CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 02

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SECTION A. General description of project activity

A.1 Title of the project activity:

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Baragran Hydro Electric Project, 3.0 MW (being expanded to 4.9 MW)

A.2. Description of the project activity:

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This project is located on Sanjoin nala, a tributary of Beas River near village Patlikuhl in Kullu District, Himachal Pradesh. The power potential of Sanjoin nala is being exploited through the existing Baragran HEP being operated by M/s KKKHPL. Baragran up gradation HEP is a run-of-the-river development envisaging utilization of surplus water available in Sanjoin nala. The surplus discharge available in the nala is proposed to be utilized to develop full potential Sanjoin Stream.

On the basis of the discharge measurement data available, it is seen that it is possible to exploit discharge and natural head to generate 4900 KW of power at economical cost. The increase in installed capacity from 3 MW to 4.9 MW can be achieved by utilizing higher discharge available in the nala.

The purpose of the project activity is to generate electricity by using the renewable hydraulic resources to meet the ever-increasing demand for energy in the region. The development of the project activity would reduce the Green House Gas (GHG) emissions produced by the grid generation mix, which is mainly dominated by fossil fuel based power plants.

KKK Hydro Power Limited, which is the owner of the project activity, believes that the project activity has the potential to shape the economic, environmental and social life of the people in the region. The project activity is likely to have beneficial effect on agriculture, rural industries and employment in the region. Government of India has stipulated the following indicators for sustainable development in the interim approval guidelines for CDM projects.

- Social Well Being
- Economic Well Being
- Environmental Well Being
- Technological Well Being

Social well being:

- Since the project activity is in the rural area, it would lead to the development of the region. It would significantly improve the conditions of the roads connecting site and nearby villages to existing roads.
- Employment opportunities would be generated for local people, both during construction and operation phases.
- The socio-economic conditions of the local people surrounding village like Baragran, Patlikuhl, etc. shall be improved by means of setting up of small scale/cottage industries in these villages
- The project will also help locate, encourage and develop local entrepreneurs for the successful development of rural enterprises & for generation of non-farm employment.

Economic well being:

- The project activity would generate employment in the local area. The project would create a business opportunity for local stakeholders such as suppliers, manufacturers, contractors etc.

Environmental well being:

- Since the project uses renewable hydroelectric resources for power generation, it doesn't lead to any emissions in the environment.
- The project activity is a step towards environmental sustainability by saving exploitation and depletion of a natural, finite and non-renewable resource like coal/gas.
- The project will not cause any adverse effect on ecology of the area. Rather, it would improve the environment by providing pollution free source of energy to the people.

Technological well being:

- The technology selected for the power project would use well-established Pelton/Francis type turbines.
- Development of small hydro locally with its well known and proved technology offers most attractive energy options as compared to petroleum, coal and wood based energy systems.

A.3. Project participants:

>>

Name of the party involved ((host) indicates the 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)
INDIA	KKK Hydro Power Limited	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

>>

The project is located on Sanjoin nala, a tributary of Beas River near village Patlikuhl in Kullu district, Himachal Pradesh.

The project lies between Latitudes $31^0$07' N to $31^0$13' N and Longitudes $77^0$04' E to $77^0$10' E.

The project activity would generate electricity and sell it to the state grid, Himachal Pradesh State Electricity Board (HPSEB) through Power Purchase Agreement (PPA).

A.4.1.1. Host Party (ies):

>>

The host party is the Government of India

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

>>

State - Himachal Pradesh

A.4.1.3. City/Town/Community etc:

