CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03

COMMUNITY-BASED RENEWABLE ENERGY DEVELOPMENT IN THE NORTHERN AREAS AND CHITRAL, PAKISTAN

CONTENTS

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	22 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 small-scale project activity

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

Community-Based Renewable Energy Development in the Northern Areas and Chitral (NAC), Pakistan

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

The *Community-based Renewable Energy Development in the NAC* project will invest in micro and mini hydropower projects (MHP) at various sites in the federally administered Northern Areas and Chitral District of NWFP, Pakistan. The project aims to generate around 15 MW of power from 103 projects ranging in size from 35 kW to 600 kW. This will provide much needed power for meeting community energy needs at the same time substituting for the use of diesel fuel, thereby contributing to reduction of greenhouse gas emissions. The vast majority of those that will be served by the MHP, do not currently have access to electricity from any source. However, there is a growing trend in the consumption of diesel fuel, which is state subsidized, for power generation at the household level in rural areas as well as by public utilities for town centres in the NAC. Without a clean energy alternative, there would be a penetration by diesel generators into the proposed project area. NAC is facing an acute shortage of energy. The region has rare alpine forest resources which are being consumed at unsustainable rates for domestic use, mainly cooking and heating. To a limited extent, the electricity generated by the project will provide cooking and heating energy at the household level. Although firewood use is not in the baseline for this project, its partial replacement will be an additional benefit of the project. Without the proposed project, use of fossil fuels and unsustainably harvested fuel wood would continue to increase despite potential for generating adequate renewable and clean energy from local streams.

NAC offers tremendous potential to generate renewable energy primarily from hydropower. NAC serves as vital upper catchments for the River Indus, on which much of Pakistan's irrigation and hydroelectricity depends. The perennial flow of water from snow melt in fast flowing streams, gives the area substantial potential to produce hydroelectricity through small, off-grid projects to serve the local area.

Plants constructed under the project will be managed and operated by a community-based management system—backed by the Aga Khan Rural Support Programme (AKRSP), Mountain Infrastructure and Engineering Services (MIES), which is a private company established in the area through AKRSP support, the Northern Areas Public Works Department (NAPWD), and Chitral Works Department (CWD) for technical support.

The project will consist of the following components:

- Setting up of power units:
  A total of 103 run-of-the-river hydroelectricity units will be installed within a period of four years, with a combined electrical generation capacity of around 15 MW.

- Establishing ownership and management systems:
  The project will use and expand existing community-based institutional mechanisms and capacities developed by AKRSP, including community-owned private-company-based management systems for constructing the power projects, carrying out operation and maintenance of the power units, and sale of power produced after completion of the project.

Contribution to Sustainable Development

Mini-grids powered by micro and mini-hydropower projects (MHPs) can provide a large number of rural households in mountainous areas with electricity for both domestic and productive applications and provide motive power for milling, small enterprises, and other needs. Such renewable energy systems have direct local environmental benefits in terms of:

- Substituting for existing diesel-based power generation and largely eliminating its need in future thereby reducing the consumption of road-transported diesel in the region. This will result in reduced local air pollution from sulphur dioxide and particulate emissions that would otherwise result from burning of diesel. There will also be reduced need to transport fossil fuels to these remote areas.
- Reduced GHG emissions as a result of avoided burning of fossil fuels and reduced use of unsustainably harvested fire wood.
- Reduction in the use of fuel-wood and kerosene for household cooking, heating and lighting., resulting in less indoor smoke pollution especially for women and children and reduced danger of in-house fires.
- Reduction in deforestation and degradation of natural habitats of rare plant and animal species presently threatened by excessive cutting of wood and shrubs for cooking and heating in winters.

In addition to the environmental benefits the project will create opportunities for economic development and alleviation of poverty in the underdeveloped and remote mountain communities of northern Pakistan through value added to agriculture and forestry products and value added to the local gems industry and tourism services. Provisions of basic amenities such as good quality power supply, television, and possibility of mobile phone networks as a result of electrification will contribute to improved quality of life. Improved health and education services are likely to be available to local people as these remote areas become more attractive for teachers and health workers to live in.

A.3. Project participants:

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 Pakistan (Host)	Aga Khan Rural Support Programme (AKRSP) Participating 103 communities	Yes
	Pakistan Poverty Alleviation Fund (PPAF)	
	Northern Areas Government	
	Pakistan Centre for Renewable Energy Technologies (PCRET)	
	IBRD as the trustee of the Community Development	Yes

	Carbon Fund (CDCF)	
Government of Norway	Royal Norwegian Embassy	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

Each community that installs a MHP is a project participant. AKRSP will acquire contractual agreement from all participating communities for transfer of CER ownership and other rights to AKRSP.

AKRSP, the project proponent, is a well known non-governmental organization based in Pakistan. It is the implementer of the renewable energy project as well as the facilitator for community participation. AKRSP has, since 1991, completed about 240 micro- and mini-hydropower schemes in six districts of northern Pakistan. To date, a total of about 10 MW of installed micro- and mini-hydel capacity has been implemented by AKRSP in the region. These projects have been executed and maintained by the local community-based Village Organizations (VOs), while AKRSP has provided technical and financial support and trained plant operators from within the communities. The plants are operating successfully. AKRSP won the prestigious Ashden Award (Green Oscars) in 2004 and the Japanese Award for Most Innovative Development Project 2005 for its community-based renewable energy programme in the area. AKRSP's main activities in the Northern Areas and Chitral include institutional development, i.e., creating village and higher level community organizations; resource development, i.e., development of small infrastructure projects, such as roads, bridges, hydel plants, irrigation channels, flood protection devices, reservoirs and water supply schemes; and market development, linking local production to local and larger markets through provision of micro-credit, as well as provision of business development services. AKRSP also works with the local government system and local communities to sustainably manage natural resources, conserve the environment and promote social forestry. Other activities include increasing productivity in food, vegetable seed, fodder and fruit crops; agricultural diversification; agro-processing and other post-harvest processing; and livestock and poultry development. The organization also carries out social, gender, and civil society development projects, community-based training and workshops, and links local organizations with available public and private sector services.

Pakistan Poverty Alleviation Fund (PPAF) is an autonomous fund set up by the Government of Pakistan to invest in community-based infrastructure projects and micro-credit for enterprises that reduce poverty. It represents an innovative model of public private partnership and works with a total of 65 intermediary Partner Organizations (POS), one of which is AKRSP, for effective outreach to tens of thousands of Community Organizations (COs). Incorporated under section 42 of the Companies Act 1984, it follows the regulatory requirements of the Securities and Exchange Commission of Pakistan. Sponsored by the Government of Pakistan and funded by the World Bank and other leading donors the PPAF had on April 30, 2006 a resource base of US$ 633.17 million (Rs. 37,990.2 million). The target beneficiaries of PPAF are poor rural and urban communities, with specific emphasis being placed on gender and empowerment of women. Benefits accrue directly to the vulnerable through income generation, improved physical and social infrastructure, micro-credit and training and skill development support.

