CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

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 project activity

A.1 Title of the project activity:

Title –Substitution of Hydro-electric power in the National Grid

Version – 01

Date – 25th February 2008

A.2. Description of the project activity:

The project activity of replacing thermal dominated grid electricity by transmitting hydro-electric power through a dedicated transmission line is being developed as a turnkey project on behalf of the Jammu and Kashmir State Power Development Corporation (JKSPDC), a corporation of the Government of Jammu and Kashmir. The project activity entails transmission of around 450 MW of hydro power into northern regional grid and thereby replacing carbon intensive grid power. The job of construction and laying of 400 kV transmission line for the evacuation of power is entrusted to KEC International. The power generation scheme is based on run-of the river type hydro power plant located on the Chenab river in Doda district of Jammu and Kashmir (J&K), the northernmost state of India.

Jammu and Kashmir's main rivers namely the Chenab, the Ravi, the Jhelum and the Indus have the potential to generate more than 20,000 MW of power[1]. However, not even 10% of this renewable source of energy of Chenab has been exploited till date. Out of 1869 MW of hydro power harnessed in the state only 309 MW have so far been developed in the state sector and 1560 MW have been developed under central sector. The per capita consumption Jammu & Kashmir is 711.01 kWh per annum which is significantly lower than the neighbouring states and is far below the global references like USA (13338 kWh), Australia (11126), Japan (8076), France (7689), Germany (7030), United Kingdom (6206), Russia (5642) and Italy (5644). However, due to extreme cold climate there is more need for heating application in winter period.

As per Central Electricity Authority, the power requirements of the state have been worked out to be 1923 MW as the peak demand, while as the total power availability to the state from various sources is only 1465 MW in 2006-07. The demand supply gap thus works out to be around 460 MW and is envisaged to be ever increasing.

The project activity will therefore result in addition of renewable (hydro) power to a carbon intensive Northern regional grid. With the implementation of the project activity, electrical energy of around 27,44,280 MWh per annum will be replaced in the Northern Regional Grid which, in turn, will result in

[1] according to the estimates of the state government

Greenhouse Gas (GHG) emission reductions of about 22,22,866 tCO_2 (tonnes of CO_2) per annum as per the carbon intensity of the Northern Regional Grid. This reduction of GHG emissions would not have happened in absence of the project activity since the same would have resulted from continued generation of electrical energy in the Northern Regional Grid.

Contribution towards Sustainable Development

The power sector in Jammu & Kashmir is one of the most underdeveloped sectors in the state. It has not only been unable to keep pace with the growing demand but its supply to ultimate consumers has also been poor. In addition to large unexplored potential, inadequate transmission and distribution network, huge transmission and distribution (T&D) losses, low power tariff, power thefts as well as long gestation period of the power projects have contributed to the dismal situation of the sector.

The project activity, in such an alarming scenario, is thus a welcome step in the state's contribution to the sustainable development of the host country- India. The sustainability aspects of the project activity are summarized below under the following pillars of sustainable development:

Social well-being: The mountainous state of J&K is endowed with vast hydro power potential, majority of which, at present, is not harnessed. Successful implementation of the project activity will pave the way for a number of similar hydro power projects and hence enable utilization of the huge potential of renewable energy sources. This will not only provide energy security but also boost industrial and agricultural growth in the region. The project proponent is also developing approach road, communication facilities, housing and other infrastructural facilities for facilitation of the project activity leading to an overall infrastructural development of the remote area. The additional revenue from power sales which otherwise been wasted in the natural flow of rivers can be diverted for development of the state's infrastructural and development activity triggering the overall income generation and leveraging the standard of life of common people in the state of J&K.

Economical well-being: The state of J&K is economically backward due to power crisis under which it has been reeling for the last few decades and therefore lacks an industrial base. The project activity will result not only in the development of a potential industrial belt in the region but also in generation of employment opportunities for construction and maintenance jobs among the people of the state. Employment of local people will directly benefit the economic structure of the remote area in the district of Doda and different parts of J&K covered under the project activity. Proper knowledge transfer activities and trainings conducted on implementation of the project activity will enhance the skills of the local people of the state.

Currently, a total capacity of about 1465 MW is available to the state from various sources including power from states' own generating facilities, allocation from central power utilities and joint ventures,

which is at least 460 MW short of the total requirement of the state. The generation level is further diminished during winters because of the low water level in the rivers. The state has to hence rely heavily on purchases from other states' plants to meet its demand. Despite large purchases from the central plants and other states, it is unable to meet its peak demand and has to curtail power supply for long hours in summers as well as winters. The state's low generation as well as lack of purchasing power is often cited as the reasons for curtailment. The project activity will help the state substantially in overcoming this limitation. To meet its essential requirements the state of J&K has been purchasing power from outside state sources and the average purchase has been about INR 1500 Crore per year in the last five years, which comes to be about 30 % of the state budget. In other words, one third of the budget goes into purchase of power which otherwise would have facilitated sustainable development of the infrastructure sector, manufacturing sector and other allied sectors which has badly been affected due to turmoil in the state of J&K and justifying their complete rejuvenation

Environmental well-being: Owing to global warming, most of the small glaciers in Indian administered Kashmir have totally melted down while the big glaciers in most of the areas have decreased in size. According to a report released by international humanitarian group, Actionaid International, many of the areas in Kashmir have seen a complete disappearance of small glaciers. The global warming has affected the Kashmir glaciers too and due to the increase in the temperature, the small glaciers in many parts of Kashmir have disappeared while the bigger ones have been reduced in size. Even the small glaciers in Srinagar and upper reaches have disappeared. In other areas like central Kashmir, the height (averaging 15-20ft) of the small glaciers has reduced to over one-fourth of the original height, Barely 20 years ago, the snow line in Kashmir valley's east was just above areas like Pahalgam and Sonmarg (3200m). Currently the line has receded to Shiashnag area which is at an altitude of 5000m only. Same is true of the Pirpanjal mountain range in the west where the snow line was above Kongwatan and Zaznar (3000-3500m). Most of the glaciers of the Great Himalayan range from Harmuk to Drungdrung including Thajiwas, Kolahoi, Machoie, Kangrez, Shafat have receded far back (4000-5000m) during the last 50 years. The study has shown an overall 21 per cent reduction in the glacier surface area.

According to the SAC, the process of deglaciation has also led to the fragmentation of the larger glaciers. The mean area of glacial extent has also declined from 1 sq km to 0.32 sq km during 1962-2004. From a study of winter run-off - which is only on account of snowmelt - the scientists found that accumulation during winter has declined between the late 1990s and the turn of the century. Also, the snow accumulation pattern has changed significantly. Likewise, they found that the winter run-off increased by as much as 75

per cent between 1966 and 1995. If additional areas start melting in the middle of winter, less snow will be available for summertime stream run-off that feeds the rivers. This is already happening in Kashmir. While winter runoff has clearly increased due to early meltdown of glaciers, faster meltdown has resulted in significant decrease in water availability in streams during summer. The recent spring time floods in Kashmir have largely been as a consequence of fast melt down of snow in the mountains, coupled with the spring rains. A Report on Climate Change and its Impact in Kashmir Integrated Mountain Development (ICIMOD) reveals that the temperature in the Himalayan region has risen by almost 1 degree Celsius (1.8 degrees Fahrenheit) since the 1970's. This shift in climate has caused meltdown of snowfalls and glaciers - at the fastest rate in the world (50 feet/ 15 m per year in northern India) - even in winter, causing icy water to accumulate in lakes hedged by unstable dams of sediment and stone.

Analysis of the data collected from the eight districts of Kashmir in the course of this study show that the water level in almost all the streams and rivers has decreased by about one-third, in some cases even by half, during the last 40 years. It is the water flow in the small streams and tributaries that finally determine the overall water availability in Kashmir's three main rivers, namely Indus, Jhelum and Chenab, which finally flow into Pakistan.

Over the last few years, sudden rise in temperatures (usually 4-50 Celsius above normal) in the months of February, March, April and May has resulted in faster melting of glaciers, thereby flooding most of the streams and rivers in these months.

The state is also witnessing depletion of its forest cover at an alarming rate. The brunt of non-availability of electric power is being borne by the state forest resources, as people in remote areas are heavily dependent on wood based resources for meeting the energy requirements.

The development of hydro potential although has always been the priority with govt of J&K, but no headway worth reference has been achieved due to number of factors including the financial constraints. Despite many bottlenecks and scarcity of financial resources, the state govt has taken up implementation of 450 MW hydroelectric project activity.

As the project activity involves replacement of power generated from fossil fuels with clean power generation from a renewable source, it results in conservation of natural resources such as fossil fuels which otherwise would have been combusted to generate equivalent quantum of power. It also results in reduction of GHG emissions and emissions of other harmful pollutants associated with fossil fuel combustion at the thermal power generation end of the Indian grid. The project activity also does not result

in any ecological imbalance. The Environmental Impact Assessment (EIA) study conducted for the project activity ensures no significant negative impact of the project activity on the baseline environment which prevailed before its implementation. Furthermore Environmental Management Plan, prepared for the project activity, will ensure minimisation of the negative impacts, if any.

Technological well-being: The project activity involves state of the art technology for construction, maintenance and operational activities. Construction of high voltage transmission line in inaccessible and high altitude mountain terrain, approach roads, dam across the river, power plant and other units of the hydro power plant in the mountainous region is a good example of the use of highly advanced technology for construction in adverse geological conditions. The project activity will provide exposure to the usage of such advanced technologies and aid in technological development of the region on a sustained basis.