>>

District - Kullu

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

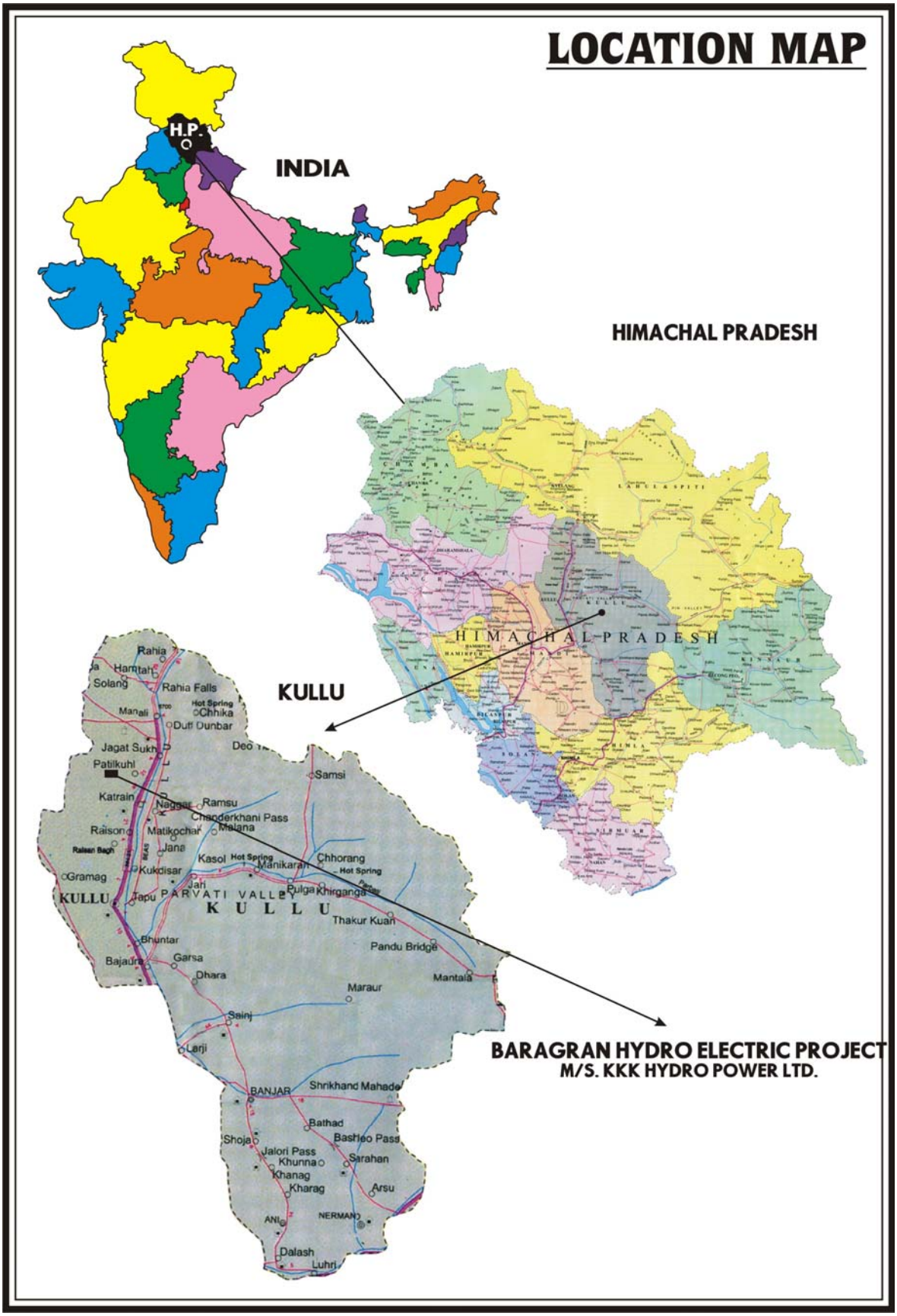
>>

The project is located on Sanjoin nala, a tributary of Beas River near village Patlikuhl in Kullu district, Himachal Pradesh**.** The project site is approx. 25 km from Kullu off the Kullu - Manali State Highway near village Patlikuhl. A good motor able road exists up to diversion as well as powerhouse site.

The total catchment area up to proposed weir site is 58 sq. km. and is fan shaped. The total catchment area at the diversion site is 82.00 sq. km. The project lies between Latitudes $31^0$07' N to $31^0$13' N and Longitudes $77^0$04' E to $77^0$10' E.

The project site is easily accessible by road and air. The area can be approached from Patlikuhl town located on National Highway NH-21, by an all weather road. The distance from Kullu to Patlikuhl is about 20 km. The diversion site is located around 6 km from Patlikuhl and is connected by fair weather jeep able road at present. The power house site is located near village Baragran on the right bank of Sanjoin nala before its confluence with Beas River.

The area around the project site is largely covered with overburden in the riverbed and adjoining terraces. Overburden consists of deep fill of ravine sediments whereas hill slopes are covered with slope wash material. The riverine terraces are mostly used as agricultural land. Rock outcrops are scanty. However, the hill slopes around the proposed project are stable and the area is conductive for constructing a small hydropower scheme on geological considerations.


LOCATION MAP
H.P.
INDIA
HIMACHAL PRADESH
HIMACHAL PRADESH
KULLU
KULLU
PARVATI VALLEY
KULLU
BARAGRAN HYDRO ELECTRIC PROJECT
M/S. KKK HYDRO POWER LTD.
Rahia
Hamtah
Solang
Rahia Falls
Manali
Hot Spring
Chhika
Duff Dunbar
Jagat Sukh
Patlikuhl
Deo
Samsi
Katrain
Naggar
Ramsu
Chanderkhani Pass
Malana
Raison
Matikochar
Jana
Kasol
Hot Spring
Manikaran
Chhorang
Hot Spring
Gramag
Kukdisar
Jari
Pulga
Khirganga
Jagatsukh
Thakur Kuan
Bhuntar
Pandu Bridge
Bajaura
Garsa
Dhara
Mantala
Maraur
Sainj
Larji
BANJAR
Shrikhand Mahadev
Bathad
Shoja
Bashleo Pass
Jalori Pass
Khunna
Sarahan
Khanag
Kharag
Arsu
ANI
NERMAND
Dalash
Luhri

A.4.2. Category (ies) & Technology to be employed by the project activity of project activity:

>>

Type :- *Renewable Energy Project*

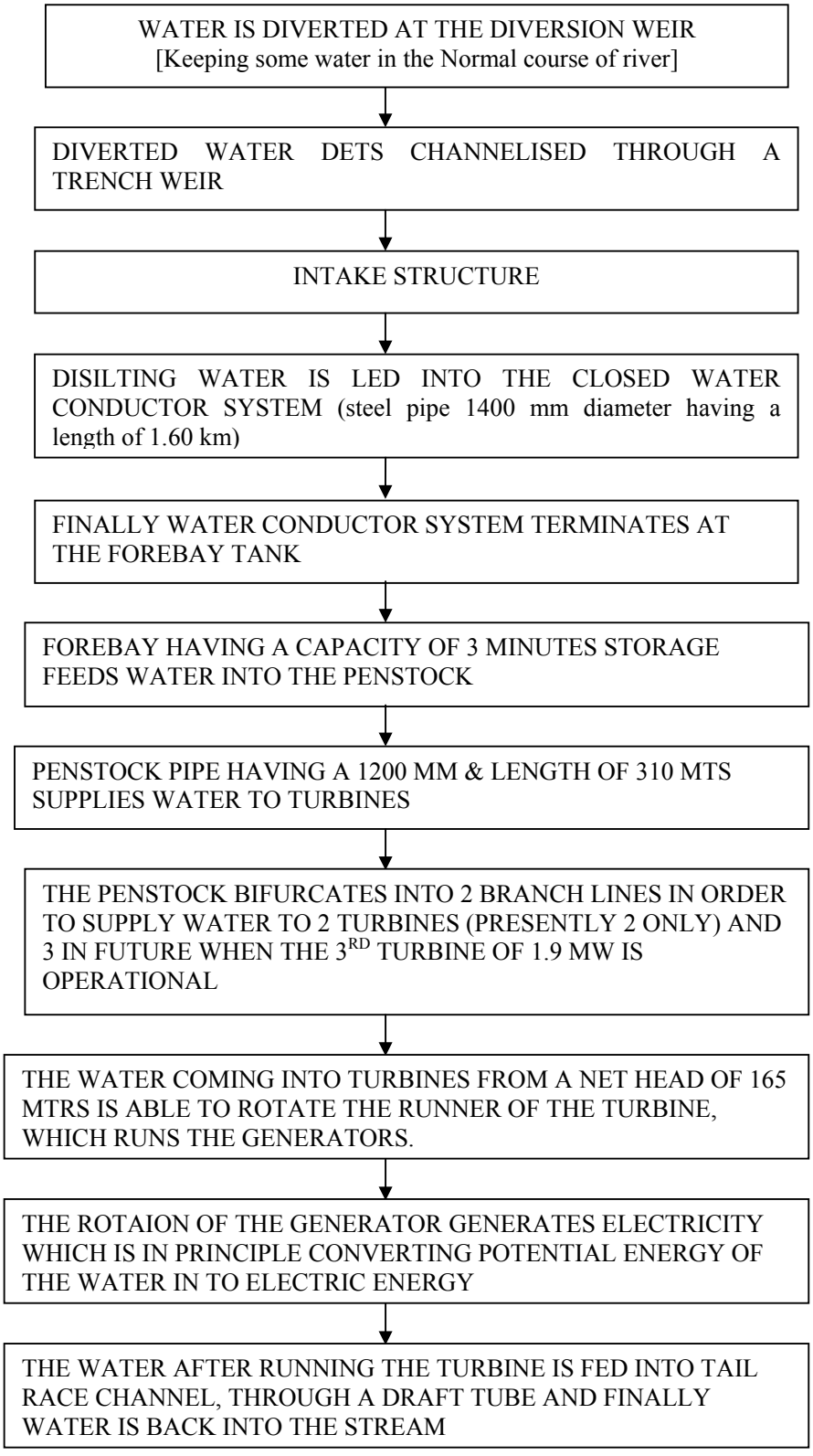
Category:- *Grid connected electricity generation*