As the lead Apex institution of the country wholesaling funds to civil society organizations, the PPAF forms partnerships on the basis of rigorous criteria. Before finalizing partnerships the PPAF ensures that the partners have well targeted community outreach programs that are committed to enhancing the social and economic wellbeing and income of the disadvantaged peoples.

The Community Physical Infrastructure (CPI) Unit of the PPAF provides support in the form of loans or grants to partner organizations for approved physical infrastructure interventions. Identification of the projects is demand driven, and is determined by the communities through an internal participatory process. For purposes of ownership it is mandatory for the communities to share in the cost of the project, and also to manage and maintain the infrastructure provided, and ensure equitable benefits to all community members. A total of 10,889 community physical infrastructure projects have been constructed to date, including a number of micro-hydropower projects, through PPAF support.

The **CDCF** is a trust fund maintained and operated by the World Bank (IBRD) in its capacity as trustee of the CDCF on behalf of its public and private participants. Official contact for the CDM project activity: The Community Development Carbon Fund (CDCF) of The World Bank.

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

Project Implementation:
AKRSP is responsible for ensuring the overall implementation of the proposed project activity in coordination with local community based organizations and donors. The figure below illustrates the management structure of the project:

Fig. A 3.1 Structure of Management System for Project

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

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

A.4.1.1. Host Party(ies):

Government of Pakistan

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

The project areas include three regions in northern Pakistan:

- Gilgit region (including the districts of Gilgit, Ghizer and Astore),
- Baltistan region (Ganche and Skardu districts), and
- Chitral district of North West Frontier Province.

A.4.1.3. City/Town/Community etc:

Different villages and towns in Giligit, Baltistan and Chitral regions of Pakistan

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

The proposed project location is the remote mountain valleys of the Northern Areas and Chitral in proximity to Pakistan's northern borders with Afghanistan, the People's Republic of China, and Indian-controlled Kashmir. The area is rugged and mountainous, located at the confluence of four of the world's highest mountain ranges: the Himalayas, the Karakoram, the Pamirs, and the Hindukush. The region's ecology is characterized by a fragile, high mountain environment and extreme climatic conditions. The region supports over a million people, mostly living in extreme poverty in approximately 850 villages.

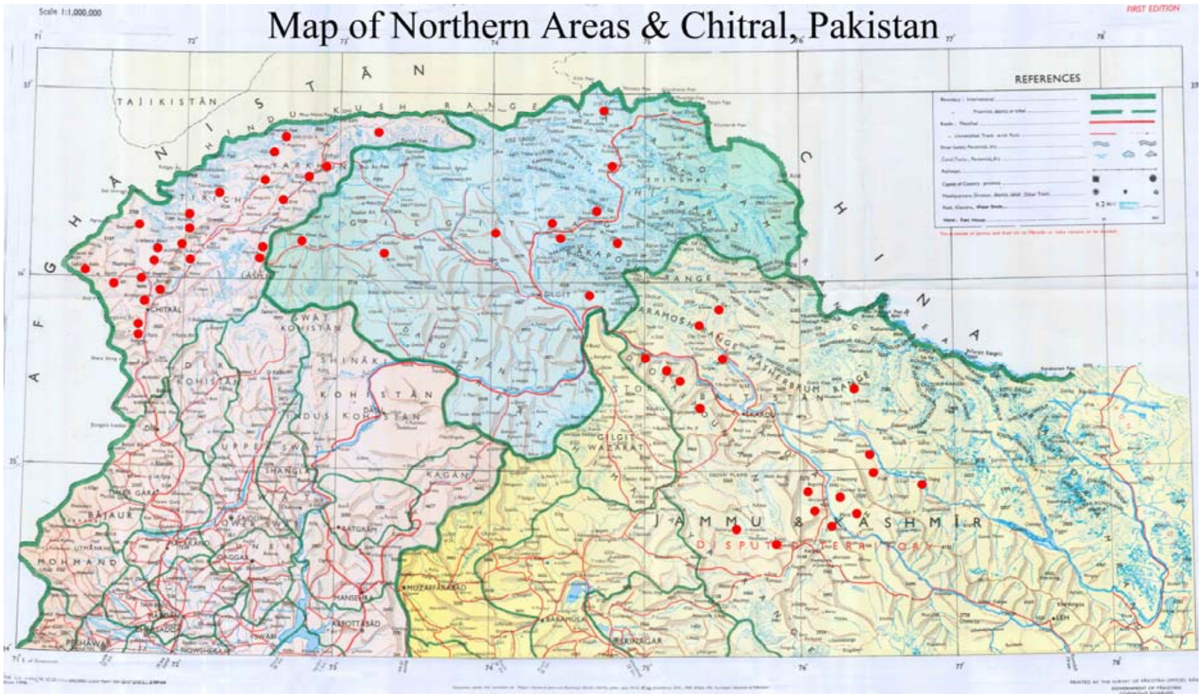

Figure 1: Map of project locations in the Northern Areas and Chitral Pakistan

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

Type I – Renewable Energy Project
Category I. A. - Electricity Generation by the User

Technology to be employed by the Project Activity
A short description of micro and mini hydropower technology is provided below:

I. Micro and mini hydropower technology
Micro and mini hydropower units offer a proven and reliable source of electricity in locations where the hydrological resources are available and the topography is favourable for their development. The turbine converts the energy of falling water to mechanical energy which can be used directly or be converted to electrical energy, through an alternator, for use in lighting, refrigeration, milling or a number of other productive uses. As shown in the diagram below, the basic components of a hydropower unit include:

- a weir to divert water into an intake where the water enters the system,
- a channel that conveys water from the intake to the forebay tank
- a penstock pipe to transport the water from forebay tank to the powerhouse,
- a turbine located in the powerhouse to convert the energy of the falling water into mechanical rotational energy,
- a generator located in the powerhouse that converts rotational energy to electricity and a governor or electronic load controller to keep the frequency and system voltage to acceptable levels in response to change in load demand
- a tailrace channel through which the water leaves the powerhouse and returns to the stream, and

- power lines to transfer power to load centres and distribute power to households.

Each country has its definitions of categories of hydropower project plant sizes. In Pakistan, 'micro' hydropower refers to units of less than 150 kW installed capacity, 'mini' hydropower refers to projects in the range of 150 kW to 5 MW, and 'small' hydropower between 5 MW to 50 MW[1]. The hydropower projects included in the proposed CDM project activity will be limited to the micro and mini hydropower ranges.