A.3. Project participants:

Name of the 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)
Ministry of Environment and Forests (MoEF), Government of India	1) Jammu and Kashmir State Power Development Corporation (JKSPDC)- Public Entity 2) KEC International – Private Entity	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

India

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

State: Jammu and Kashmir

A.4.1.3. City/Town/Community etc:

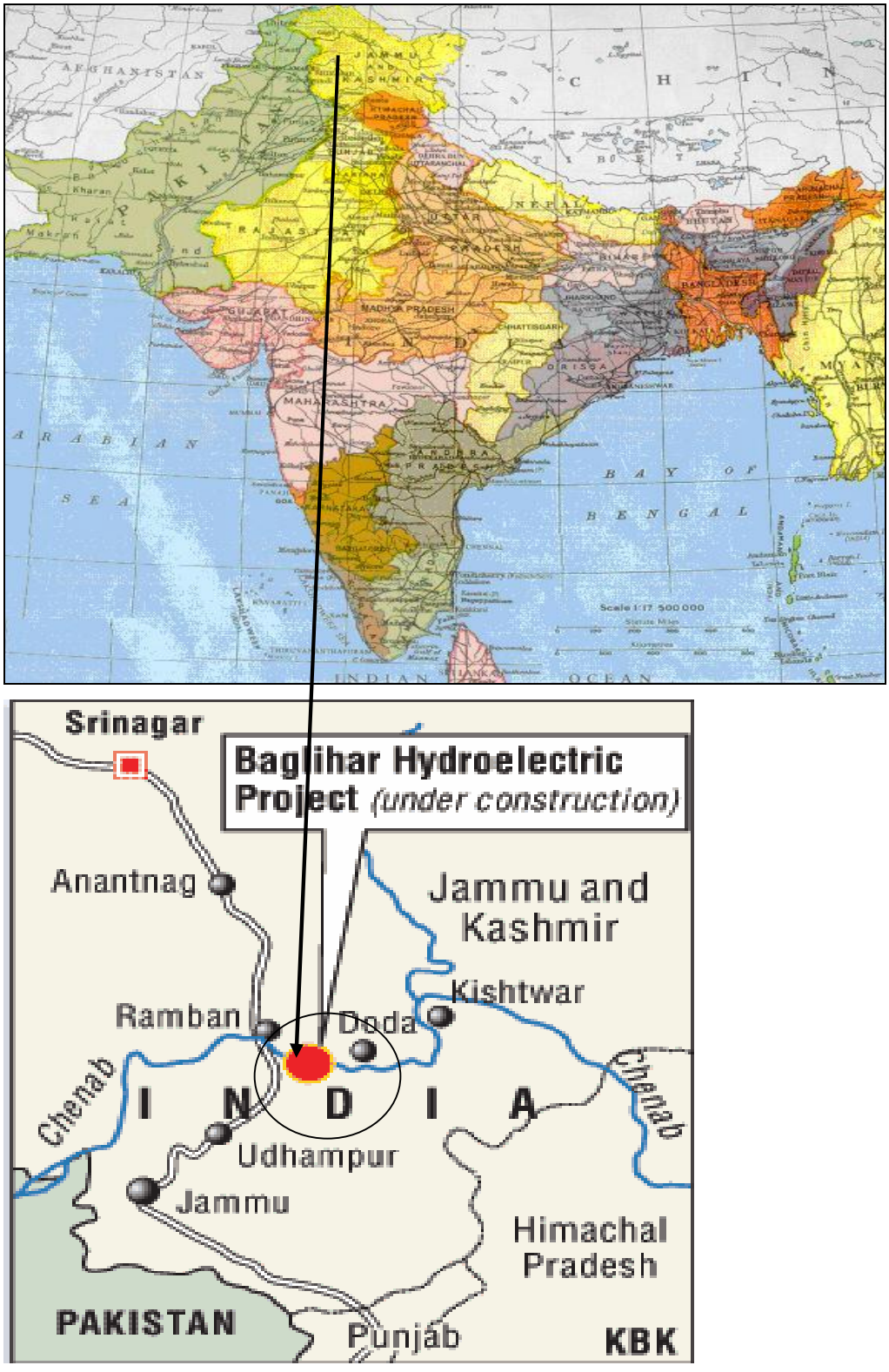
District: Doda

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

The project activity is replacement of thermal dominated grid electricity by transmitting green hydro power produced in the Ramban Tehsil of Doda district in Jammu province, via a dedicated transmission line from Baglihar to Kishenpur, of Jammu and Kashmir state. The project site is located between 75°18'10" E – 75°20'E and 33°09'30"N – 33°11'N. The nearest railhead is at Udhampur, about 85 km form the project site.

The project is also close to Batote on Jammu-Srinagar National Highway-1A on Nasri Bypass Road. Baglihar is 150 km away from Jammu on this road which is an all weather road.

The nearest airports are Jammu and Srinagar and both are connected with New Delhi.


Srinagar
Baglihar Hydroelectric Project (under construction)
Anantnag
Jammu and Kashmir
Kishtwar
Ramban
Doda
Chenab
I N D I A
Chenab
Udhampur
Jammu
Himachal Pradesh
PAKISTAN
Punjab
KBK

A.4.2. Category(ies) of project activity:

The project activity may principally be categorized in 'Category 1- Energy Industries (Renewable/Non-Renewable sources)' as per the scope of the project activities enlisted in the 'List of sectoral scopes and approved baseline and monitoring methodologies' on the UNFCCC website for accreditation of Designated Operational Entities[2].

A.4.3. Technology to be employed by the project activity:

The facilitation of the project activity can be envisaged in two distinct steps as mentioned below:

Step-I: Transmission of power generated

The power generated from the project activity will be transmitted to the Kishenpur substation and, as per the current policy of the J&K government, 50% of the power is to be consumed within the state of J&K while the remaining 50% will be sold through Power Trading Corporation (PTC) to the buyers outside the state through the Northern Regional Grid. The electrical energy generated at the hydro power plant is transmitted via a dedicated 400 kV double circuit transmission line through Gas Insulated Switchgear (GIS) comprising six buses (3 incoming, 2 transmission line bays and one bus coupler bay). The 67.936 km long transmission line from Baglihar to Kishenpur will comprise, besides other features, 215 towers including 10 special type of tower with body extensions and 3 additional towers of other type.

Step-II: Generation of hydro power

Generation of hydro power, under the project activity, is facilitated by construction of a solid straight concrete gravity dam of 143 m height (from deepest foundation level) and 317 m length at the top. The dam construction is enabled by erection of two horse-shoe shaped (with flat invert) Diversion Tunnels. The reservoir has a gross storage capacity of 475 million cum (upto FRL). The river water is diverted to the Head Race Tunnel at the intake. The water from the Head Race Tunnel passes into the three nos. underground circular steel-lined Pressure shafts with usual arrangement of hydro power plants like surge shaft. The project activity utilises the 130 m gross head to generate power in an underground Power House which houses three turbo-generator sets (Francis vertical axis type turbines) of 150 MW each and other necessary machines/ equipment to utilise the available energy in the river water stream for generation of electrical energy.

[2] http://cdm.unfccc.int/DOE/scopes.html

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_2 e
April 2008- Mar 2009	2222866
April 2009- Mar 2010	2222866
April 2010- Mar 2011	2222866
April 2011- Mar 2012	2222866
April 2012- Mar 2013	2222866
April 2013- Mar 2014	2222866
April 2014- Mar 2015	2222866
April 2015- Mar 2016	2222866
April 2016- Mar 2017	2222866
April 2017- Mar 2018	2222866
Total estimated reductions (tones of CO_2 e)	22228660
Total number of crediting years	10
Annual average over the crediting period of estimated reductions ((tonnes of CO_2 e)	2222866

A.4.5. Public funding of the project activity:

No public funding from any Annex – I country is available to the 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 project activity:

Title: Consolidated baseline and monitoring methodology for grid-connected electricity generation from renewable resources

Reference: Approved consolidated methodology ACM0002/Version 07, Sectoral Scope 1, EB 36.[3]

The methodology also refers to the "Tool for demonstration and assessment of additionality, Version 04" for establishing additionality for the project activity and the "Tool to calculate the emission factor for an electricity system, Version 01 (EB 35 report, Annex 12)" that provides the guidance for computation of electricity emission factor of the relevant grid to which the project power plant is connected.

Approach: Existing actual or historical emissions, as applicable

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

As per the applicability criteria of the approved consolidated baseline methodology,

"This methodology is applicable to grid connected renewable power generation project activities that involve electricity capacity additions.

The methodology is applicable under the following conditions:

The project activity is the installation or modification/retrofit of a power plant/unit of one of the following types: hydro power plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit."

- *In case of hydro power plants:*
  - *The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.*

The project activity is a new run-off the river hydro electric power project with a capacity of 450 MW (450 x 10^6 W) and hence involves electricity capacity addition of renewable energy resource to the grid. Considering the aspects of (i) connectivity of the project power plant to the state grid and (ii) the layered dispatch system of the host country India whereby the state grid is further connected to the Northern

[3] http://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_323M30IDF1IH6AG3GRCJ4PKR9CKM7P

Regional Grid of India (as discussed in Section B.3), the latter has been chosen as the grid wherein the displacement of fossil fuel would occur due to capacity addition through the project activity. The reservoir area for the project activity at full reservoir level is approximately 23 x 10^4 m^2, and hence the power density of the project activity is approximately 1976 W/m^2 (> 4 W/m^2). Hence the methodology is applicable to the project activity. For details, please refer to Section B.6 below.

"The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available."

The project activity entails generation of hydro power in a power plant connected to the Northern Regional Grid of India. The geographic and system boundaries for the above grid can be identified clearly and information on the characteristics of the grid is also available. Therefore the project activity satisfies the above applicability condition of the methodology.

"This methodology is not applicable to the following:

- *Project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site*
- *Hydro power plants that result in new reservoirs or in the increase in existing reservoirs where the power density of the power plant is less than 4 W/m^2."*

The project activity is an entirely new initiative (i.e. does not involve switching from fossil fuels in an already existing practice) and will displace fossil fuel based electricity that would otherwise be provided by the operation and expansion of the Northern Regional Grid. Further, as explained earlier, the reservoir resulting from the new hydro power plant has a power density greater than 4 W/ m^2.

Thus the project activity meets the applicability criteria laid down by ACM0002, Version 07. Hence the choice of the aforesaid methodology is justified for the project activity.

B.3. Description of the sources and gases included in the project boundary

According to the Approved Consolidated Methodology ACM0002, Version 07,

*1) "Project participants shall account only the following **emission sources** for the project activity:*

- *For new hydroelectric project with reservoirs, the project boundary includes the physical site of the plant as well as the reservoir area.*

For the baseline determination, project participants shall only account CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity; and

*2) The **spatial** extent of the project boundary includes the project site and all power plants connected physically to the electricity system that the project power plant is connected to".*

- Hence for the project activity under consideration the project boundary will include the following units of the hydroelectric project:

- Dam site
- Diversion Tunnel
- Head Race Tunnel
- Surge Shaft
- Pressure Shafts
- Underground Power House
- Tail Race Tunnel
- Power evacuation and transmission system

For the purpose of determining the build margin (BM) and operating margin (OM) emission factor, as described in Annex 3: Baseline Information, a (regional) **project electricity system** is defined by the spatial extent of the power plants that can be dispatched without significant transmission constraints.