This is a run-of-the-river development scheme of small hydro power projects in which the hydro power plant uses water limited to the rated capacity of the plant, from the natural flow of the river without storage.

The water shall be directed at an elevation of 1730.50 M through a trench weir and the silt will be eliminated at a de-silting unit after which it will be conveyed through partially an open channel and partially through cut and cover up to forebay which has a temporary storage of 3 minutes. From here the water shall be conveyed under pressure through penstock, which will run the turbine, which is housed, in the power-house. The water later on will be released into the river through tailrace stock

"The Technology used for generation of Power in the Baragran Hydro-Power Project is using Horizontal Francis Turbine (1500 KW) 2 Nos. these turbines have been selected based on available head at site and are ideally suited for such project"

FLOW CHART OF PRODUCTION



A.4.3 Brief description of how anthropogenic emissions of anthropogenic green house gas (GHGs) by sources are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/ or sectoral policies and circumstances:

>>

The Baragran HEP is a run-of-river hydel scheme and there is no project emissions associated with its operations. The project activity uses renewable energy sources for generation of power. In the absence of the project activity, same amount of power would have been generated using fossil fuels as in case of current grid generation mix. The project activity thus avoids power generation using fossil fuels and reduces associated GHG emissions.

The implementation of scheme would also be a positive step in the direction of the global effort to achieve stabilisation of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. The project would save burning of coal in the thermal plant in the northern grid and reduction of diesel consumption in the transportation and industrial sector.

Conventional energy equivalent of

3.0 MW	1.9 MW	Total (4.9MW)
18.90 million kwh	8.07 million kwh	26.97 million kwh

For a period of 7 years would be replaced by power generated from the project activity. The project would thereby result in total CO_2 emission reduction

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

>>

Years	Annual estimation of Emission Reductions in tonnes of CO_2
2007-2008	20227.5
2008-2009	20227.5
2009-2010	20227.5
2010-2011	20227.5
2011-2012	20227.5
2012-2013	20227.5
2013-2014	20227.5
Total estimated amount of reductions (tonnes of CO_2)	141592.5
Total number of Crediting Years	7 years
Annual average over the crediting period of estimated reductions (tonnes of CO_2)	20227.5

A.4.4. Public funding of the project activity:

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No public funding is involved in the project activity. The resources of the implementation have been organized by the investor through in house equity and debt from financial institution through equity debt structuring.

SECTION B. Application of a baseline and monitoring methodology

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

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Main Category: Type 1 – Renewable Energy Projects

Sub Category: I.D. – Grid Connected Renewable Electricity Generation

The reference has been taken from the list of the small scale CDM project activity categories contained in 'Appendix B of the simplified M&P for small scale CDM project activities'

B.2 Project category applicable to the small scale project activity:

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Appendix B of the simplified M&F for small scale CDM project activity provides indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories. As per this document the project activity falls under Category I.D. – Renewable electricity generation for a grid.

Baseline for projects under type I.D. has been detailed in paragraph 7 of type I.D. described in Annex B of the simplified modalities and procedures for small-scale CDM project activities. It states that the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in $kgCO_2/kWh$) calculated in a transparent and conservative manner as:

a) The average of the "approximate operating margin" and the "build margin", where,

   i. The average of the "approximate operating margin" is the weighted average emissions (in $kgCO_2equ/kWh$) of all generating sources surviving the system, excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation;

   ii. The "build margin" is the weighted average emissions (in $kgCO_2/kWh$) of recent capacity additions to the system, defined as the higher (in MWh) of most recent 20% of plants built or the 5 most recent plants.

OR

b) The weighted average emissions (in kgCO_2/kWh) of current generation mix.

Considering the available guidelines and the present project scenario, Northern region grid has been chosen for baseline analysis by selecting "The average of the approximate operating margin and the build margin (combined margin)" for baseline calculations. The Operating Margin (OM) estimates the effect of the project activity on the operation of the existing power plants and the build margin (BM) estimates the effect of the proposed project activity on the building of alternate power plants. Elements of operating and build margins are captured in the combined margin, which is chosen as representative baseline for the crediting period.

In the absence of the project activity, the same energy load would have been taken up by Northern region grid comprised primarily of thermal power plants and emission of CO_2 would have occurred due to combustion of conventional fuel like coal/gas. Replacement of grid electricity results in equivalent GHG (CO_2) emission reductions related to corresponding reduction in fossil fuel usage in the power plant feeding the grid. If such replacement is brought about by a renewable resource like mini hydro power plants as in the project case, then project emission is zero and the entire emission reductions due to fossil fuel reduction in grid mix gets credited to the project activity.

B.3. 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):

>>

The proposed CDM project activity was neither planned by the state or central sector utilities of the country nor was it identified as project for private sector development. Thus practically the project is a clear additional project, as the investor himself identified this possible small project on the downstream of a large hydropower scheme.

The description and explanation on why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances is given below.