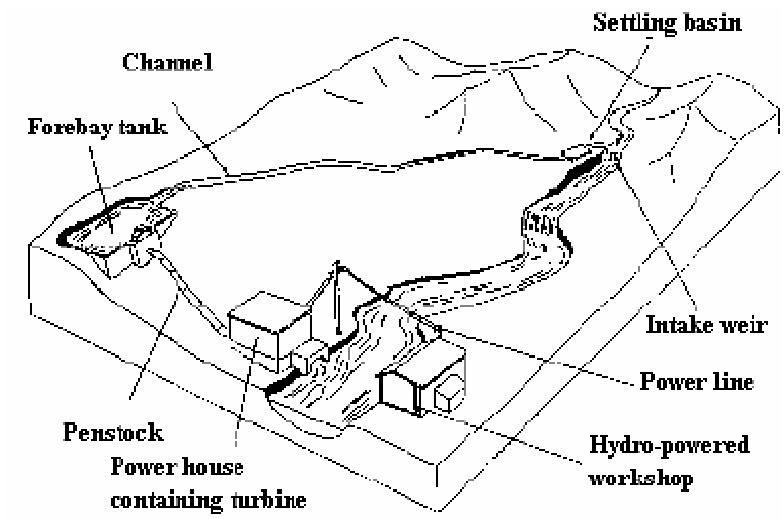

Figure 2: Simple sketch of micro-hydro
Source: http://www.itdg.org/html/technical_enquiries/docs/micro_hydro_power.pdf

Both locally manufactured and imported technology will be used for the implementation of the mini hydropower units, depending on operational specifications and requirements. The turbines that will be installed would likely fall in the categories of (a) Cross-flow, (b) Pelton wheel, (c) Francis, and possibly (d) Kaplan types. Pelton turbines are used for high head applications. Francis and cross-flow turbines cover medium head sites. Kaplan turbines are used for exceptional low head sites in less steep locations. AKRSP has previously employed only the former two in the region, as the latter two were not manufactured in Pakistan. Most sites will likely continue to utilize Cross-flow and Pelton turbines because of their robustness and ease of local fabrication. It is likely that imported technology will be used for plants of capacity above 500 kW. The sources for procurement of imported equipment will likely include China and Europe.

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 536,993 tCO_2eq in the first 7 year crediting period from 2008 to 2014. It should be noted that the actual GHG emission reduction would be measured based on aggregation of the annual meter readings at each operating MHP. Section E provides further details of calculations.

[1] Definition as per Government of Pakistan document: "Policy for Development of Renewable Energy for Power Generation" 2006.

Please indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emission reductions shall be indicated using the following tabular format

For type (iii) small-scale project the estimation of project emission is also required

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2008	7,567
2009	30,334
2010	66,259
2011	108,208
2012	108,208
2013	108,208
2014	108,208
Total estimated reductions (tonnes of CO_2e)	536,993
Total number of crediting years	7
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)_	**76,713**

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

The project is expected to receive public grant funding from the Pakistan Poverty Alleviation Fund (PPAF), the Northern Areas Government, and from the Pakistan Centre for Renewable Energy Technologies (PCRET). Discussions are ongoing with the Royal Norwegian Embassy for additional grant funding. Norway, the potential Annex I country provider of the public funding, will not purchase any emission reductions generated by the proposed project and thus there will be on diversion of ODA funds.

The details of the committed amounts of public funding are given in Annex II.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale 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 none of the above is true for the proposed CDM project activity, it is not a debundled component of a large project activity.

SECTION B. Application of a baseline and monitoring methodology

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

The baseline and monitoring methodologies applied for the project 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.

The project falls under,

Type I – Renewable Energy Projects
Category I. A. – Electricity Generation by the User

The approved baseline and monitoring methodology given in Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, relevant to this project are available at:

http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_VECB8EZJV6NSM13KPOVCDLO9PBR4OY

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 or groups of 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 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……"

The proposed project activity involves hydropower projects which will supply isolated mini-grid distribution systems. In the absence of the project, the consumers that will be supplied electricity on these mini-grids would have eventually been supplied by diesel generators through the same or smaller mini-grids. As such this project qualifies under Category I-A of Appendix B of the small-scale guidelines.

B.3. Description of the project boundary:

According to the baseline methodology for project category I.A., "The physical, geographical site of the renewable energy generating unit and the equipment that uses the electricity produced delineates the project boundary." The geographic project boundary selected for the project activity is the political boundary that covers federally administered Northern Areas and Chitral (NAC) of Pakistan. Micro- and mini-hydropower projects will be constructed in those rural areas of the NAC where there is no access to the national or regional grid or supply through isolated generation by the Public Works Department. Power will be distributed through mini-grids in the vicinity of the hydropower plants and will be used to meet domestic electricity needs and power for productive end-uses.

Figure 3: Baseline emissions project boundary

Figure 4: Project boundary

B.4. Description of baseline and its development:

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:

(a) Option 1:

$$EB = \Sigma_i (n_i \cdot c_i)/(1 - l)$$

Where:

EB annual energy baseline in kWh per year.

Σi the sum over the group of "i" renewable energy technologies (e.g. residential, rural health centre, rural school, mills, water pump for irrigation, etc.) implemented as part of the project.

ni number of consumers supplied by installations of the renewable energy technology belonging to the group of "i" renewable energy technologies during the year.

ci 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 group of "i" renewable energy technologies. If energy consumption is metered, ci 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 programmes or distribution companies in isolated areas, expressed as a fraction.

OR

(b) Option 2:
EB = ΣiOi /(1 - l)

Where:

EB annual energy baseline in kWh per year

Σi the sum over the group of "i" renewable energy technologies (e.g. solar home systems, solar pumps) implemented as part of the project.

Oi 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 programmes or distribution companies in isolated areas, expressed as a fraction."

Option 2 is selected to determine the baseline emissions for the proposed project activity. The emissions baseline is calculated using the aggregate of annual kWh output of all MHP power plants times the CO_2 emission coefficient for the fuel displaced. According to the approved methodology a default value of 0.8 KgCO2e/kWh which is derived from diesel generation units, may be used as the emission factor. However, a small-scale project proponent may, with adequate justification use a higher emissions factor from Table I.D.1 under category I.D.

A survey carried out of diesel generators operating in the NAC region in May/June 2007 found that actual emission factors are much higher than the default value. Based on the results of the survey a conservative value of 1.83 kg CO_2eq/kWh is used as the CO_2 emission coefficient for the fuel that would be displaced by the MHP installations. The survey which was carried out in all three districts covered by the project – Gilgit, Chitral, and Baltistan showed that diesel gensets being used in this region generally have emission coefficients which are significantly higher than that specified by the manufacturers. The likely explanation for this finding is that the gensets being used are not being maintained well and many are of inferior brands. The larger gensets operated by the Public Works Department have much lower emission coefficients since they use high quality equipment which they maintain regularly. Table B 4.1 shows that emission factors varied by generator size and ranged from an average of 2.25 kg CO_2eq /kWh for small generators in the <15 kW size category to 0.89 kg CO_2eq /kWh for generators in the >200 kW range. Details of the survey and its results are given in Annex 3.