The project activity boundary thus encompasses the physical and geographical site of the project activity at the project location specified in Section A.4.1.4, which would include all the components listed above, and other equipment / installations relevant to the project and present within the project site. The project activity will evacuate power to the Kishenpur substation, for catering to the power requirement of the state as well as buyers outside the state, all of which in turn are connected to the Northern Regional Grid of India. Therefore, those power plants contributing to the Northern Regional Grid are taken in the project electricity system for calculation of baseline emissions.

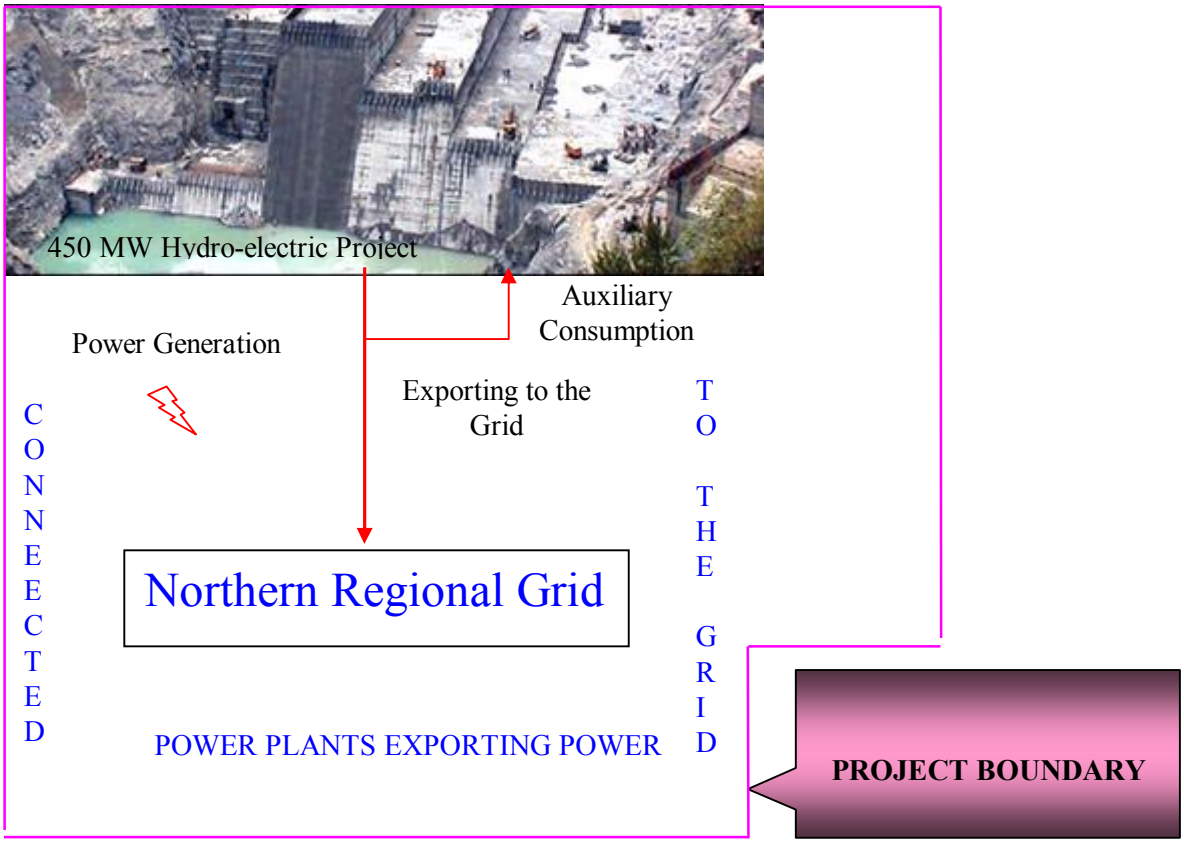
Similarly, a **connected electricity system**, e.g. national or international, is defined as a (regional) electricity system that is connected by transmission lines to the project electricity system and in which power plants can be dispatched without significant transmission constraints.

The Indian electricity system is divided into five regional grids, viz. Northern, Eastern, Western, Southern, and North-Eastern. Each grid covers several states. Each state in a regional grid meets their demand with their own generation facilities and also with allocation from power plants owned by the central sector such as NTPC and NHPC etc. Specific quotas are allocated to each state from the central sector power plants.

Power generation and supply within the regional grid is managed by Regional Load Dispatch Centre (RLDC). As the regional grids are interconnected, there is inter-state and inter-regional exchange depending on the demand and generation. A small power exchange also takes place with the neighbouring countries like Bhutan and Nepal. Recently, the Indian regional grids have started to work in synchronous mode, i.e. at same frequency. Hence, power plants can be dispatched within each region and in between the different regions without significant transmission constraints.

For each of the five regions, the main emission factors are calculated in accordance with the relevant CDM methodological tool, namely the "Tool to calculate the emission factor for an electricity system, Version 01 (EB 35 report, Annex 12)". The calculations are based on generation, fuel consumption and fuel quality data obtained from the power stations. Typical standard data were used only for a few stations where information was not available from the station.

The project activity, as mentioned earlier, is located in the state of Jammu and Kashmir and evacuates its power to components comprised under the Northern Regional Grid. Hence, the connected electricity system for the project activity is the Northern Regional Grid of India.



In accordance with the methodology, the following emission sources in the project boundary, as defined above, are considered for the purpose of determination of baseline emissions and project emissions.

Source		Gas	Included?	Justification/ Explanation
Baseline	CO2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity.	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project Activity	For hydro power plants, emissions of CH4 from the reservoir.	CO_2	No	Minor emission source
		CH_4	No	Is considered as a main emission source for hydro power plants with power density between 4 W/ m^2 and 10 W/ m^2. But since the project activity plant has a power density of 1976 W/ m2 (>10 W/ m^2), hence it results in zero project emissions, as per the methodology.
		N_2O	No	Minor emission source

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

The baseline scenario for a project activity is the most likely scenario in absence of the project activity. Hence for the case of the hydroelectric project activity under consideration the baseline scenario will be the most likely scenario in absence of the hydroelectric project activity. The following section identifies the plausible alternatives available to the project proponents which may correspond to the baseline scenario.

Alternative 1 – Implementation of the project activity not undertaken as a CDM project activity:

This alternative involves generation of hydroelectric power by constructing a run-off the river hydroelectric power plant on the Chenab River, catering to the Northern Regional Grid of India. This alternative is in compliance with all applicable legal and regulatory requirements and may be a part of the baseline. However, in absence of CDM revenue it would not have been possible for the project proponents to implement the project activity on account of the number of regulatory, financial, operational and technological barriers faced by the project activity (please refer to *Step 3: Barrier Analysis* in Section B.5. of this document for details on the barriers faced). Therefore in absence of the project activity this alternative would not have been viable and hence it cannot be a part of the baseline scenario.

Alternative 2 – Continuation of pre-project scenario

Under this alternative there would be no power generation by utilizing the hydroelectric potential of the Chenab River. The power that will be exported to the grid by the project activity post implementation would have been generated in the power plants (mostly fossil fuel based thermal power plants) connected to the Northern grid leading to higher GHG emissions. This alternative is also in compliance with all applicable legal and regulatory requirements. Moreover this alternative faces no barriers to its implementation and hence it may be part of the baseline scenario.

Thus from the above analysis, only alternative 2 *i.e. Continuation of pre-project scenario* is the most plausible alternative in absence of the project activity. Hence this alternative is the baseline scenario for the project activity. This choice of the baseline scenario also complies with the guidance provided in the approved consolidated baseline methodology, which states that:

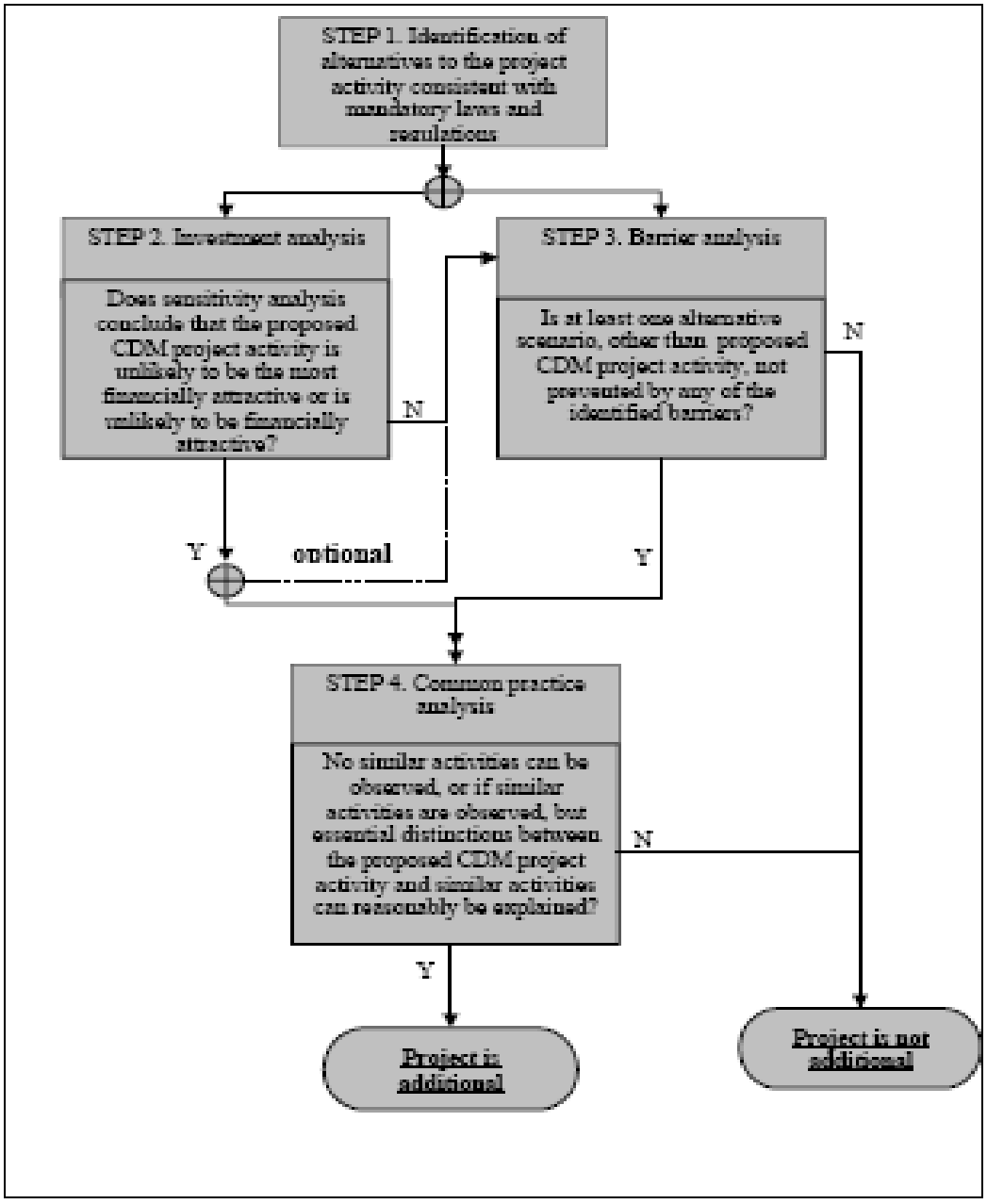
"Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources."