The total installed generating capacity in India, as on January 2005 was about 115,545 MW. This includes 69.4% thermal (80201 MW), 26.08% hydro (30135 MW), 2.23% nuclear (2720 MW) and 2.15% wind based generation (2488 MW). Coal based thermal power generation has been the mainstay of electricity generation (http://cea.nic.in/exe_summ/jan/6.pdf).

The total electricity generated in the country during the year 2003-04 was 633275 GWh (utilities + non utilities) recording as increase of 6.16% from the previous year nearly 83% coming from thermal power plants.

It is evident that the power generation is heavily dependant on the thermal generation. There are about 143 thermal power stations in India, out of which 90 are coal based and remaining use other fuels like gas, naphtha, diesel etc.

In India electricity is a concurrent subject between the state and the central governments. The perspective planning, monitoring of implementation of power projects is the responsibility of Ministry of Power, Government of India. At the state level the state utilities or state electricity boards (SEBs) are responsible for supply, transmission and distribution of power. With power sector reforms there have been unbundling and privatisation of this sector in many states. Many of the state utilities are engaged in power generation also. In addition, there are different central/public sector organizations involved in generation like National Thermal Power Corporation (NTPC), National Hydro Power Corporation (NHPC), etc. in transmission e.g. Power Grid Corporation of India Ltd. (PGCIL) and in financing e.g. Power Finance Corporation Ltd. (PFC)

There are five regional grids: Northern, Western, Southern, Eastern and North-Eastern.

Regional Grid	**Northern**	**Western**	**Southern**	**Eastern**	**North Eastern**
States	Haryana	Rajasthan	Andhra Pradesh	Bihar	Arunachal Pradesh
	Himachal Pradesh	Madhya Pradesh	Karnataka	Orissa	Assam

	Jammu & Kashmir	Maharashtra	Kerala	West Bengal	Manipur
	Punjab	Goa	TamilNadu	Jharkhand	Meghalaya
	Rajasthan	Chattisgarh			Mizoram
	Uttar Pradesh				Nagaland
	Uttaranchal				Tripura
	Delhi				

The management of generation and supply of power within the state and regional grid is undertaken by the state load dispatch centre (SLDC) and regional grid despatch centres (RLDC). Different states within the regional grid meet the demand from their own generation facilities plus generation by power plants owned by the central sector i.e. NTPC and NHPC etc. Specific quota is allocated to different states from the central sector power plants. Depending on the demand and generation there are exports and imports of power within different states in the regional grid. Thus there is an exchange of power among states in the regional grid. Similarly there exists imports and export of power between regional grids.

The project activity falls in Himachal Pradesh, which is a part of the Northern grid, is largely dependant on thermal generation. He commissioning of this project will therefore provide clean electricity to the northern grid of the country, which would have otherwise never been generated. The northern grid is currently dominated by thermal sources of energy and during the current five-year and next five-year plan; the following implementations are under execution for capacity addition in the northern grid.

Type	10^{th} Five Year Plan

Hydro	8974 MW
Thermal	10436 MW
Nuclear	Nil
Renewable	Through private sector, thus not planned (les than 200 MW)

Thermal plants perform at a higher PLF whereas the generation of electricity from hydro electric projects depends upon the availability of water in the river. Thus even if about 46% of the new installations will be from hydro, their generation contribution would be less than 30% of the total generation added into the grid.

In accordance with paragraph 28 of the simplified modalities and procedures for small-scale CDM project activities, a simplified baseline and monitoring methodology listed in appendix B may be used for a small-scale CDM project activity if project participants are able to demonstrate to a designated operational entity that the project activity would otherwise not be implemented due to the existence of one or more barrier(s) listed in attachment A of Appendix B.

The implementation of the hydropower based project activity is voluntary step undertaken by KKK Hydro-Power with no direct or indirect mandate by law.

The main driving forces to this 'Climate change initiative' have been:

- ✓ GHG reduction
- ✓ The rural development of the region by making roads and creating job opportunities for the local people demonstrating of other entrepreneurs the untapped potential of generating clean power from small rivulets of water.

However, the project proponent was aware of the various barriers associated to project implementation. But it is felt that the availability of carbon financing against a sale consideration of carbon credits

generate due to project activity would help to overcome these barriers. Some of the key barriers are discussed below:

Investment barrier

The project activity is a run of river hydropower project, without any storage of water. So the plant load factor (PLF) is dependant on the rainfall in the region. The project activity is located in rural set-up without sufficient infrastructure like roads, communication and transportation facilities. The sites for the project are located in hilly terrain. Shear zones with loose rocks, resulting in frequent landslides are dominate in the region which were anticipated to cause severe problems in making approach roads and the diversion channel. KKK Hydro Power Ltd. finally decided to cover the channel with reinforced cement concrete (RCC) slabs, which has resulted in significant cost, and time overruns.

The possibility of flash floods and cloud burst that can totally wipe the project components cannot be ruled out in this region. Thus the project proponent is bearing a considerable investment risk by investing in the project activity.

Also multitude of required clearances, the unclear legal processes anticipated time required for getting the regulatory clearances etc., prevented the KKK Hydro Power to start with implementation of the project activity.

Barrier due to prevailing practice

Thermal power plants are predominant in the Indian power sector, due to availability of fossil fuel and the vast experience in this technology. Whereas the lack of experience of private sector in small scale hydro power projects make them uncommon.

KKK Hydro Power decided to go ahead with the implementation of the project activity in August 2004. No small hydro project in private sector with capacity comparable to that of the project activity was commissioned till July 2004 in the state of Himachal Pradesh. Still KKK Hydro Power decided to go ahead with implementation of the project activity taking CDM funding into consideration.

Inspite of above discussed barriers; KKKHPL was one such entrepreneur to initiate this GHG abatement project under Clean Development Mechanism. KKKHPL's success would depend on securing the proposed carbon finance and it would definitely encourage other entrepreneurs to come up with similar

project activities contributing further towards GHG emission reduction through the huge untapped small hydro-power potential.