Table B 4.1 Emission Coefficients of different size generators based on survey results

Category	Measured fuel efficiency (kWh/litre)	Litres of diesel/ kWh	kg of diesel/kWh	kg CO_2eq/ kWh
< 15 kW	1.19	0.84	0.70	2.25
>=15 <35 kW	1.47	0.68	0.57	1.82
>=35 <135 kW	1.73	0.58	0.48	1.55
>=135 <200 kW	2.78	0.36	0.30	0.96
>= 200 kW	3.03	0.33	0.28	0.89
Weighted average of gensets <35 kW	**1.47**	**0.68**	**0.57**	**1.83**

The survey also found that most operating generators were in areas close to towns and only a few existed in areas to be supplied by the MHP installations. It also found that the more rural areas of the three districts, where the hydropower projects are slated to be installed, were served by smaller size generators mostly in the < 15 kW category. Some gensets in the >=15kW <35kW range being used to supply institutions like banks, hospitals and NGO offices in rural areas. The larger size gensets in the >=35 <135kW, >=135 < 200kW, and >200 kW are mostly in urban centres with most of the installations in the last two categories being operated by the government Public Works Department. The emission coefficient of 1.83 was calculated by taking the weighted average of gensets surveyed in the first two categories < 15 kW and >=15 <35 kW. This gives a conservative estimate given that most generators likely to be used in the rural areas where the MHP installations will be installed are likely to be in the first category of <15 kW and have higher emission coefficients.

It is not expected that there will be a significant transfer of existing diesel gensets to other areas after the communities are supplied by micro and mini-hydropower systems. Firstly there are few generators currently supplying the areas to be electrified. Secondly, most generators supplying institutions like banks, hospitals, and NGO offices will likely be retained as back up generators. For these reasons, leakage has not been considered in the baseline analysis.

The date of completion of the baseline study is 10/8/2007. The baseline is developed by Winrock International, Pakistan which is not a project participant. Contact information is provided below:

Mr. Bikash Pandey
Winrock International Pakistan
House 20, Street 19, Sector F-7/2
Islamabad
bikashpan@gmail.com

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:

The electricity supply in northern Pakistan does not at present supply even half of the local population. Although their penetration into rural areas is still very limited, off-grid diesel-run generators are increasingly being installed in un-electrified areas as their capital costs are low and they are readily available. With both national and regional electricity demand increasing rapidly, there is high likelihood of significant additional diesel-generation being installed in the area, including in areas where the MHP installations are likely to be carried out. This will result in additional fossil fuel consumption and increased GHG emissions, besides being a costly source of electricity due to high petroleum prices, transportation and storage expenses.

The proposed project will reduce greenhouse gas emissions that would otherwise be produced from the use of diesel-based generators. Diesel generators are the most ready means of meeting the needs of un-electrified populations that are not connected to the national electricity grid due to the remoteness of the communities and mountainous terrain. The GHG emissions mitigated would include carbon dioxide and oxides of nitrogen.

This project is additional and would not have occurred anyway because of a number of barriers that prevent investments in micro- and mini-hydropower investments in the NAC region of Pakistan. With reference to Attachment A to Appendix B of the Simplified Modalities and Procedures for Small-Scale CDM Project Activities, the proposed project activity faces specific barriers related to investment and technology as described below.

Investment Barrier

AKRSP aims to construct micro and mini hydropower projects (as given in Table B 5.1) of cumulative capacity around 15 MW in cooperation with 103 beneficiary communities in the NAC area of Pakistan.

The implementation of the proposed activity requires a considerable amount of upfront capital. In order to install 15 MW of cumulative power, the MHP program will require total funds of PRs 995.9 Million (~ US $16.598 million). This includes capital expenditures required for procurement of equipment and construction, the costs of management of the program, supervision during construction and local labour and materials. The required funds for implementing the program will come from a number of funding organizations (PPAF, NAG, PCRET, and private sector) as well as the local beneficiary communities which will be expected to contribute around 20% of the total project cost in the form of labour and in-kind contribution. Community contribution is capitalised as the equity of each participating household into the community-owned project.

Table B 5.1 provides the list of the projects to be constructed, their sizes, location, the year when they would be commissioned, and expected project costs. The projects to be completed in 2008 have accurate costs based on detailed design. Construction costs are estimated for projects to be completed in subsequent years based on the experience of the first eight projects and previous experience of AKRSP in the construction of micro-hydropower projects to be $1,000 per kW. This includes equipment purchases, cost of construction materials and skilled labour, and the community in-kind contribution. A construction supervision cost of 12%, to be charged for AKRSP design and supervision services, is added to this cost to arrive at a total per kW cost of $1,120.

Table B 5.1: Project costs

S. No.	Commissioned year	Name of Project	Region	District	Tehsil	Project Capacity (MW)	Project Cost (US$ '000)

1	2008	Besil	Baltistan	Skardu	Shigar	0.200	153
2	2008	Memushthang	Baltistan	Skardu	Kharmang	0.035	41
3	2008	Brep	Chitral	Chitral	Mastuj	0.230	316
4	2008	Droneel	Chitral	Chitral	Chitral	0.100	70
5	2008	Onawich	Chitral	Chitral	Mastuj	0.050	54
6	2008	Shabronz	Chitral	Chitral	Mastuj	0.050	57
7	2008	Bilphok	Chitral	Chitral	Chitral	0.075	46
8	2008	Ahmadabad	Gilgit	Gilgit	Hunza	0.309	237
		Sub-total				**1.049**	
9	2009	Hushay	Baltistan	Ghanche	Mashabroom	0.100	112
10	2009	Hango	Baltistan	Skardu	Rondu	0.100	112
11	2009	Konar	Baltistan	Skardu	Gultari	0.100	112
12	2009	Shagarthang	Baltistan	Skardu	Skardu	0.100	112
13	2009	Ganuk	Baltistan	Skardu	Kharmang	0.100	112
14	2009	Terich Bala	Chitral	Chitral	Mastuj	0.050	56
15	2009	Kishmanja	Chitral	Chitral	Mastuj	0.050	56
16	2009	Baleem Laspur	Chitral	Chitral	Mastuj	0.075	84
17	2009	Pawoor	Chitral	Chitral	Mastuj	0.150	168
18	2009	Gobor Deghili	Chitral	Chitral	Chitral	0.050	56
19	2009	Arkari	Chitral	Chitral	Chitral	0.150	168
20	2009	Zoodkhon	Gilgit	Gilgit	Hunza	0.12	134
21	2009	Teru	Gilgit	Ghizer	Gupis	0.150	168
22	2009	Dirashkin Khanyat	Gilgit	Ghizer	Gupis	0.1	112
23	2009	Khutum Khalti	Gilgit	Ghizer	Gupis	0.051	57
24	2009	Hassanabad	Baltistan	Ghanche	Khaplu	0.100	112
25	2009	Doko	Baltistan	Skardu	Shigar	0.100	112
26	2009	Izh	Chitral	Chitral	Chitral	0.130	146
27	2009	Shagram	Chitral	Chitral	Mastuj	0.120	134
28	2009	Mayoon	Gilgit	Ghizer	Punial	0.125	140
29	2009	Hagusil	Baltistan	Skardu	Kharmang	0.12	134
30	2009	Dapa	Baltistan	Skardu	Kharmang	0.17	190
31	2009	Katisho	Baltistan	Skardu	Kharmang	0.075	84
32	2009	Brisil	Baltistan	Skardu	Kharmang	0.050	56
33	2009	Memush	Baltistan	Skardu	Kharmang	0.050	56
34	2009	Nilt	Gilgit	Gilgit	Nagar	0.100	112
35	2009	Moorkhun	Gilgit	Gilgit	Hunza	0.15	168
36	2009	Mardeen	Chitral	Chitral	Chitral	0.15	168
37	2009	Yurjogh	Chitral	Chitral	Chitral	0.12	134
38	2009	Zhitur	Chitral	Chitral	Chitral	0.15	168
		Sub-total				**3.156**	