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 CDM project activity (assessment and demonstration of additionality): >>

As per the decision 17/CP.7 Para 43, a CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of the registered CDM project activity.

As per the guidance of the selected methodology ACM0002, the project proponents have followed the 'Tool for the demonstration and assessment of additionality' (Version 04, EB 36) for establishing additionality of the project activity.

The flowchart presented in below provides a step-by-step approach to establishing additionality of the project activity.



The project proponent wishes to demonstrate additionality of the project activity as hereunder.

Step 1: Identification of alternatives to the project activity consistent with mandatory laws and regulations

Define realistic and credible alternatives to the project activity that can (part of) the baseline scenario through the following sub-steps:

Sub-step 1a: Define alternatives to the project activity:

In sub-step 1a, the project proponent is required to identify realistic and credible alternative(s) that were available to them or similar project developers that provide output or services comparable with the project activity under consideration.

The project proponents have identified the different potential alternative(s) to the project activity. Please refer to section B.4 for details regarding identification of the alternatives to the project activity. The following alternatives to the project activity have been identified.

Alternative 1 – Implementation of the project activity not undertaken as a CDM project activity:

Alternative 2 – Continuation of pre-project scenario *i.e.* the current situation (no project activity or other alternatives undertaken)

Outcome of Step 1a: Identified realistic and credible alternative scenario to the project activity

From amongst the identified alternatives to the project activity given above, it is concluded that the only realistic and credible alternative to the project activity is Alternative 2 – Continuation of pre-project scenario (no project activity undertaken). Thus only this alternative may be (a part of) the baseline scenario and hence a realistic and credible alternative to the project activity.

Sub-step 1b: Consistency with mandatory laws and regulations:

Taking into account the mandatory regulations in the host country of India and the EB decisions on national and/or sectoral policies and regulations it is concluded that among the identified alternatives to the project activity, Alternatives 1 and 2 are in compliance to all the legal and mandatory regulations of the country. The project activity contributes towards conserving fossil fuels and reducing the deficit of power supply in the state grid. The project is additional and not a 'Business As Usual' scenario because:

• The project faces financial and technical barriers (demonstrated below).

• The revenue from CER sales is vital for the sustainability of the project.

• There are only a few number of similar project activities in the renewable energy sector, implemented previously or currently underway in the state of J&K with respect to the aspect of size and magnitude of the project, usage of higher end technology and the level of investment involved, which makes the project activity a clear trendsetter.

Outcome of Step 1b:

Thus as per Step 1 of the Tool for the demonstration and assessment of additionality (version 04), Alternative 2 *i.e.* 'Continuation of the pre-project scenario' is the identified alternative to the project activity.

As per the above mentioned tool, the project proponent is required to conduct

Step 2: Investment Analysis and / or

Step 3: Barrier Analysis

The project proponent wishes to establish the project activity additionality by conducting Step 3 (Barrier Analysis).

Step 3: Barrier analysis

In this section, the project proponent is required to determine whether the project activity faces barriers that:

- Prevent the implementation of this type of project activity; and
- Do not prevent the implementation of at least one of the alternatives.

All the realistic and credible alternatives available to the project proponent were evaluated with respect to the barriers that would be faced by the project activity. These barriers have been dealt with in Sub-Step 3a and the evaluation of the alternatives has been done in Sub-Step 3b.

Sub-step 3a: Identify barriers that would prevent the implementation of the proposed CDM project activity:

The project proponent wishes to establish that there are barriers that would prevent the implementation of the project activity from being carried out if the project activity was not registered as a CDM activity. The barriers include:

Regulatory Barrier

Although the host country government had decided to commence building the project activity quite a long time back, the same could not progress due to objections raised by the neighbouring government of Pakistan citing violation of provisions of the 1960 Indus Waters Treaty. The latter claimed that the dam would impede water flow enough to disrupt agriculture, power generation and general water supply for its people. Several negotiations were held but resulted in no progress over the dispute over the dam. The concerns and protests of Pakistan against the implementation of the project activity culminated with Pakistan's invocation of Clause IX of the Indus Water Treaty which allowed for a neutral arbitrator to be appointed by the World Bank to resolve the conflict. Finally, when the project went ahead after the determination of the neutral arbitrator in February, 2007, it had suffered huge cost overruns due to overrun in time and a number of other barriers faced in the course of this period. The same have been discussed below.

Financial Barrier

(a) Project financials: As mentioned earlier, not only one of the most prestigious but one of the most long-drawn hydro-electric projects coming up in Jammu and Kashmir, the project activity's problems run beyond the conflict with Pakistan which though have been sorted out. The 450 MW project (associated with Stage I) conceived long back was contracted out in anticipation of financial closure to two contractors – Jaiprakash Industries Limited , now called Jaiprakash Associates Limited, and Siemens Consortium for Civil and Electro Mechanical works respectively. As per the initial deadline for project completion, the project should have been operational a long time back. More than three years already passed by the initial deadline; the project has overrun its estimated cost by several hundred millions of rupees. It is still nowhere near completion. The Construction companies and the government both had announced another deadline of December 2007, but this deadline too is not realistic.

The project was appraised by IDBI led consortium at a cost of INR 3810 crores, but the financial closure could not be achieved upto the year 2003. Owing to a host of problems, as appraised by Jammu and Kashmir's then Minister for Power, Mr. Nawang Rigzin Jora, like non achievement of financial closure, delay in land acquisition, difficult geological strata and labour problems, the project could not be completed by the due date. Meanwhile the expenditure on the project in anticipation of the financial closure was met from Bonds of INR 1054 crores raised from financial market and annual plan outlays of the state. Another consortium, led by PFC, was approached in the year 2003 for the financial closure of the project and PFC appraised the project at a revised cost of INR 4000 crores and financial closure was achieved in the year 2005.

Till December 2006, loan amount of INR 1131 crores has been lifted and an expenditure of INR 3274 crores excluding financing costs of Bonds of INR 508 crore has occurred. According to the present day estimate, the project costs have gone up to about INR 5000 crore.

The financial crisis has culminated in the power ministry, in the face of stiff opposition, trying to convince the state to forego some free power in the initial years in order to make the project viable.

(b) Funds crisis: Paucity of funds is a major reason for slow addition to the generating capacity of the state. There has been constant delay in completion of the projects, where targets set for one Plan have spilled over to the next. For this reason the state experienced no or negligible addition to the generating capacity during 8th and 9th Plan periods. Law-and-order problems have also contributed to the delays.

Power sector outlay & share of power sector outlay in total outlay (Rs. in crore):

	Power Sector	All Sectors	%
Eighth Plan	1175.2	4000.00	29.38
Ninth Plan	2387.00	9500.00	25.13

Of the total Plan outlay of Rs. 4000 crore during the 8th Plan, the power sector's share was 29.38 per cent. The allocation was comparable to the other states. During the 9th Plan, however, the allocation increased in absolute terms, share of the sector out of the total outlay decreased to 25.13 per cent. This plan was laid out in spite of the fact that the state needs large investments to develop its hydel potential.

Other barriers

(a) Natural disasters: In July-August 2005, heavy and sustained flood discharge in the River Chenab followed by sudden draw down triggered heavy slides on the up stream slopes of diversion tunnel inlet faces which blocked the diversion tunnels causing the river to over flow the dam blocks and eventually leading to scouring of the right bank on down stream of dam side and damaging the trail track. Later, after series of deliberations between Jammu and Kashmir State Power Development Corporation, Foreign Consultants Lahmayer International, Contractor and CWC, the strategies to tackle these damages were decided. Apprehensions around the incident among people at different levels, however, varied from there being sabotage to technical failure to being part of a much larger conspiracy. These problems however not only delayed the project but substantially added to the initially estimated cost.

(b) General site characteristics: The site for the project activity lies in seismic Zone IV, based on the seismic zoning map of India, which implies that it is under high risk of experiencing earthquakes. The same is supported by data on earthquake occurrences in and around the project site, which are evident of seismic activities on a relatively higher scale and frequency, compared to the area in the Indo-Gangetic plains and shield regions of India. Added to this, there are three big slides at Assar, Malhori and Napli which are falling in the reservoir area. The area is also known to be highly prone to erosion. A major circumstantial evidence is obtained from the fate of the existing 390 MW Dul Hasti project, commissioned on the upstream side of the project activity power plant, which suffered huge cost and time overrun mainly because of geological failures. The topography of the state (Jammu being the only rail link) together with remote & far-flung villages across the landscape compounds the energy crises of the state. Transmission of power to these areas is not only un-economical but difficult as well. Worse still is the population density in some villages, where households are interspersed and habitations dispersed. In such geographical locations, electrification by laying long Transmission & Distribution lines becomes practically impossible.

Furthermore, the Chenab brings down with it a huge quantity of sediment that may affect the smooth operation of the project. This calls for substantial investments for mitigation of the siltation problem failing which will result in reduction in the life of the reservoir as well as the daily peaking facility of the project.

All the above factors have called for procurement and utilisation of state of the art technology, abiding by the guidelines provided in the International Commission on Large Dams (ICOLD), which again has led to the incurring of huge expenses.

Barriers due to prevailing practice

(a) Although the state of J&K is endowed with huge hydro power potential but the development in this sector has not been commensurate because of shortage of financial resources and the Indus Waters Treaty signed between India and Pakistan. Since only run off the river projects are conceived due to the provisions of the treaty, the scope of generating electricity from hydro power is reduced. This fact can be gauged by realizing that against a power potential of 20,000 MW, the State has been able to develop only 309 MW by itself and 1569 MW with aid from the central sector till date. Among the hydel power projects nearest in scale to the project activity power plant is the 690 MW Salal hydro-electric project on the river Chenab which too faced serious objections from Pakistan on the grounds of the Indus Water Treaty and its implementation was also affected. On the other hand, the two projects namely Kishenganga and Tulbul already remain suspended due to Pakistan's objections. As a matter of fact, since already quite a number of projects, though small scale, being planned or being built on the Indian side of the region, are facing similar objections from Pakistan, plans for going ahead with the project activity in such hostile circumstances include an unprecedented risk factor that will ultimately have its effect on the financials involved.