In the absence of the project proponent's initiative to implement the project, the regional grid mix dominated by fossil fuel based power plants would generate the equivalent. With the implementation of the project,

- 1.9 MW - 8.07 million kwh
- 3 MW - 18.90 million kwh

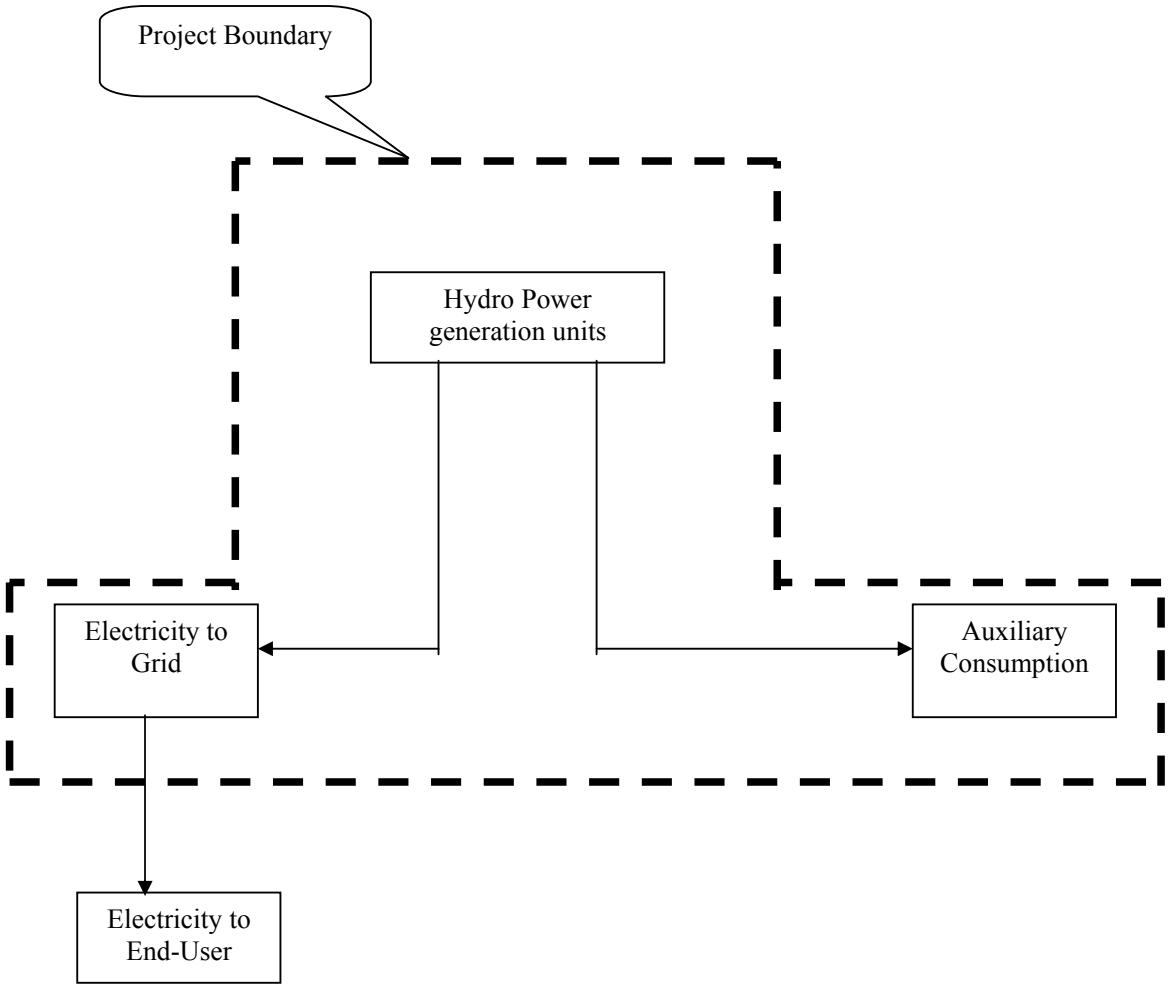
of clean electricity would be generated over a period of 7 years.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity.

>>

As per the guidelines mentioned in paragraph 4 of Type I.D. described in Annex. B of the simplified modalities and procedures for small-scale CDM project activities, project boundary encompasses the physical and geographical site of the renewable generation source.

For the project activity the project boundary is from the trench type diversion weir to the point of power supply to nearest substation where the project proponent has a full control. Thus, boundary covers ersion weir, intake chamber, desilting chamber, diversion channel, forebay, penstock, powerhouse HT lines and all other accessory equipments. However, for the purpose of calculation of baseline emissions, northern grid is included in the system boundary.



B.5. Details of the baseline and its development:

>>

Using the methodology available in paragraph 7 of type I.D. described in Annex B of the simplified modalities and procedures for small-scale CDM project activities, the average of the approximate operating margin and the build margin (in $kgCO_2/kWh$) of current generation mix of Northern region grid is used for the calculation of baseline.

Baseline Data

Carbon emission factor of grid

Northern region's present generation mix, thermal efficiency, and emission coefficient are used to arrive at the net carbon intensity/baseline factor of the chosen grid. As per the provisions of the methodology the emission coefficient for the electricity displaced would be calculated in accordance with provisions of paragraph 7 of Type I.D. mentioned in Appendix B of Draft Simplified Modalities and Procedures for Small Scale CDM Project Activities for grid system.

The provisions require the emission coefficient (measured in kg CO_2equ/kWh) to be calculated in a transparent and conservative manner as:

a) The average of the "approximate operating margin" and the "build margin" (or combined margin)

OR

b) The weighted average emissions (in kg CO_2/kWh) of the current generation mix.

Complete analysis of the electricity generation has been carried out in for calculation of the emission coefficient as per paragraph 7 (a).

COMBINED MARGIN

The baseline methodology suggests that the project activity will have an effect on both the operating margin (i.e. the present power generation sources of the grid, weighted according to the actual participation in the grid mix) and the build margin (i.e. weighted average emission of recent capacity additions) of the selected grid and the baseline emission factor would therefore incorporate an average of both these elements.

OPERATING MARGIN

The "approximate operating margin" is defined as the weighted average emission (in $kgCO_2/kWh$) of all generating sources serving the system, excluding hydro, geothermal, wing, low-cost biomass, nuclear and solar generation.

The project activity would have some effect on the operating margin of the Northern region grid. The carbon emission factor as per the operating margin takes into consideration the power generation mix of 2005-2006 excluding hydro, geothermal, wind, low-cost biomass, nuclear and solar generation of the selected grid, and the default value of emission factors of the fuel used for power generation.