39	2010	Lunkha	Baltistan	Ghanche	Khaplu	0.100	112
40	2010	Dansar	Baltistan	Skardu	Kharmang	0.125	140
41	2010	Gidakh	Baltistan	Skardu	Kharmang	0.115	129
42	2010	Beshgram	Chitral	Chitral	Chitral	0.150	168
43	2010	Bireer	Chitral	Chitral	Chitral	0.100	112
44	2010	Batkore	Gilgit	Gilgit	Gilgit	0.035	39
45	2010	Kunjukushal	Gilgit	Gilgit	Nagar	0.100	112
46	2010	Ingut	Baltistan	Skardu	Kharmang	0.050	56
47	2010	Bunyal	Baltistan	Skardu	Gultari	0.075	84
48	2010	Gazeen	Chitral	Chitral	Mastuj	0.130	146
49	2010	Droshp*	Chitral	Chitral	Chitral	0.600	672
50	2010	Shali*	Chitral	Chitral	Chitral	0.600	672
51	2010	Mastuj*	Chitral	Chitral	Mastuj	0.600	672
52	2010	Arundu	Chitral	Chitral	Chitral	0.100	112
53	2010	Rau Gole	Chitral	Chitral	Chitral	0.100	112
54	2010	Yarmagoma	Baltistan	Ghanche	Mashabroom	0.150	168
55	2010	Marcha	Baltistan	Ghanche	Khaplu	0.100	112
56	2010	Khurkondo	Baltistan	Ghanche	Mashabroom	0.075	84
57	2010	Khenjure Kock	Chitral	Chitral	Chitral	0.150	168
58	2010	Begust	Chitral	Chitral	Chitral	0.150	168
59	2010	Bhoroghol	Chitral	Chitral	Mastuj	0.150	168
60	2010	Barswat	Gilgit	Ghizer	Punial	0.200	224
61	2010	Borth	Gilgit	Astore	Astore	0.150	168
62	2010	Shalter	Gilgit	Astore	Astore	0.150	168
63	2010	Bulachi	Gilgit	Astore	Astore	0.040	45
64	2010	Shamshal	Gilgit	Gilgit	Hunza	0.150	168
65	2010	Rosh gole terich	Chitral	Chitral	Mastuj	0.150	168
66	2010	Farocha	Gilgit	Astore	Astore	0.035	39
67	2010	Darkoot	Gilgit	Ghizer	Ishkoman	0.150	168
68	2010	Kasunder	Gilgit	Ghizer	Ishkoman	0.200	224
		Sub-total				**4.980**	
69	2011	Wazirpoor	Baltistan	Skardu	Shigar	0.075	84
70	2011	Chowar	Baltistan	Ghanche	Khaplu	0.125	140
71	2011	Karabosh/Gultari	Baltistan	Skardu	Gultari	0.100	112
72	2011	Ganji	Baltistan	Skardu	Rondu	0.100	112
73	2011	Belargo	Baltistan	Skardu	Kharmang	0.075	84
74	2011	Khot Bala	Chitral	Chitral	Mastuj	0.175	196
75	2011	Bomborait	Chitral	Chitral	Chitral	0.200	224
76	2011	Susum	Chitral	Chitral	Chitral	0.150	168
77	2011	Shoghore*	Chitral	Chitral	Chitral	0.450	504
78	2011	Birzeen	Chitral	Chitral	Chitral	0.250	280
79	2011	Thol	Gilgit	Gilgit	Nagar	0.145	162
80	2011	Chotadass	Baltistan	Skardu	Gultari	0.120	134
81	2011	Ghawis	Baltistan	Skardu	Kharmang	0.100	112
82	2011	Rabat Arkari	Chitral	Chitral	Chitral	0.230	258
83	2011	Momi	Chitral	Chitral	Chitral	0.150	168

84	2011	Rowa	Chitral	Chitral	Chitral	0.250	280
85	2011	Raman	Chitral	Chitral	Mastuj	0.250	280
86	2011	Oveer	Chitral	Chitral	Mastuj	0.210	235
87	2011	Golain Istore	Chitral	Chitral	Chitral	0.200	224
88	2011	Kusraw Gol	Chitral	Chitral	Chitral	0.200	224
89	2011	Chilim Diralay	Gilgit	Astore	Astore	0.160	179
90	2011	Parabek	Chitral	Chitral	Chitral	0.175	196
91	2011	Longole	Chitral	Chitral	Mastuj	0.100	112
92	2011	Kiyar	Chitral	Chitral	Chitral	0.100	112
93	2011	Rumboor	Chitral	Chitral	Chitral	0.100	112
94	2011	Ghoru	Chitral	Chitral	Mastuj	0.100	112
95	2011	Damal Nasir	Chitral	Chitral	Chitral	0.100	112
96	2011	Besti Shenjure	Chitral	Chitral	Chitral	0.200	224
97	2011	Sunich	Chitral	Chitral	Chitral	0.100	112
98	2011	Guludass	Gilgit	Astore	Astore	0.150	168
99	2011	Gotolti	Gilgit	Astore	Astore	0.075	84
100	2011	Thoie	Gilgit	Ghizer	Yaseen	0.250	280
101	2011	Darmandar	Gilgit	Ghizer	Yaseen	0.250	280
102	2011	Sandi	Gilgit	Ghizer	Yaseen	0.250	280
103	2011	Skamal	Gilgit	Ghizer	Yaseen	0.150	168
	2011	**Sub-total**				**5.815**	
		Cumulative				**15.000**	**$16,598**

Table B 5.2 shows a breakdown of the financing available to carry out the CDM project activity. The PPAF grant for the program will cover 42% of the total cost (US$ 7.028 million). Support from public sources like the Northern Area Government (NAG), and Pakistan Centre for Renewable Energy Technologies (PCRET) will cover respectively about 10% of the cost ($1.583 million). Private sector investors have agreed to invest around 12% of the total cost ($1.980 million). These investors expect to earn returns on investment generated both from electricity tariff and expected carbon revenue. There will need to be a loan component from a commercial bank to cover the funding gap of 16% of total cost ($ 2.688 million) as grant funding is not in place for the full program. Negotiations are ongoing with the Royal Norwegian Embassy (RNE) to provide grant funding for a portion of the total cost and correspondingly reduce the loan amount. The loan will be repaid from carbon revenues from the CDM project. It is expected that around US$6.775 million in carbon revenue will be generated by the project till 2015. In addition to repaying the loans, this revenue will be shared with the private investors and the Pakistan Poverty Alleviation Fund. PPAF will be paid 40% of the carbon revenue of their share of the total investment into the project. This comes to around 16.8% of the total ERs. Discussions are ongoing on a formula for sharing revenues with the private companies.