(b) A major problem in hydel power generation in the region is the low discharge of the rivers during winters. Since all hydel projects in the state are run-of-the-river type with no storage, the generation reduces to 25-30 per cent of the installed capacity. This leads to high cost hydel projects generating much below their installed capacity. For instance, run-of-the-river 480 MW Uri Hydel Project built at a cost of more than 800 million US dollars has been producing maximum of only 200 MW in winter. As such the J&K State is unable to meet its demand of about 1526 MW, even after it has been importing 230 MW of power from the northern grid[4].

Problems in transmission: a substantial increase in the estimated cost for transmission line is apprehended as necessary measures are required to be adopted due to unforeseen circumstances that may arise as a

[4] Ibid. Rashid Ahmad, "Incessant Power Cut takes Valley into Dark Age", Pioneer, 21 January 2000.

result of the region being prone to landslide, flash floods, heavy rains and slow, and provision for which is not possible to be kept in precise entirety in the initial job orders.

The project proponent however looks up to CDM revenue in order to mitigate the risks associated, as described above, with the project activity.

Sub-step 3b: Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

Alternative 2, as identified in Step 1 above, consists of continuation of pre-project scenario. This alternative involves generation of approximately 450 MW of power in the Northern Regional Grid which is dominated by fossil fuel based thermal power plants. The barriers to the implementation of the project activity discussed above can be broadly categorised as below:

- Regulatory barrier
- Financial Barrier
- Other Barrier
- Barrier due to prevailing practice

So far as financial barrier is concerned, there is no high initial cost or high operational and maintenance cost required for Alternative 2. Alternative 2 can as a matter of fact be considered as a no investment option for the project proponent to adopt in absence of the project activity.

The institutional barriers are mainly related to setting up a hydro-power (storage based) plant for supply to the grid. However, Alternative 2 would not have faced these barriers.

Similarly the barriers mentioned under *Other Barriers* or *Barrier due prevailing practice* would also have not been faced by this alternative. Hence it is ascertained that the barriers are particular only to the hydro power generation project activity and would not have been faced by the Alternative 2.

Step 4. Common practice analysis

The project proponent is further required to conduct the common practice analysis as a credibility check to complement the Barrier Analysis (Step 3). The project proponent is required to identify and discuss the existing common practice through the following sub-steps:

Sub-step 4a: Analyze other activities similar to the proposed project activity

As per the revised additionality tool (Version 3) being used to demonstrate additionality, *"projects are considered similar if they are in the same country/region and/or rely on a broadly similar technology, are of similar scale, and take place in a comparable environment with respect to regulatory framework, investment climate, access to technology, access to financing etc."*

Though hydel power has a large potential in the state of Jammu and Kashmir, as mentioned earlier, but most of the unexploited potential is located in difficult/ inaccessible areas. In such areas, small and medium hydro projects can play a comparatively better role in meeting the local power requirements by tapping water streams and rivers of small discharge. Moreover, these would not face the impediments that large scale projects like the project activity have faced or are still having to deal with. Accordingly, although the hydro power potential of the region has been tapped to a very insignificant extent due to various constraints, the state power authorities have also shown greater interest in tapping the same through the development of small scale hydro projects. The same is evident from the list of installed projects of the state, as given below.

Existing Hydel Power Projects in J&K

S T A T E S E C T O R			
S.No.	**Name of Power House**	**Configuration**	**Installed Capacity(MW)**
A	**Jhelum River Basin**		
1.	**Lower Jhelum**	**3*35**	**105.00**
2.	**Upper Sindh-I**	**2*11.3**	**22.60**
3.	**Ganderbal**	**2*3+2*4.5**	**15.00**
4.	**Upper Sindh-II**	**3*35**	**105.00**
5.	**Karnah**	**2*1**	**2.00**
6	**Pahalgam**	**2*1.5**	**3.00**
	Sub – Total		**252.60**
B	**Chenab River Basin**		
1.	**Chenani-I**	**5*4.66**	**23.30**
2.	**Chenani-II**	**2*1**	**2.00**
3.	**Chenani-III**	**3*2.5**	**7.50**
4.	**Baderwah**	**2*0.5**	**1.00**
	Sub – Total		**33.80**
C	**Ravi River Basin**		
1.	**Sewa –III**	**3*3**	**9.00**
	Sub – Total		**9.00**
D	**Indus River Basin**		
1.	**Iqbal**	**3*1.25**	**3.75**
2.	**Hunder**	**2*0.20**	**0.40**
3.	**Sumoor**	**2*0.05**	**0.10**
4.	**Bazgoo**	**2*0.15**	**0.30**

5.	Stakna (with PDD)	2*2	4.00
6	Igo-Mercellong	2*1.5	3.00
7.	Marpachoo	3*0.25	0.75
8	Haftal	2*0.5	1.00
	Sub – Total		13.30
	Total Hydel		308.70
C E N T R A L S E C T O R			
1.	Salal (Chenab Basin)	6*115	690.00
2.	Uri – I (Jhelum Basin)	4*120	480.00
3.	Dul-Hasti (Chenab Basin)	3*130	390.00
	Sub – Total		1560.00 (Only 12% free power is available to the State)
	Grand Total		1868.70

Source: Power Development Department, J&K, 2006-07.

From the above information, it is clear that, among the twenty-two hydel power plants that have been installed in the state, only three schemes with a similar investment climate have been implemented previous to the project activity, and therefore the project activity is not a common practice.

Sub-step 4b: Discuss any similar options that are occurring:

Below is given a list of the proposed hydel power plants in the state of J&K:

Upcoming Hydel Projects in J&K

S.No.	Name of Projects	Capacity (MW)
State Sector		
1	Pahalgam (3rd unit)	1.50
2	Matchil	0.35
3	Sanjak	1.26
4	Bhadarwah (3rd unit)	0.50
5	Baglihar Stage II	450
	Total	903.61
Central Sector		
1.	Uri-II	240.00
2.	Sewa-II	120.00

3.	**Nimo Bazgoo**	**45.00**
4	**Chutak**	**44.00**
	Total	**449.00**

Source: Power Development Corporation, J&K, 2006-07.

The above figures are evident of the fact that only one out of the nine proposed hydel power plants, other than the project activity itself, belong to a scale comparable to that of the project activity plant, i.e. have the capacity to harness the potential of hydel energy to generate power on a comparably large scale.
The above data again confirms that there is hope for only a small number of hydro power plants in the state of J&K with a similar investment climate to be implemented in the near future and therefore the project activity is not a common practice, when compared to similar future options.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

The emission reduction resulting from the project activity is estimated as a difference between the baseline emissions and the sum of project emissions and leakage.

Baseline Emissions

As per the methodology,

"For project activities that do not modify or retrofit an existing electricity generation facility, the baseline scenario is the following:
Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources"

As per the selection of the baseline scenario conducted in Section B.4 of this PDD, 'Alternative 2: No project activity; continuation of the current situation' is found to be the baseline for the project activity. Under such a circumstance, electricity equivalent to the net amount generated in the project activity (and hence exported to the grid) would have been generated at power plants connected to the grid. Therefore following the guidance of the methodology, the baseline emission will be computed by quantifying the emissions related to generation of this quantum of electrical energy at the grid, as described below.

Calculation of Baseline Emissions

1. Calculation of the grid emission factor

The baseline emission factor of the grid (EF_y) will be computed as the Combined Margin emission factor ($EF_{Grid, CM, y}$) , *i.e.* weighted average of the Operating Margin emission factor ($EF_{OM, y}$) and the Build Margin emission factor ($EF_{BM, y}$):

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad (1)$$

Where the weights w_{OM} and w_{BM}, by default, are 50% (*i.e.* $w_{OM} = w_{BM} = 0.5$). For calculation of $EF_{OM, y}$ and $EF_{BM, y}$ please refer to Steps I and II under Computation of CO_2 Baseline Emission Factor of Northern Regional Grid (EF_y) in Annex III – Baseline Information of this PDD.

2. Calculation of baseline emissions from electricity export to the grid

The project activity involves generation and transmission of clean hydro power to the Northern Regional Grid of India. The baseline emissions (BE_y) and the corresponding emission reductions from the project activity are estimated based on the net quantum of electricity (EG_y) to be exported by the project activity and the Combined Margin Baseline Emission Factor (EF_y) of the chosen Northern Regional Grid to which the electricity will be exported.

$$BE_y = EG_y \, . \, EF_{Grid, CM,y} \quad (2)$$

Where

$$EG_y = EG_{GEN,y} - EG_{AUX,y} \quad (3)$$

Here,

$EG_{GEN,y}$ = Total electricity (in MWh) generated by the project activity per annum in the year 'y', and

$EG_{AUX,y}$ = Auxiliary electricity (in MWh) consumption of the power plant equipment in the year 'y'

Calculation of Project Emissions

According to the approved consolidated methodology, the quantification of project emissions will depend on the power density of the hydro power plant, which is given by the following equation:

$$PD = (Cap_{PJ} – Cap_{BL}) / (A_{PJ} – A_{BL}) \quad (4)$$

Where:

PD = Power density of the project activity, in W/m^2.

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m^2).

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m^2). For new reservoirs, this value is zero.

Since the power density of the project activity power generation scheme is approximately 1976 W/ m^2, hence as per the guidance of the selected approved consolidated methodology ACM0002, version 07, there are no project emissions for the project activity.

Calculation of Leakage Emissions

The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction, fuel handling (extraction, processing and transport), and land inundation. According to the methodology the project proponents need not consider these emission sources as leakage in applying this methodology. Hence leakage emissions are nil.

Calculation of Emission Reductions

The project activity reduces carbon dioxide through displacement of grid electricity generation with mainly fossil fuel based power plants by renewable-hydro electricity. The emission reduction ER_y due to the project activity during a given year y is calculated as the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y), as per the formulae given below:

$$ER_y = BE_y – PE_y - L_y \quad (5)$$

Where,

BE_y = baseline emissions (please refer to the section on ‘Baseline Emissions’)

PE_y = project emissions; where, $PE_y = 0$

L_y = emissions due to leakage; where, $L_y = 0$

The total net emission reductions achieved from the project activity is presented in Section B.6.3 & B.6.4 of this PDD.

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

The following parameters, required for the computation of baseline emissions and project emissions (and hence emission reductions resulting from the project activity), are standard parameters which will not be

monitored throughout the crediting period and will remain fixed for the entire crediting period. The same will be available during validation of the project activity.