Key parameters with their data sources

S. No	Key Parameters	Data Sources
1.	Generation data for all plants for the year 2005-06 (kWh)	Annual reports of Northern Region Electricity Board (NREB) (http://www.nreb.nic.in/Reports/ar05-06/chapter2/annx2.7.pdf)
2.	Coal Consumption	Annual Performance Review of Thermal Power Plants; CEA (http://www.cea.nic.in/Th_per_rev/CEA_Thermal%20Performance%20Review0506/section-9.pdf)
3.	Calorific value of gas	IPCC
4.	Calorific value of coal	IPCC
5.	Oxidation factors	IPCC
6.	Efficiency of gas based power plants supplying power to grid	Emission Baselines-Estimating the Unknown, page 156: by International Energy Agency (www.iea.org/textbase/nppdf/free/2000/embase2000.pdf)

The Net Calorific Values (NCV) and emission factors ($EFCO_2$) of various fuel types (grades of coal from D to F, lignite, gas, diesel) utilized in power stations were also obtained from the report "Baseline for Renewable Energy Projects under CDM" who have used the values obtained from CEA in planning studies.

The fuel consumption data was obtained by back calculating fuel consumption from generating data, operating heat rates and net calorific values of the fuel used.

Emission Factors

The emission factors are based on IPCC Guidelines for National Greenhouse Gas Inventories and are given below.

Fuel	Emission Factor (tC/TJ)	Emission Factor (tCO_2/TJ)

Natural gas	15.3	56.1
Sub-Bituminous coal	25.8	94.6

Average efficiency of gas/combustion turbine (peak load) works out to be 35 % and that for gas turbines in combined cycle work out to be 50 %. On conservative basis average efficiency for base line calculation is considered as 50 %. Standard emission factors given in IPCC for coal and gas (thermal generation) are applied over the expected over the expected generation mix and net emission factor is determined.

The formulae are presented in Section-E. Carbon Emission Factor of grid as per operating margin is 0.98 tCO_2/Mwh electricity generation.

BUILD MARGIN

The "build margin" emission factor is the weighted average emissions (in $kgCO_2equ/kWh$) of recent capacity additions to the system, which capacity additions are defined as the greater (in MWh) of most recent 20% of existing plants or 5 the most recent plants.

It requires the data for recent capacity additions to the grid. The generation details of these capacity additions for the year 2005-2006 were obtained from Performance Review of Thermal Power Station 2005-2006 and NRLDC Annual Report 2005-2006.

The project activity will have some effect on the build margin of the northern region grid. The baseline factor as per the build margin takes into consideration the delay effect on the future projects and assumes that the past trend will continue in the future. Capacity additions of most recent 20% of existing plants is greater than (in MWh) than 5 most recent plants hence, for our build margin calculation we would take into consideration 20% of most recent plants built in Northern region grid. The key parameters for calculating build margin have been assumed same as that for calculating operating margin. Carbon Emission Factor of grid as per build margin is 0.53 tCO_2/Mwh electricity generation.

Net Carbon Emission Factor Grid for Combined Margin = (OM+BM)/2 = 0.75 tCO_2/Mwh

Name of the person/entity determining the baseline:
http://www.cea.nic.in
The baseline calculations have been done by:

J.M. EnviroNet (P) Ltd
7-ch-10, Jawahar Nagar,
Jaipur – 302 004 (Rajasthan)
Tel: 0141 – 2653352, 2650441
Tel/Fax: 0141 – 2650441
E-mail: **jmenvironet@sify.com**

SECTION C. Duration of Project Activity/Crediting Period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

3.0 Mega-Watt	1.9 Mega-Watt
August 2004	June 2007

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

>>

The expected lifetime of the project is 40 years, which can be extended further for 20 years on the basis of terms and conditions settled at that time.

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:

>>

June 2007

C.2.1.2. Length of the first crediting period:

>>

7 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>

NA

C.2.2.2. Length:

>>

NA

SECTION D: Application of the monitoring methodology and plan:

>>

D.1 Name and reference of approved monitoring methodology applied to the small scale project activity:

Title: Monitoring Methodology for the category I.D. – Grid Connected Renewable Electricity Generation

Reference: 'Paragraph 9' as provided in Type I.D. of Appendix B of the simplified modalities and procedures for small-scale CDM project activities – Indicative Simplified Baseline and Monitoring Methodologies for Selected Small-Scale CDM Project Activity Categories.

D.2. Justification of the choice of the methodology and why it is applicable to the small – scale project activity:

As established in Section A.4.2 the project activity falls under Category I.D. and can use the monitoring methodology for Type I.D. project activities.

The methodology requires the project-monitoring plan to consist of metering the electricity generated by the renewable technology. In order to monitor the mitigation of GHG due to the project activity, the total energy exported and imported need to be measured. The net energy supplied to grid (difference of energy exported and imported) by the project activity multiplied by emission factor for Northern Region Grid, would form the baseline for the project activity.

GHG SOURCES

Direct on-site emissions

There would be no direct on-site emissions after implementation of the project activity since it is a run-of river hydro power project without any storage of water.

Direct off-site emission

Also there would be no direct off-site emissions after implementation of the project activity since it doesn't involve any transportation of fuel.

Indirect on-site emission

The indirect on-site GHG source is the consumption of energy and the emission of GHGs involved in the construction of project activity.

Considering the life of the project activity and the emissions to be avoided in the life span of 30 years, emission from above-mentioned source is too small and hence neglected.

No other indirect on-site emissions are anticipated from project activity.

Indirect off-site emissions

The indirect off-site emissions would include GHG emissions resulting from the erection of the HT lines from the point of generation to the nearest HT lines.

Considering the life of the power plant and the emissions to be avoided in the life span of 30 years, emissions from this source is also too small and hence neglected.