Table B 5.2 Financing for Project

Total Project Cost	$16.598 million	100%
Pakistan Poverty Alleviation Fund	$7.028 million	42%
Public sources of funding (Northern Area Government, PCRET)	$1.583 million	10%
Royal Norwegian Embassy	$0.000 million	0%
Private Sector	$1.980 million	12%
Commercial Loan (to be repaid with carbon revenue and tariff)	$2.688 million	16%
Community Investment	$3.320 million	20%

On the basis of experience of already existing projects, the annual operation and maintenance cost (O&M) of the hydel projects is estimated as 5% of the project capital cost. The electricity tariff is assumed, for the base year 2008, to be Rs 1.25 (US cents 2.08), Rs 2.50 (4.17 cents) and Rs 4.00 (6.67 cents) per kWh for three proposed categories of consumers – lifeline domestic, higher consumption domestic, and commercial - respectively, with tariff increasing commensurate with an expected annual inflation of 5%. It is assumed that 75% of the energy will initially be sold to customers at the lifeline consumption level. Plant life is assumed to be 20 years. The outcome of the financial analysis is summarized in Table B 5.3.

Table B 5.3: Summary Financial Analysis for Consolidated 103 Projects

Power capacity installed	15 MW
Annual energy production	59.1 GWh
Total estimated cost	US$16.598 million
Average tariff revenue per year	US$1.633 million
Project IRR with 80% grant (including carbon revenue)	28%
IRR with 80% grant excluding carbon revenue	3%

The financial analysis shows that the internal rate of return (IRR) for the consolidated 103 projects with the committed grants and carbon revenue[2] accruing till 2015 comes to 28%. This is an attractive IRR for the project. With additional carbon revenue beyond 2015, the IRR can be expected to improve even further. The IRR for the project without carbon revenue comes to only 3%, which is low even for a social enterprise such as the one proposed here. This implies that the program would not go ahead without the proposed CDM project activity.

Technology barrier

Micro and mini hydropower are well established technologies. Nevertheless at the community level, construction of a power project is a complex undertaking that requires technical and managerial skills that are not locally available in the NAC region. AKRSP has previous experience with designing some 240 micro and mini hydropower projects and in organizing communities to construct them. It is anticipated that both local and imported technology will be needed for the implementation of the mini hydel units. AKRSP will assure that the best available MHP technology on the market will be used for the installations. AKRSP will also collaborate with PCRET and other agencies to introduce technologies such as electronic load controllers which are proven internationally but are not yet easily available in Pakistan. It is likely that imported technology will be used for plants above 0.5 MW capacity. Without quality control and strict inspection, there is the risk that equipment suppliers and manufacturers will provide low quality equipment. Such equipment would lead to frequent breakdowns creating low performance and extra maintenance burden on poor communities. Civil construction needs to be carried out to high standards if the projects are to operate optimally over their full economic life. AKRSP will support communities in both design and construction supervision to ensure this. Since rural communities cannot discern the quality of purchased equipment or of civil construction, AKRSP through the proposed project will undertake the technical design of projects and construction supervision. Communities will be advised to procure equipment only from reliable suppliers and manufacturers. This technology and quality control support of projects by AKRSP would not be possible in the absence of this CDM project activity.

[2] Assuming $10.50 per ER

In the face of the investment and technological barriers described above communities would likely use diesel based power generation if it were not for the proposed CDM project activity.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The formulae given in Appendix B to calculate energy baseline has been used as explained in Sections B.2 and B.4 above. The calculation of GHG emissions reduction has been presented below.

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

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 aggregation of the annual kWh meter readings of all the micro-hydro systems give the ($\Sigma_i O_i$); the distribution losses 'l' is assumed to be zero since the MHP mini-grids can be expected to have similar losses as the diesel powered mini grid. So the annual energy baseline in kWh per year (E_B) comes out to be the same as the sum of all the annual meter readings.

Total annual emission reductions can be calculated by multiplying E_B by the emission coefficient of the displaced fuel. An emission coefficient of 1.83 kg CO_2eq/kWh is used in the calculations as discussed in Section B.4.

Baseline Emissions (tCO_2/yr) = E_B (kWh) * 1.83 kg CO_2eq/kWh * 1/1000

Project emissions are assumed to be zero.

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

(Copy this table for each data and parameter)

Data / Parameter:	**Emission factor of operating diesel gensets**
Data unit:	kg CO_2eq /kWh
Description:	This emission factor was derived from the results of a survey of existing diesel generator sets operating in the region where the project activity is to be carried out
Source of data used:	Survey of existing generator sets
Value applied:	1.83 kg CO_2eq /kWh
Justification of the choice of data or description of measurement methods and procedures	Available in Annex 3

actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

The installed micro- and mini-hydropower projects are expected to have an average plant load factor of 0.45. This estimated plant load factor includes 2% of down time (175 hours a year) of the system for repairs and an energy utilization rate at 46% of total plant capacity. Off-grid MHP systems typically have a plant factor below 50% since consumers don't demand power for much of the day when they work in the fields or at night when they go to bed. While the system sees demand close to the capacity of the power plant during evening peak hours, load is significantly smaller during off-peak hours. Industrial loads will generate demand in the day time but this will vary from location to location and will tend to be limited to a fraction of the full plant capacity in the more remote rural communities.

Annual energy production from 15 MW of generation will thus be
= 15,000 kW * 8,760 hours * 0.45 = 59,130,000 kWh.
Multiplying by the emission factor of 1.83 kg CO_2eq /kWh, we get a total baseline emission
= 59,130,000 kWh * 1.83 kg CO_2eq /kWh = 108,208 tonne CO_2eq

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

Emission reductions by year till 2015 are estimated to be as follows:

Years	Estimated energy production by year (GWh)	Annual estimation of emission reductions (tonnes of CO_2 e)
2008	4.135	7,567
2009	16.576	30,334
2010	36.207	66,259
2011	59.130	108,208
2012	59.130	108,208
2013	59.130	108,208
2014	59.130	108,208
2015	59.130	108,208

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	Energy production by each power plant
Data unit:	kWh (kilowatt hour)
Description:	Three phase kWh (energy) meters at each power house will measure energy supplied to the distribution system of the mini grid
Source of data to be used:	Log book placed at each power house
Value of data	As per actual daily reading