Fixed parameter for the computation of Baseline Emissions

Data / Parameter:	$EF_{Grid, CM, y}$
Data unit:	tCO_2/MWh
Description:	Combined margin CO_2 emission factor Northern Regional Grid of India
Source of data used:	CO_2 Baseline Database Version 3.0, Dated 15 December 2007 (Combined Margin Emission Factor for Northern Regional Grid) published by Central Electric Authority (CEA), India
Value applied:	0.81
Justification of the choice of data or description of measurement methods and procedures actually applied :	Information available from authorised government agencies – National standard value has been calculated by Central Electricity Authority (CEA) as per guidelines of the "Tool to calculate the emission factor for an electricity system, Version 01 (EB 35 report, Annex 12)"
Any comment:	Calculated as a weighted sum of the Operating Margin and Build Margin emission factors. Please refer to Annex III – Baseline Information for details.

Fixed parameter for the computation of Project Emissions

Data / Parameter:	Cap_{PJ}
Data unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data to be used:	Plant records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	450×10^{6}
Description of measurement methods and procedures to be applied:	The value is determined from the individual installed capacities of the turbo-generators
Any comment:	The data will be archived both electronically and in paper for the entire crediting period and two years after.

B.6.3 Ex-ante calculation of emission reductions:

Ex-ante estimation of Baseline Emissions

The ex-ante computation of baseline emission for the project activity is tabulated below:

Sl. No.	Operating Year	Net electricity generated in the project activity (and hence substituted from the grid) in the year y, EG_y (MWh)	Baseline Emission Factor for grid-connected renewable power generation, EF_y (tCO_2/MWh)	Baseline Emission (tonnes of CO_2 e)
1.	April 2008- Mar 2009	2744280	0.81	2222866
2.	April 2009- Mar 2010	2744280	0.81	2222866
3.	April 2010- Mar 2011	2744280	0.81	2222866
4.	April 2011- Mar 2012	2744280	0.81	2222866
5.	April 2012- Mar 2013	2744280	0.81	2222866
6.	April 2013- Mar 2014	2744280	0.81	2222866
7.	April 2014- Mar 2015	2744280	0.81	2222866
8.	April 2015- Mar 2016	2744280	0.81	2222866
9.	April 2016- Mar 2017	2744280	0.81	2222866
10.	April 2017- Mar 2018	2744280	0.81	2222866
Total		27442800		22228660

Ex-ante estimation of Project Emissions

As described above in Section B.6.1 above, there will be no project emission from the project activity and hence the project proponent will not consider any project emission for ex-ante computation of emission reductions resulting from the project activity.

Therefore,

$PE_y = 0$

Where,

PE_y = Project Emissions in the year y (tCO_2)

Ex-ante estimation of Leakage Emissions

The methodology does not require the project proponent to consider any leakage emissions. Therefore,

$L_y = 0$

Where,

L_y = Leakage Emissions in the year y (tCO_2)

Ex-ante estimation of Emission Reductions

The ex-ante computation of emission reductions resulting from the project activity is tabulated as below:

Sl. No.	Operating Year	Emission Reductions (tonnes of CO_2 e)
1.	April 2008- Mar 2009	2222866
2.	April 2009- Mar 2010	2222866
3.	April 2010- Mar 2011	2222866
4.	April 2011- Mar 2012	2222866
5.	April 2012- Mar 2013	2222866
6.	April 2013- Mar 2014	2222866
7.	April 2014- Mar 2015	2222866
8.	April 2015- Mar 2016	2222866
9.	April 2016- Mar 2017	2222866
10.	April 2017- Mar 2018	2222866
Total		22228660

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

Years	Estimation of project activity Emissions (tonnes of CO2 e)	Estimation of baseline Emissions (tonnes of CO2 e)	Estimation of leakage (tonnes of CO2 e)	Estimation of overall emission reductions in tonnes of CO_2 e
April 2008- Mar 2009	0	2222866	0	2222866
April 2009- Mar 2010	0	2222866	0	2222866
April 2010- Mar 2011	0	2222866	0	2222866
April 2011- Mar 2012	0	2222866	0	2222866
April 2012- Mar 2013	0	2222866	0	2222866
April 2013- Mar 2014	0	2222866	0	2222866
April 2014- Mar 2015	0	2222866	0	2222866
April 2015- Mar 2016	0	2222866	0	2222866
April 2016- Mar 2017	0	2222866	0	2222866
April 2017- Mar 2018	0	2222866	0	2222866
Total (tonnes of CO_2 e)	**0**	**22228660**	**0**	**22228660**

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

B.7.1 Data and parameters monitored:

The approved consolidated monitoring methodology requires the project proponent to monitor the following parameters for the computation of baseline emissions, project emissions and hence emission reductions. The parameters and the monitoring procedures are detailed below:

Parameters to be monitored for the computation of Baseline Emissions

1.0 Parameters related to generation of electrical energy in the project activity

Data / Parameter:	A_{PJ}
Data unit:	m^2
Description:	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full
Source of data to be used:	Plant Log Book
Value of data applied for the purpose of calculating expected emission reductions in section B.5	23×10^4
Description of measurement methods and procedures to be applied:	The surface area at full reservoir level is computed based on standard practice.
QA/QC procedures to be applied:	QA/QC procedures are not planned for this parameter
Any comment:	The data will be archived both electronically and in paper for the entire crediting period and two years after.

Data / Parameter:	PD
Data unit:	W/m^2
Description:	Power density of the project activity
Source of data to be used:	Plant records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1976
Description of measurement methods and procedures to be applied:	The value is determined as per equation (4) in Section B.6.
QA/QC procedures to be applied:	QA/QC procedures are not planned for this parameter
Any comment:	The data will be archived both electronically and in paper for the entire crediting period and two years after.

Data / Parameter:	$EG_{GEN,y}$
Data unit:	MWh/year
Description:	Total electricity generated in the project activity in the year y
Source of data to be used:	Plant Log Book
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2800000
Description of measurement methods and procedures to be applied:	The parameter will be measured continuously (online measurement) with energy meter and the same will be available in the plant's PLC system. The Manager In-charge will be responsible for regular calibration of the energy meter. The data will be archived both electronically and in paper for the entire crediting period and two years after.
QA/QC procedures to be applied:	The calibration certificates of the energy meters will serve to demonstrate the QA/QC procedures
Any comment:	The uncertainty level of the parameter will be low since the same will be monitored with calibrated meters.

Data / Parameter:	$EG_{AUX,y}$
Data unit:	MWh/year
Description:	Auxiliary electricity consumption of the power plant equipment in the year y
Source of data to be used:	Plant Log Book
Value of data applied for the purpose of calculating expected emission reductions in section B.5	55720
Description of measurement methods and procedures to be applied:	The parameter will be metered with calibrated energy meters.
QA/QC procedures to be applied:	The uncertainty level of the parameter will be low since the same will be monitored with calibrated meters.
Any comment:	The data will be archived both electronically and in paper for the entire crediting period and two years after.

Data / Parameter:	EG_y
Data unit:	MWh/year
Description:	Net electricity generated in the project activity (and hence substituted from the grid) in the year y
Source of data to be used:	Plant Log Book
Value of data applied for the purpose of calculating expected emission reductions in section B.5	2744280
Description of measurement methods and procedures to be applied:	The parameter will be measured continuously (online measurement) with energy meter and the same will be available in the plant's PLC system. The Manager In-charge will be responsible for regular calibration of the energy meter. The data will be archived both electronically and in paper for the entire crediting period and two years after. However, for the purpose of ex-ante calculations of emission reductions, the same has been calculated as a difference between the 'total electricity generated in the project activity in the year y' and the 'auxiliary electricity consumption of the project activity power plant equipment in the year y'.
QA/QC procedures to be applied:	Yes
Any comment:	The uncertainty level of the parameter will be low since the same will be calculated with two measured parameters of low uncertainty levels.

B.7.2 Description of the monitoring plan:

As per the requirements of the monitoring methodology included in Approved Consolidated Methodology ACM0002, Version 07, the following parameters will be monitored for the project activity.

- Electricity generation from the project activity
- Data needed to recalculate the operating margin emission factor, if needed, based on the choice of the method to determine the operating margin (OM), consistent with ACM0002. This will be sourced from information authorized by a Governmental agency namely Central Electricity Authority (CEA) of India.
- Data needed to recalculate the build margin emission factor, if needed, consistent with ACM0002. This will be sourced from information authorized by a Governmental agency namely Central Electricity Authority (CEA) of India.
- The surface area of reservoir at full reservoir level.

The project proponent has developed a monitoring plan for proper monitoring of the relevant parameters. Please refer to 'Annex 4 – Monitoring Information' of this PDD for details of the monitoring plan.

Organizational structure for data monitoring: The project proponents have developed a CDM Team which will be responsible for regular monitoring of the emission reduction related data. Please refer to the Monitoring Plan outlined in Table An-4.1 for the roles and responsibilities of each member of the CDM Team.

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

Date of completion of the application of baseline and monitoring methodology: 25th February 2008

Name of responsible person: Jammu and Kashmir State Power Development Corporation (as listed in Annex I of this PDD)

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:

07/01/2005 (date of financial closure)

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

40y 0m.

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

C.2.1. Renewable crediting period

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

Not Applicable.

C.2.1.2. Length of the first crediting period:

Not Applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/04/2008 or the date of registration of the project activity with UNFCCC, whichever is later.

C.2.2.2. Length:

10 y 0 m.

SECTION D. Environmental impacts

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

Article 12 of the Kyoto Protocol requires that a CDM project activity must contribute to the sustainable development of the host country. Assessing the project's positive and negative impacts on the local environment and society is thus a key element for each CDM project. The project activity being developed as a turnkey project on behalf of the Jammu and Kashmir State Power Development Corporation (JKSPDC) may be considered as a positive footstep to ensure maximum global and local benefits in relation to certain environmental and social issues.