D.3 Data to be monitored:

>>

a. **Parameters affecting the emission reduction potential of the project activity**

ID Number	Data type	Data variable	Data Unit	Measured (m), Calculated (c), or Estimated (e)	Recording frequency	Proportion of data to be monitored	How will data be archived? (Electronic/ paper)	For how long is archived data to be kept	Comment
1.	Energy	Energy Exported	kWh	M	Monthly	Total	Paper	2 years after end of crediting period	This monitored at interconnection point
2.	Energy	Energy Imported	kWh	M	Monthly	Total	Paper	2 years after end of crediting period	This monitored at interconnection point
3.	Energy	Net saleable energy	kWh	C	Monthly	Total	Paper	2 years after end of crediting period	This is calculated as difference of land. It would be based on monthly bills raised by KKKHPL to HPSEB

D.4 Quantitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

Data	Uncertainty level of data (High/Medium/Low)	Are QA/QC procedures planned for these data?	Other explanation why QA/QC procedures are or are not being planned.
D.3.(a)1	Low	Yes	This data will be used for calculation of emission reductions by project activity
D.3.(a)2	Low	Yes	This data will be used for calculation of emission reductions by project activity
D.3.(a)3	Low	Yes	This data will be used for calculation of emission reductions by project activity

Key Project Parameters affecting Emission Reductions

Total Power Generated by the Project: The power exported by KKKHPL would be measured to the best accuracy. The parameter would substantiate the smooth operation of the power plant.

Auxiliary Consumption: The power imported by KKKHPL would also be recorded to the best accuracy. The total quantum of power consumed by the auxiliaries would affect the net power exported to the grid and therefore the amount of the GHG reductions. Therefore any increase in the consumption pattern of the auxiliary system would be attended to.

Net Power exported to the grid: The project revenue is based on the net units exported by KKKHPL.

The general principles for monitoring above parameters are based on:

- Frequency
- Registration and reporting
- Reliability

Frequency of Monitoring

Monthly joint meter readings of main and check meters installed at interconnection point shall be taken and signed by authorised officials of KKKHPL and HPSEB at 12:00 hrs on the first day of every month.

Registration and Reporting

Records of this joint meter reading at interconnection would be maintained by KKKHPL. Monthly reports stating the generation, auxiliary consumption, and net power exports would be prepared by the shift in-charge and verified by plant manager.

Reliability

Payments to KKKHPL by HPSEB and emission reduction calculations would be based on net energy supplied by KKKHPL at interconnection point. For measuring the delivery and import of energy by KKKHPL at interconnection point, one set of main meter and check meter shall be provided by KKKHPL and HPSEB respectively at interconnection point

KKKHPL as well as HPSEB would keep requisite sets of metering equipment, duly tested/calibrated, as spares, for replacement as and when required. Main or check meter would be replaced by spare set of meter with, mutual consent of parties when a faulty meter is required to be removed.

The main and check meter installed at interconnection point would be jointly inspected and sealed on behalf of the parties and shall not be interfered with, by either party except in presence of the other party.

The main and check meter would be test checked for accuracy every sixth months. If during half yearly test heck, main meter were found to be within permissible limits of error and check meter is found to be beyond permissible limits, then billing as well as emission reduction calculation would be as per main meter as usual. The check meter would be calibrated or replaced with spare tested calibrated meter, as may be necessary.

If during half yearly test check, the main meter is found to be beyond permissible limits of error but check meter is found to be within permissible limits, then billing as well as emission reduction calculation for the month and up to date and time of the calibration/replacement of defective main meter shall be as per check meter. The main meter would be immediately calibrated or replaced with spare tested calibrated

meter, as may be necessary where after billing as well as emission reduction calculation would be as per main meter.

If during half yearly test checks, the main meter and check meter are both found to be beyond permissible limits of error, then both meters would be immediately replaced with spare calibrated meters and correction would be applied to data recorded by main meter to arrive at correct energy figures for billing as well as emission reduction calculation purposes for period of two months prior to the month in which test check has been done up to time of calibration/replacement of defective meter.

While taking joint meter reading, if effectiveness between data recorded by main check meter if found to be outside the permissible limits, then both the meters would be tested. Pending such calibration of main meter, billing, payment as well as emission reduction calculation would be provisionally based on energy recorded by check meter ad would be subjected to adjustment on testing of check meter. If both main and check meters are found to be beyond the permissible limits of error, the energy recorded by main meter for previous billing month and up to date of removal of such meter in current month shall be corrected by applying appropriate correction factor. If on testing error in main meter is within accuracy limit and check meter is beyond accuracy limit, the main meter reading shall be used for billing as well as emission reduction calculation and check meter would be recalibrated. However, if check meter is found to be within accuracy limit and error in main meter is beyond accuracy limit, then check meter reading would be used for billing as well as emission reduction calculation purposes for previous billing month and till the time main meter is calibrated.

If during joint meter reading both the main and check meters are found to be non-operational, then energy figures for billing as well as emission reduction calculation for previous month would be computed on a mutually agreeable basis between KKKHPL and HPSEB.

KKKHPL shall archive and preserve all the monthly bills raised against net saleable energy for at least two years after end of the crediting period.

D.5 Please describe briefly the operational and management structure that the project

participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:

1. The project activity doesn't involve any leakage within the project boundary because no alternate fuel (fossil fuel or any other GHG emitting fuel) and be used to run the turbines and generate the electricity.

2. The generate electricity from the project is sold to the state electricity utility (HPSEB) for the complete project lifespan, for which the promoter has entered into a long term power purchase agreement (PPA) with the state power utility. Thus throughout the project cycle (crediting period) and beyond the electricity generated from the project will be monitored by both the project proponent and a third party i.e. HPSEB.

3. The generated electricity, before entering into the grid, at the grid interconnection point will be measured by digital, sealed kilowatt hour (kwh) meter on monthly basis and will be documented both on paper as well as in electronic form. The generation records will be signed by the officials of project proponent and third party (HPSEB). This generation record will be maintained and would be made available on demand throughout the crediting period of the project.

4. The project proponent has appointed a full time project in-charge to manage the overall project activities after commissioning. The project in-charge will be stationed at the project site and will be responsible for monitoring the generation of electricity and maintaining statutory minimum discharge between the diversion weir and tailrace of the stream. To ensure that the micro-ecosystem of the stream is not disturbed due to the candidate CDM project, the discharge in the stream will be measured on fortnightly basis during the lean season of the stream i.e. the months of January, February and March. This data will also be recorded and preserved throughout the crediting period of the project.

5. For duration other than lean season, random measurement of the discharge between diversion weir and tailrace will be carried out.

