption potential. For each type, the average monthly demand calculated was an average consumption per household of around 28 kWh per month

A special trip to Kavre NEA branch has identified the following energy subscription rates in Dhumharka Village of Kavre District.

Average Monthly Energy Consumption (kWh)	Subscription %
20 kWh	96.75
40 kWh	0.24
200kWh	2.64
Low Voltage(400/200 volt): Cottage and Rural Industry	0.36

Discussions with SLREC members, and consideration of the similarity of the proposed electrification area to Dhumharka Village, indicate that the energy consumption subscription rate of the SLREC business plan's base case model will follow a pattern similar to the table above: 96.75% of the consumers will use up to 20 kWh, 0.24% will consume an average of 40 units, 2.64 % will consume up to 200 units and 0.36 % will constitute the category of lower voltage for rural and cottage purposes. As a result, SLREC's average consumption unit per/household is approximated at 26kWh.

Considering the above mentioned sources, a conservative monthly consumption value of 18 kWh per household (i.e., 216 kWh per year) has been used for baseline calculations.

In addition to this, a study based on actual field findings from 13 agro-processing units in rural areas of Nepal found that an average household requires about 9 kWh per month for milling purposes.

Thus, the average monthly electricity consumption per household will be 18 kWh for lighting and 9 kWh for milling, which gives a total monthly value of 27 kWh (i.e., 324 kWh per year).

ANNEX 4: MONITORING INFORMATION

QC/QA at the Centre: AEPC is the apex/executing organisation for renewable energy promotion in the country, therefore if a micro hydro plant wants government subsidy for the construction of the plant then it has to be registered and follow the processes laid out by AEPC, which are stated below:

AEPC implements a strict quality assurance system to enhance the quality of micro-hydro schemes. A separate set of standards is prepared and implemented for the micro- hydro plants (Quality Standards for Micro hydro is attached to this document). Procedural guidelines for carrying out preliminary and feasibility studies are available for practical use (this guideline is also attached to this document). The guidelines include standard design aids with a built-in expert system. Furthermore, guidelines on tariff setting and social mobilization (these guidelines are also attached to the document), and standard bidding and contract agreement formats are also prepared as part of the quality assurance system, (These are also attached).

Therefore all engineers and designers of micro-hydro plant under the AEPC will have to strictly follow the QS and Design guidelines while designing the system. The adherence to these standards and guidelines are checked by Technical Review Committee at AEPC, which has the authority to l reject the design if it varies from the standards. Due to this monitoring at the central level, all micro-hydro plants approved by the TRC will comply with the standards set by AEPC.

Power output verification is done in each scheme to check the power output as designed. The supplier can be penalized for providing reduced amount based on the reduced kW. A margin of ±10% is allowed and acceptable.

There is also system for qualifying manufacturers, installers and surveying companies based on their performance indicators. A pool of quality inspectors is maintained for supervising and assisting the construction works by AEPC.

QC/QA at the District:

Regular (staff from the district office visit the site at least twice a year) monitoring of the schemes are carried out during and after construction by the district staffs ,of District Energy and Environment Section (DEES), Regional Renewable Energy Service Centres (RRESCs) and staff of District Energy and Environment Unit (DEEU) to ensure construction as per design and sustainable operation of the schemes.

QC/QA at the Community or Plant Level:

Metering: All the plants under the project will be fitted with energy meters to indicate the amount of energy (kWh) consumed by the plant within the crediting period. As the ER is directly related to the energy consumption at the plant metering and metering data will be the prime basis for the ER report to be prepared by AEPC.

AEPC will allow installers to buy the energy meter at their convenience but all the meters have to be certified, calibrated and sealed by the authorized organization of the country. At the present RETS has been checking and certify the quality of solar components like PV panels, CFL bulbs and other electricity related parts of a Solar system..

Aside from the certification of the meter, the authorized organization will be responsible for checking and recalibrating the meters at the plant every three years. A work plan will be drawn up so that all the meters in all the plants are checked and recalibrated every three years.

Meter monitoring:

The first set of data will be prepared at the plant by the operator. The operator will be responsible for maintaining a standard logbook prepared by AEPC. Each log entry has to be signed by the operator. This log entry will be done on a daily basis.

The engineer at the district (DEES or DEEU or RRESC) will verify the log entry at the plant, the engineer will have to counter sign the log if he agrees to its validity. Then it is the responsibility of the engineer to bring the log to the district head quarters and enter the data into the database and send the meter reading data to AEPC on a half yearly basis (both electronic as well as the original paper while keeping a copy of the paper log as reference in the district).

All the meter reading data that comes to AEPC will be entered into the main database and this data will be the basis for preparing the Annual ER report which will be sent to the buyer.

Meter Cross Checking:

District office will crosscheck the data entry at the plant level. It is not feasible to cross check every plant every year thus a minimum of 25% of the plants will be cross checked to verify no tampering has been done to the meter, log or the data base at the district.

Capacity Building;

At the present there is no set standard for logbook keeping at the plant nor is there data base maintenance at the district. Thus to make the above monitoring activities work all the operators have to be trained in the process of meter reading and logbook maintenance. This aspect has already been included in the curriculum for Operators training for new operators training from July 2007, but for the older operators this will be incorporated in the refresher training given bi-annually. In the district level the engineer(s) have to be trained in meter monitoring, database management and reporting. For this training to take place a database has to be designed, which AEPC is working to finalize.