The project activity of setting up a 450 MW hydro-power plant has been taken up in view of the abundant water resources, favourable location (in the Himalayas) and topography of the region. Water, being a renewable natural resource, can thus be harnessed for sustainable socio-economic development of the economically backward and energy-starved region of Jammu and Kashmir by meeting its growing energy demand. An 'Environmental Impact Assessment (EIA)' has been conducted for the project activity under consideration which includes the impacts of the project activity on the baseline environment that prevailed before its implementation. The impacts of the project activity and the respective mitigation measures have been discussed below:

Environmental Impact Assessment		
Parameter	Impacts Assessment	Recommendations / Mitigation Measures
Project Location	Resettlement of local populace With the construction of the reservoir, about 16 villages comprising population of 287 families with 2337 number of inhabitants will have to be displaced. The size of individual holdings is only marginal varying from 0.1 to 1.0 hectare. The tribals being migratory in nature are not envisaged to be affected by the project activity.	The local people have been provided with jobs on a preferential basis. The project authorities have planned the establishment of forest depots for distribution of fuel wood, in consultation with the Forest Department, to the workers at a very nominal rate.
	Loss of Land It was observed that about 96.63 hectare of land would be submerged due to the project activity of which 12.82 hectare was forested land, 59.54 was cultivated land and the rest comprised uncultivated lands.	
	Encroachment into forest land and loss of forest products On the high altitude thick forests are found whereas thin and sparse types of forests are found on the lower hill slopes near the reservoir. The steep hilly and rocky slopes coming in the reservoir area are mostly devoid of dense vegetation. Areas at Kulthi, Assar and Baggar have good fields, useful for cattle grazing, which will be partly submerged under the reservoir.	To compensate for the loss of forest, plantations have been planned with the objective of maintaining ecological balance on a sustainable basis. The Forest Department will be responsible for the conservation and management of forest in the project area. The woodlots, as mentioned, are expected to take care of the illegal felling of trees.
	Encroachment into natural reserves and wildlife There will be no conflict regarding such encroachment as neither the project area nor its surroundings have been declared as natural reserves. Since there is no submerging of flat areas and all water conduction systems are underground, it will not impede wildlife movement. As for the affected areas, no rare species of flora and fauna are available in there.	In fact, increase in the area covered with water surface will create additional habitat for aquatic wildlife. Mudflats created by the receding waterlines will provide suitable feeding site for migratory birds and breeding habitats for resident species.
	Loss of historical and cultural monument No such loss will occur due to the implementation of the project activity.	No mitigation measure is therefore required.
Project Design	Change in hydrological regime and impact on fish No adverse effect is envisaged	No mitigatory measure is hence required.

Environmental Impact Assessment		
Parameter	Impacts Assessment	Recommendations / Mitigation Measures
	Risks due to earthquakes The project area falls under seismic zone IV as mentioned earlier.	Necessary design factor has been incorporated in designing the structure.
Project Construction Works	Soil erosion at construction sites Run-off from unprotected excavated area, quarry sites and dam faces can result in soil erosion.	Construction works have been stopped during the monsoon season. In order to limit the impact of rainfall on open excavations, large areas will be either grass-sodded or isolated by other construction for surface water. Dam faces and other open structures will be vegetated with riprap stabilization.
	Pollution by construction spoils The required construction materials have been collected from the nearby sites either by blasting rocks or by open cast mining. The quantity of earthwork to come out was large as majority of the project components are underground.	The hazards due to these activities were mostly of a temporary nature. About 60% of the excavated earth has been reused in the construction activity while the rest has been utilized for levelling low-lying areas which, in turn, have been re-vegetated appropriately.
	Health risk This includes disease hazards due to lack of sanitation (water supply, human waste disposal), vector borne diseases and hazards due to local carriers.	Mitigation measures included installation of proper sanitary health care and human waste disposal facilities, avoidance of water spells and disease control measures during construction.
	Cultural hazards During the construction activities, the project proponent envisaged problems due to differences of customs of imported workers and local residents.	These risks have been reduced by providing adequate facilities in workers' camps and by employment of preferably local labour.
Project Operations	Erosion and Siltation Risks Most of the silt load of the main area was expected to come from run-off.	Reservoir faces will be vegetated and provided with riprap stabilization. The scheme being run-off-the-river, the sediment will be washed off along with the water. Hydraulic flushing, involving the release of water from the reservoir through a low level

Environmental Impact Assessment		
Parameter	Impacts Assessment	Recommendations / Mitigation Measures
		outlet is recommended.
	Change in air quality The project activity includes generation and transmission of hydro power. It replaces power generation with fossil fuels and hence the emissions (like SO_x, NO_x and SPM) from the same. Furthermore it contributes to the mitigation of global warming by reduced emissions of greenhouse gases from fossil fuel based power generation.	The impact of the project activity on the air quality was primarily restricted to the construction phase. During operational phase, no major adverse impacts are envisaged as it improves the local as well as global environmental quality.
	Increased incidences of water borne diseases The main factors responsible for water related diseases are vectors and pathogens. The proliferation of such factors is aided by the stagnant water and vegetation.	As water will be in flow, such chances will be minimum. Moreover field survey showed that typical vector borne diseases are not common in the project area. Additional health facilities coupled with an appropriate monitoring program will take care of such risks, if any, in the future.

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:

The Environmental Impact Assessment (EIA) for the project activity under consideration has been carried out as per the statutory requirement of the host country – India. It deals with all the aspects of the project activity implementation starting from its construction upto the operation. While constructing the dam and developing the project activity, all the mandatory guidelines have been followed. The project activity aims at generation and transmission of approximately 450 MW of hydro power thereby increasing the share of clean renewable power in a primarily fossil fuel dominated Indian grid. Apart from its significant contribution to the sustainable development of the region, the project activity has major contribution towards socio-economic and environmental improvements of the entire state as well. The project site may also be developed as a small scale recreation spot. Therefore the project activity is a positive footstep towards eco-friendly mechanism of power generation and sustainable development of India. However the

project performance will be regularly monitored as a part of the Environmental Monitoring Plan developed and negative impacts, if any, will be addressed immediately by the project proponents.

SECTION E. Stakeholders' comments

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

The project activity is a hydro electricity generation-cum-transmission project being developed by Jaiprakash Associates Ltd (JAL) for civil and hydro-mechanical works and Siemens Consortium for electro-mechanical works and the transmission line by KEC International Ltd on behalf of the Jammu and Kashmir State Power Development Corporation (JKSPDC). It has been undertaken as a positive footstep towards socio-economic development and environmental improvement of the state of J&K as well as of the host country India. With the view of this objective, the project proponents are always committed to identify different stakeholders involved with the implementation and operation of the project activity, getting their feedbacks on the same and addressing their concerns. Therefore the project proponents have developed a robust stakeholder consultation mechanism which allows them to

- Identify various stakeholders
- Share the relevant information and requesting their feedback and
- Compile the feedback

The stakeholder consultation is carried out in a transparent manner as outlined below:

Identification of stakeholders: Stakeholder identification has been carried out in an extensive way by the representatives from JKSPDC. This includes identification of all the people/ parties who are involved with the project activity at any stage of its implementation and operation. Both government and non-governmental organizations have been considered for this purpose. The stakeholder list includes the following:

- Local people
- Employees of JKSPDC
- Consultants
- Contractors and Equipment Suppliers

- Non Governmental Organizations (NGOs)
- Ministry of Environment and Forests, Government of India

Information Sharing: Once the stakeholders have been identified, the consultation process has been initiated by sharing salient information on various aspects of the project activity implementation with them. They have been apprised about the project activity and its different attributes either verbally or through written communications and requested to send their feedback.

Compilation of the feedbacks received: The comments received from all the stakeholders are compiled and given due considerations. In case of any significant comment received, the JKSPDC authorities have been informed with the request for proper measures to be undertaken. The same has been addressed by the authorities on a timely basis. In case of any serious issues raised by any stakeholder, the Management of JKSPDC has ensured immediate adaptation of adequate measures that address the stakeholder's concern.

Please refer to the following section for details on stakeholder consultation with all the stakeholders identified as above.

E.2. Summary of the comments received:

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status
1	Local people	Representatives from the JKSPDC have met with the local people in and around project site. Brief details on the project activity, its environmental impacts, planned rehabilitation measures and socio-economic development attributes have been	The people of the region acknowledged the project activity's contribution towards socio-economic development of the locality through infrastructural development and creation of employment opportunities. The people of the region have applauded the initiative of the project proponents and commended them for the compensations that has been provided to the land owners for setting up the project activity on lands acquired from them.	JKSPDC has already received written consents form the representatives of the region.

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status
		communicated to the local people and they were requested to provide their feedback on the same.		
2	Employees of JKSPDC	The employees of JKSPDC have been informed about the project activity and its associated socio-economic and environmental benefits through a formal notice.	The employees have understood the positive attributes of the project activity like generation of clean energy thereby conserving non-renewable natural fossil fuel resources, the socio-economic and environmental development of India and its contribution towards mitigation of global warming. They have appreciated the authorities' endeavour to come up with such a project activity that results in an all around improvement of the two neighbouring countries thereby strengthening the relationship between them.	The employees have communicated their feedback through written communication to the Management of JKSPDC.
3	Consultants	Different consultants and equipment suppliers have been involved with the project activity during its conceptualization and construction phase.	The civil contractors have acknowledged that all the environmental aspects, safety and occupational health measures have been properly addressed during the construction phase of the project activity. Environmental impacts associated with the construction of transmission lines have also been envisaged and the same has been	The contractors and the consultants have provided their consent through a written communication to the representatives
4	Equipment			

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status
	Suppliers	They have played a key role in successful implementation of the project activity. The representatives of JKSPDC have communicated the details of the project activity to them and requested for their feedbacks/ suggestions.	planned accordingly by conducting detailed survey. Best possible locations have been chosen which will have a minimal impact on the local people and the environment. The project consultant has endorsed that the project activity has been developed without any adverse impact on the environment and will help in the generation and transmission of clean power thereby reducing the impact of climate change through global warming.	of JKSPDC.
5	Non Governmental Organizations (NGOs)	The details of the project activity implementation, its associated environmental benefits as well as its contribution towards socio-economic up-liftment of the people in the region have been communicated to non-governmental organisation and they have been requested for their feedbacks.	The NGO has appreciated the initiative of JKSPDC for venturing into a cleaner environment friendly mechanism for hydro power generation and its transmission and for ensuring adherence to all the environmental rules and regulations of the country during the construction and operation of the project activity.	A written consent has already been received by the Management of JKSPDC from the NGO.

Sl No.	Name of Stakeholders	Mode of Communication	Feedback	Status
6	Ministry of Environment and Forests, Government of India	The project proponents have developed the project activity with consultation with the Government of India. They have been intimately informed about the progress of the project activity and the different measures being undertaken under the project activity.	The project activity is a positive footstep towards eco-friendly mechanism of generation of hydro power and its transmissions. The same has been developed to contribute to the socio-economic development of both the host countries. All the country specific rules and guidelines have been followed during its implementation. The same will also be followed during the operation of the project activity.	The Project Design Document and the Project Concept Note have been submitted to Ministry of Environment and Forests, Government of India for host country approval.