Description of measurement methods and procedures to be applied:	The power house operator will keep daily logs of kWh produced. At the end of the month, he will send this information to the AKRSP office, where this information will be compiled from all 103 project sites. All the data will be consolidated and stored in an electronic data log at the AKRSP office. The data will be regularly updated and shared with the DOE to enable verification of ERs.
QA/QC procedures to be applied:	Regular monitoring of the schemes is carried out during and after construction by AKRSP to ensure high quality construction and sustainable operation of the MHP schemes. Power output of each plant will be verified to ensure that power output is as designed. AKRSP will carefully monitor the monthly energy production and end-uses data submitted by each of the utilities and will provide guidance to improve the load factor and increase energy use in productive end uses.
Any comment:	

The Table below shows the data to be monitored:

ID No.	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	Meter reading	Energy generated	kWh reading	M	Monthly	100%	Electronic	Crediting period plus 2 years	Data is annually reported

B.7.2 Description of the monitoring plan:

Monitoring will consist of filling out the log book each day with the reading from the energy (kWh) meters, situated in the power house, for each of the 103 power plants. These readings will be submitted by the power house operator to the AKRSP office every month where they will be added up to compute annual energy production for each plant and combined to compute annual energy production for the aggregate of all the power plants. All the data will be stored in an electronic data log at the AKRSP office. The data will be regularly updated and will be available for verification by the DOE. Monthly readings at each plant will be monitored by AKRSP and visits made to site for investigation in case of unusually high or low readings. The energy meters will be certified by a reputable agency every two years or as needed if readings are unusual at any site.

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 baseline and monitoring methodologies has been developed by Winrock International, Pakistan on August 10, 2007. Contact information for the responsible person is given below.

Mr. Bikash Pandey
Winrock International Pakistan
House 20, Street 19, Sector F-7/2,
Islamabad 44000
Pakistan.
Tel: + 92 (0) 51 265 2558,
bikashpan@gmail.com

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

The starting date for the project activity is January, 2008. Each plant will start operation as soon as the installation is complete.

C.1.2. Expected operational lifetime of the project activity:

21 years.

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

C.2.1. Renewable crediting period

Yes.

C.2.1.1. Starting date of the first crediting period:

Jan 1, 2008.

C.2.1.2. Length of the first crediting period:

7 years.

C.2.2. Fixed crediting period:

Not applicable.

C.2.2.1. Starting date:

C.2.2.2. Length:

SECTION D. Environmental impacts

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

The adoption of mini hydel power units reduces the consumption of firewood, kerosene and dry-cell batteries at the household level for non electrified region. It also offsets the diesel based power generation in the region. This reduces GHG emissions and improves air quality indoors. There is also a positive impact on forest cover. The project significantly contributes to reduction of health problems associated with indoor air pollution. The negative impacts of mini-hydropower on the local environment are negligible. The small run-of-river systems do not involve storage reservoirs or inundation. No additional river bank erosion is expected at the sites as a result of the project. Ecological flow of at least 10% of the dry season flow of the streams will be retained in the river year round so there are no significant environmental effects downstream of the weirs. Accompanying afforestation activities will lead to improved watershed management. Significant forest clearing is not required for construction or transmission lines because of the small size of the developments. The visual impact of the penstock pipes is small. In order to avoid the risk of accidents from potential electrical hazards, high safety standards will be established.

The project will conform to local laws and environmental regulations, specifically the Pakistan Environmental Protection Act 1997, and the policies and guidelines set by the World Bank Group for development projects. It will also comply with all Safeguards Policies of the World Bank Group.

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:

NA.

SECTION E. Stakeholders' comments

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

The project follows a three-part dialogue process with the local communities. In the First Dialogue, communities are briefed about the nature of the hydropower project, the intended outcomes and mutual obligations between AKRSP and the communities. Once there is initial agreement, technical staff of AKRSP work with the community representatives to assess the available water resources, survey potential sites and prepare cost estimates. The outcome of this informs the Second Dialogue which consists of the conducting of the feasibility study. Survey results and cost estimates are presented to the full meeting of the Village Organization (VOs), and detailed terms of Partnership (TOP) are discussed, and agreement reached. A design and cost estimation of the project is completed based on the feasibility study. Following this a general meeting of the beneficiary community will be called upon in the village premises to initiate the project (3rd Dialogue). During the third dialogue, terms of partnership (ToP) will be signed between AKRSP and the beneficiary community, and the first instalment of the project cost will be paid and deposited in the project account opened by the community. First Dialogues have been conducted with around 100 communities; Second Dialogues are underway in 35 communities and Third Dialogues have been concluded with 9 communities.

Comments are invited from community members at each step of the dialogue process. The received comments, their response and agreed upon actions are compiled by AKRSP after each of the Dialogue steps. Annex 4 provides a Note for the Record of a 3rd Dialogue carried out recently with community members of Ahmedabad in Hunza (Gilgit region) on May 23rd, 2006.

In addition to detailed interaction with the beneficiary community, AKRSP has had discussions about the project with several public and private sector partners. These are other local stakeholders in the development of the hydropower projects. Discussions have so far been held with the Northern Areas Public Works Department (NAPWD); the Planning and Development Department (P&DD), the Pakistan Council for Renewable Technology (PCRET) and two private hydropower companies established with the support of AKRSP. These discussions are recorded by AKRSP.

E.2. Summary of the comments received:

The comments received from beneficiary communities have in generally been highly encouraging. Communities are very interested in moving ahead with the projects. However they do have comments and questions concerning the details of the project. Comments received include the following:

1. Who will provide the land for the construction of project related structures?
2. Which construction cost components will be covered by the community and which by AKRSP?
3. Who will be responsible for project management and maintenance after completion of the project? Who will take care of large repair costs?
4. What will the tariff be for the provided electricity?
5. Will the hydropower project interrupt irrigation in the fields?

The meetings with the public and private sector partners have resulted in the following actions:

1. The NAPWD has revised the Northern Area Government's Energy Strategy, and incorporated CDM as an additional objective. It now allows local NGOs and community organizations to invest in hydropower projects below a certain threshold and to develop them as CDM projects.
2. The two private companies will take part in technical surveys, and provide back up support to communities in project design, installation and post project maintenance.
3. PCRET will sign an MOU with AKRSP and channel its technical resources, including new technology and provide research and development support to AKRSP for this project.