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

The project proponents have always ensured transparency in the entire stakeholder consultation process. All the comments received from the stakeholders have been discussed in an appropriate forum and addressed properly. Till date the project activity has received a number of positive feedbacks from all the stakeholders as explained above. All these comments have been considered while preparation of the CDM Project Design Document.

However stakeholder consultation is an on-going process which will be continued throughout the proposed lifetime of the project activity. The project proponents, as their commitments towards developing a sustainable project activity, will adopt appropriate measures to address the concerns of the stakeholders throughout the lifetime of the project activity.

Furthermore, as per the requirement of UNFCCC, the CDM Project Design Document will be web-hosted on the DOE's (Designated Operational Entity) website for a period of one month for global stakeholder

consultation. The comments received by the Validator during the period of global stakeholder consultation will be properly addressed as a part of CDM process.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No funding from any Annex I country is available for the project activity.

Annex 3

BASELINE INFORMATION

Computation of CO_2 Baseline Emission Factor of Northern Regional Grid (EF_y)

The Northern Regional Grid emission factor (EF_y) is calculated as a combined margin (CM), following the guidance provided in the "Tool to calculate the emission factor for an electricity system, Version 01 (EB 35 report, Annex 12)" as a weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$) as described below:

Step-I: Calculation of CO_2 Operating Margin emission factor of Northern Regional Grid ($EF_{OM,y}$)

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Operating Margin emission factor of Northern Regional Grid as an average of the 3-years' (*i.e.* 2004-2005, 2005-2006 and 2006-2007) Simple Operating Margin emission factor of the Northern Regional Grid. The Simple Operating Margin emission factors are calculated following the guidance of the above-mentioned methodological tool. The following table gives the CO_2 Operating Margin emission factor of Northern Regional Grid as provided by CEA in 'CO_2 Baseline Database for the Indian Power Sector / Version 3.0 dated 15 December 2007'.

Computation of Operating Margin Emission Factor for Northern Regional Grid					
Parameters	Unit	2004-2005	2005-2006	2006-2007	Remarks/ Source
Simple Operating Margin Emission Factor, $EF_{OM,Simple,y}$	tCO_2/ MWh	0.9	1.0	1.0	Baseline Carbo Dioxide Emission Database/ Version 3.0 dated 15 December 20 07 available at http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm
Operating Marging Emission Factor, $EF_{OM,y}$	tCO_2/ MWh	0.9			3-years' average

Step-II: Calculation of CO_2 Build Margin emission factor of Northern Regional Grid ($EF_{BM,y}$)

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 Build Margin emission factor of Northern Regional Grid for the year 2006-2007 following the guidance of above-mentioned methodological tool. The following table gives the CO_2 Build Margin emission factor of Northern Regional

Grid as provided by CEA in 'CO_2 Baseline Database for the Indian Power Sector / Version 3.0 dated 15 December 2007'.

Computation of Build Margin Emission Factor for Northern Regional Grid			
Parameters	Unit	2006-2007	Remarks/ Source
Build Margin Emission Factor, $EF_{BM,y}$	tCO_2/ MWh	0.6	Baseline Carbo Dioxide Emission Database/ Version 3.0 dated 15 December 2007 available at http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

Step-III: Calculation of CO_2 emission factor of Northern Regional Grid (EF_y)

Central Electricity Authority (CEA) of Government of India has calculated the CO_2 emission factor of Northern Regional Grid following the guidance of above-mentioned methodological tool as a weighted average of the Operating Margin emission factor and Build Margin emission factor of the Northern Regional Grid. The following table gives the CO_2 emission factor of the Northern Regional Grid as provided by CEA in 'CO_2 Baseline Database for the Indian Power Sector / Version 3.0 dated 15 December 2007'.

Data used for Combined Margin CO_2 Emission Factor of Northern regional Grid		
Parameters	Values (ton of CO_2/MWh)	Remarks
Operating Margin Emission Factor, $EF_{OM,y}$	0.99	Please refer to Step-I above.
Build Margin Emision Factor, $EF_{BM,y}$	0.63	Please refer to Step-II above.
Combined Margin CO_2 Emission Factor of Northern Regional Grid, EF_y	0.81	Calculated

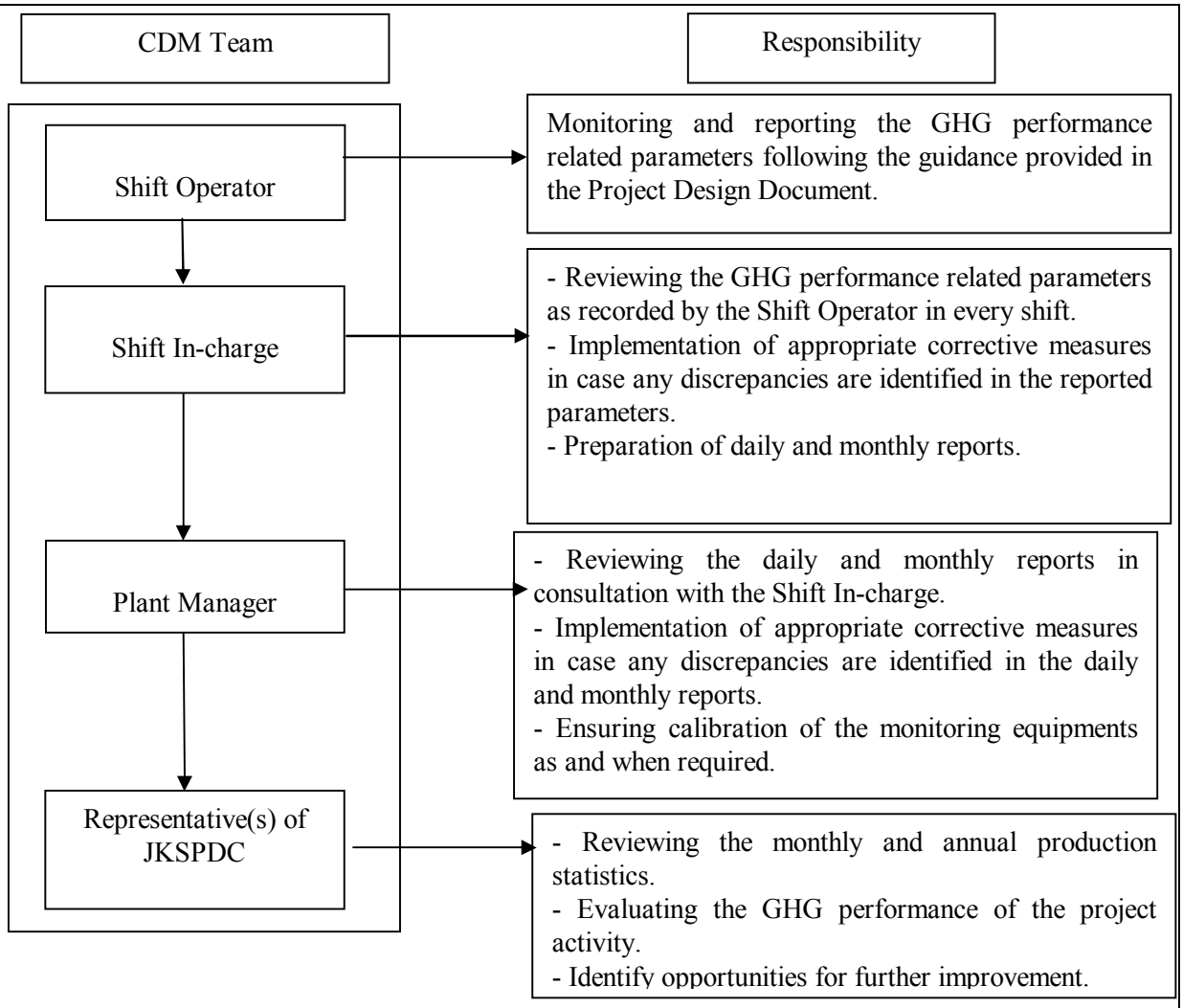
The CO_2 Emission Factor of Northern Regional Grid has been calculated at the start of the crediting period and will remain fixed for the entire crediting period of 10 years.

Annex 4

MONITORING INFORMATION

The project activity is a GHG emission reduction project which entails generation of power using the hydro energy potential of the state of Jammu and Kashmir and transmission of the same to cater to the electrical energy requirement of the energy deficit state. The surplus electrical energy of the project activity, after meeting the auxiliary power consumption of the power plant and the local power demand, may be transmitted to farther regions which are primarily a part of the Northern Regional Grid. Therefore the project activity will replace an equivalent quantum of electrical energy from the Northern Regional Grid. The GHG performance of the project activity primarily depends on the quantum of electrical energy transmitted to the grid as well as on the carbon intensity of the recipient grid. The financial performance of the project activity depends significantly on the CDM revenue to be availed through sale of Certified Emission Reduction (CER) units accrued from the project activity. Therefore the project proponents are required to monitor all the relevant GHG parameters for proper operation of the project activity which in turn will help them to maximise their revenue through sale of carbon credits. In view of this objective, the project proponents have developed a robust monitoring plan which will be followed throughout the proposed crediting period in order to ensure proper operation of the project activity resulting in generation of carbon credits. The same is explained below:

Table An-4.1: Monitoring Plan
1.0 Objective
▪ To ensure smooth uninterrupted operation of the project activity and hence generation of carbon credits ▪ To ensure proper monitoring, reporting and verification of all the parameters required to evaluate the GHG performance of the project activity ▪ To define the procedures and responsibilities for GHG performance monitoring, measurement and reporting of data and dealing with uncertainties ▪ To identify flaws in the monitoring system and open up opportunities for further improvement
2.0 Roles and Responsibilities
The project proponents have developed a 'CDM Team' who will be involved in monitoring, reporting and verification of all the GHG performance related parameters. The following schematic diagram will explain the individual roles and responsibilities of all the members of the 'CDM Team':



3.0 Internal Audit

Internal Audit will be conducted once in a year in order to assess the GHG performance of the project activity. Auditors will consist of people from JKSPDC. The audit findings and the necessary corrective actions will be documented and reported to the Representative(s) of JKSPDC for their immediate actions. The Plant Management will also be informed on the same. Compliance with the audit findings and evaluation of implementation of the corrective actions will be a part of the subsequent audit.

4.0 Experience and Training

The Plant Managers and the relevant personnel In-charge will be qualified engineers. All the Operators will be provided with extensive on-the-job trainings under the guidance of the relevant In-charge which will include training on plant operations, data monitoring and report generation.