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

Comments and questions from the beneficiary community are responded to during public meetings. All outstanding issues are resolved before the Terms of Partnership is signed between AKRSP and the participating community. Annex 4 provides an example of the types and clarifications and conflict resolution which might typically take place during such meetings.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Aga Khan Rural Support Programme (AKRSP)
Street/P.O.Box:	AKRSP Core Office, Babar Road
Building:	
City:	Gilgit
State/Region:	Northern Areas
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E-Mail:	
URL:	www.akrsplessons.org
Represented by:	
Title:	General Manager
Salutation:	
Last Name:	Hunzai
Middle Name:	Ali
First Name:	Izhar
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Mobile:	
Direct FAX:	
Direct tel:	+(92 5811) 52480
Personal E-Mail:	Izhar.hunzai@akrsp.org.pk

Organization:	World Bank Carbon Finance Unit
Street/P.O.Box:	1818 H Street, NW
Building:	MC4-414
City:	Washington DC
State/Region:	DC
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FAX:	+ 1 202 522 7432
E-Mail:	cfcontacts@worldbank.org
URL:	www.communitycarbonfund.org
Represented by:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

AKRSP is finalizing partnership agreements with:

1. Pakistan Poverty Alleviation Fund (PPAF) for grant financing of $7.028 million. PPAF would be entitled to a share of the carbon revenue.
2. The government of Northern Areas to financing for grant funding of at least two projects on a pilot basis with potential for more in following years.
3. Pakistan Centre for Renewable Energy Technologies (PCRET) for provision of capital items such as turbines and generators for 15 units, amounting to more than one million dollars.
4. One private sector company has expressed interest in making an equity investment into a number of the larger projects to generate returns from tariff collection and carbon revenue.
5. Norwegian Government funding for a larger multi-year support package for AKRSP, of which this project is a part. This has been delayed but it is expected an agreement can be concluded by the middle of 2008. It must be noted here that Norwegian funding is not required for project implementation. Its availability would, however, reduce the loan amount for the project. When the Norwegian funding is secured, the donor will confirm that this funding is not a diversion of ODA.

Written commitments will be shared as they become available.

Annex 3

BASELINE INFORMATION

Results of Survey Carried out to Find out the Emission Coefficient of Diesel Generator Sets Currently used in the NAC Region

A team of 6 engineers from the three regions (Gilgit, Baltistan and Chitral, Northern Pakistan) of AKRSP carried out a questionnaire survey of diesel generators currently being used in the regions, where MHP investments are proposed. As operating diesel generators in the region mostly serve town centres rather than rural areas, few if any of them will actually be replaced by the planned micro-hydropower plants. However, it is expected that generators which would eventually serve the locations in the absence of the micro-hydropower projects would have similar or higher emission coefficients. The Questionnaire is attached below. The ranges of diesel generator sets (gensets) sampled fall under the following categories a) < 15 kW; b) >=15 <35 kW; c) >=35 <135 kW; d) >=135 <200 kW; e) >= 200 kW to be consistent with Table I.D.1 as per the small scale methodology for Type I – Renewable Energy Projects Section I.D. 'Grid connected renewable energy generation'. An attempt was made to survey 10 generators from each of the three areas for each of the five above categories. The surveyors were also instructed to the extent possible to survey gensets outside the municipal area to get a more realistic sample of generators that would likely be used in the more rural communities. As there were unlikely to be any generators outside the municipal areas in categories >=135 <200 kW and >= 200 kW, at least two generators in each of these categories would be sought for the survey in each of the three regions.

A total of 50 well filled out questionnaires were analyzed after some of the questionnaires received were discarded as they were incomplete or had obviously wrong information. They are broken down as follows:

Category	Number of Questionnaires received
< 15 kW	23
>=15 <35 kW	13
>=35 <135 kW	9
>=135 <200 kW	2
>= 200 kW	3
Total	**50**

The methodology used was to measure the fuel efficiency of the gensets in terms of the number of kWh they produced per litre of diesel. This was done by filling up the diesel tank, running the generator at normal load for a few hours. The amount of diesel used was computed by measuring the amount of diesel needed to fill up the diesel tank a second time. The amount of electricity generated was noted by taking the before and after readings on the kWh meters. The fuel efficiency (kg of diesel required to produce 1 kWh of electricity) was then multiplied by the factor of 3.2 kg CO_2eq per kg of diesel following the revised 1996 IPCC Guidelines for National Greenhouse Gas Inventories to arrive at the emission coefficient of the diesel gensets.

The results of the survey are given in the table below. The fuel efficiency for each category of gensets is computed as a simple average, without taking into account the different amounts of energy each genset is likely to produce on account of its size. It can be seen clearly that the smaller gensets have significantly lower efficiency and correspondingly higher emission factors than the larger gensets. The majority of generators currently used in the more rural locations similar to where the MHP projects are planned to be located are in the first category < 15 kW with a few institutions like banks, hospitals, schools, and NGOs using gensets in the second category >=15 <35 kW. If we take a simple average between these first two categories of gensets we arrive at an emission coefficient of around 2.04 kg CO_2eq/ kWh.

Category	**Measured fuel efficiency (kWh/litre)**	**Litres of diesel/ kWh**	**kg of diesel/kWh**	**kg CO_2eq/ kWh**
< 15 kW	1.19	0.84	0.70	2.25
>=15 <35 kW	1.47	0.68	0.57	1.82
>=35 <135 kW	1.73	0.58	0.48	1.55
>=135 <200 kW	2.78	0.36	0.30	0.96
>= 200 kW	3.03	0.33	0.28	0.89
Weighted average of gensets <35 kW	**1.47**	**0.68**	**0.57**	**1.83**

The weighted average can also be taken of the 23+13 = 36 gensets in these first two categories. This can be done by taking an average after multiplying the computed emission coefficient of each generator by its size to account for the amount of energy the generator can produce. This would be a more conservative approach as it would provide higher weightage to the larger generators. The emission coefficient computed in this way comes to 1.83 kg CO_2eq/ kWh. This is shown in the last row of the table above. This is the emission coefficient which has been used to compute the baseline emissions for the proposed CDM project activity.

Annex 4

Monitoring Information

Monitoring will consist of filling out the log book each day with the reading from the energy (kWh) meters, situated in the power house, for each of the 103 power plants. The readings of the completed month will be submitted by the power house operator to the AKRSP regional office within the first week of the new month. The AKRSP regional office in the three areas of Baltistan, Chitral, and Gilgit will collect the data sheets, and enter them electronically for the projects in their respective regions. This information will be sent by email to the project monitoring officer in Islamabad, who will add up the energy production each month for all power plants included in the CDM project. The monitoring officer will compute annual energy production for the aggregate of all the power plants. All the data will be stored in an electronic data log at the AKRSP Islamabad office. The data will be regularly updated and will be available for verification by the DOE.

Quality Assurance

AKRSP will provide technical support in the feasibility study, project design, equipment procurement, construction supervision of the micro- and mini-hydropower projects, and in the training of the operators and electricity users. AKRSP charges 12% of the cost of the project for these services. This means that while the project is implemented by the community, there is strong quality control by AKRSP on all technical aspects of the project. This has proven to be a tried and tested mechanism for building and operating over 200 high quality MHP plants in the NAC region. For power projects included in this CDM project activity, commissioning will also include power output verification by AKRSP to make sure that the equipment can produce the full power it was designed for.

Internal Verification

Monthly kWh readings at each plant will be monitored both by the engineering teams at each of the regional offices responsible for supporting the energy projects and by the monitoring officer at the Islamabad office of AKRSP. In addition to regular visits made by the regional team to sites, special trips will be made to specific sites for investigation in case of unusually high or low kWh readings. The energy meters will be certified by a reputable agency every two years or as needed if readings are found to be unusual at any site. In addition to kWh readings, the daily log books at the power house will also record the voltage, current, frequency, every hour and any incidences of breakdown during the course of the day. This information will be available at the power house for the AKRSP engineers to check when they visit the site.