6. The plant manager would be qualified diploma/degree engineer with 5-7 year experience in power industry. All the shift in-charges would be diploma/degree holders and would undergo related training including data monitoring & report generation etc.

D.6 Name of Person/entity determining the monitoring methodology:

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J.M. EnviroNet (P) Ltd.

7-ch-10, Jawahar Nagar, Jaipur – 302 004 (Rajasthan), India

Tel: 0141 – 2653352

Fax: 0141 – 2650441

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SECTION E. Estimation of GHG emission by sources:

E.1. Formulae Used:

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E.1.1. Selected Formulae as provided in appendix B:

No formulae for GHG reduction is specified for Category I.D. of Appendix B of the simplified Modalities and Procedures for Small-scale CDM Project Activities.

E.1.2 Description of formulae when not provided in appendix B:

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E.1.2.1 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

There would be no GHG emissions of any kind, due to project activity within the project boundary as it is a run-of-river hydropower project producing clean energy with no storage of water.

E.1.2.2. Describe the formulae used to estimate leakage due to project activity, where require, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

As per paragraph 8 of Type I.D. of appendix B of Simplified Modalities and Procedures for Small-scale CDM Project Activities no leakage calculation is required since the project activity is renewable energy technology without transfer of equipment from another activity.

E.1.2.3.The sum of E.1.2.1 and E.1.2.2 represent the small-scale project activity emissions:

Emissions due to project activity are zero.

E.1.2.3 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for Small-scale CDM project activities.

Northern region grid has been considered as the baseline. Northern region's present power generation mix has been used to arrive at the net carbon intensity/baseline factor of the chosen grid. As per the provisions of the methodology the emission coefficient for electricity displaced would be calculated in provisions of paragraph 7 (a) of type I.D. of *'Appendix B of Simplified Modalities and Procedures for Small Scale CDM Project Activities'*

The emission coefficient has been calculated in a transparent and conservative manner as: **'the average of the approximate operating margin and the build margin'.**

The step-by-step calculation of the baseline emission is as follows:

Step 1. Calculation of Operating Margin emission factor (EF_{OM})

$$EF_{OM} = \sum_{I,J} F_{i,j} \times COEF_{i,j} / \sum_{j} GEN_{j}$$

Where

$COEFi,j$ = is the CO_2 emission coefficient of the fuel i (tCO_2/mass or volume unit of the fuel), calculated as given below

GEN_j = is the electricity generated to the grid by source j (MWh)

Fi,j = is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j, calculated as given below

j = refers to the power sources delivering electricity to the grid, not including low-operating cost and must run power plants

The CO_2 emission coefficient $COEF_i$ is obtained as

$COEF_i$ = NCVi x $EFCO_2i$ x OXID

where

NCVi = is the net calorific value (energy content) per mass or volume unit of a fuel i

$EFCO_2$,i = is the CO_2 emission factor per unit of energy of the fuel i

OXIDi = is the oxidation factor of the fuel

Step 2. Calculation of Build Margin emission factor (EF_{BM})

It is calculated as the generation weighted average emission factor (tCO_2/MWh) of a sample of power plant m of grid, as follows:

$$EF_{BM} = \sum_{i,m} F_{i,m} \times COEF_{i,m} / \sum_{m} GEM_m$$

Where

$F_{i,m}$, $COEF_{i,m}$, and GEN_m – are analogous to the variables described for the OM method for plants m.

Calculations for the Build Margin emission factor EFBM has been done as ex ante based on the most recent information available on plants already built for sample group m of northern grid at the time of PDD submission. The sample group consists of the 20% of power plants supplying electricity to the grid that have been built most recently, since it comprises of larger annual power generation.

Further, none of the power plant capacity additions in the sample group have been registered as CDM project activities.

Step 3. Calculation of electricity baseline emission factor (EF_Y)

It is calculated as the weighted average of the Operating Margin emission factor (EF_{OM}) and the Build Margin emission factor (EF_{BM}):

$$EF_Y = W_{OM} \times EF_{OM} + W_{BM} \times EF_{BM}$$

where the weights W_{BM} and W_{OM} by default, are 50% (i.e. $W_{OM} = W_{BM} = 0.5$), and EFOM & EFBM are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh

$BE_Y = EF_Y \times EG_Y$

BE_Y = are the baseline emission due to displacement of electricity during the year y in tons of CO_2

EG_Y = is the net quantity of electricity generated by the project activity during the year y in MWh, and

EF_Y = is the CO_2 baseline emission factor for the electricity displaced due to the project actrivity in tons CO_2/MWh.

If the same amount of electricity generated by the Northern region grid mix, it adds to the emissions that are ultimately getting reduced by the project activity. Hence, the baseline calculated using above methods/scenarios would represent the realistic anthropogenic emissions by sources that would occur in absence of the project activity.

The uncertainties in the baseline, arising out of capacity additions trends are already taken into consideration during calculation of combined margin factor.

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

CO2 emission reduction due to project activity = Baseline Emission - Project activity emission

E.2. Table providing values obtained when applying formulae above:

Parameters	Year 2005-2006
Operating Margin emission factor	0.98 tCO2/MWh
Build Margin emission factor	0.53 tCO2/MWh
Baseline emission factor	0.75 tCO2/MWh
Baseline emission (per year)	20227.5 tCO2 from 2007 to 2014
Projected emissions	0
Leakage	0

Emission Reduction per year	20227.5 tCO2 (upto 2014)

Emission reduction by project activity for 7 year crediting period have been calculated and tabulated as follows:

S.No.	Operating Years	3.0 MW + 1.9 MW = 4.9 MW
1.	2007-2008	20227.5
2.	2008-2009	20227.5
3.	2009-2010	20227.5
4.	2010-2011	20227.5
5.	2011-2012	20227.5
6.	2012-2013	20227.5
7.	2013-2014	20227.5
Total for the Project		141592.5
Total		20227.5

SECTION F. Environmental impacts

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

Amendment dated 13 June 2002 to the Environment Impact Assessment (EIA) notification of 27 Jan 1994 of Ministry of Environment and Forest; Govt. of India says that EIA notification doesn't apply to entry number 19 of Schedule I of the notification if the investment is less than INR 100 crore for new project. Since the cost of 3.0 MW project is approximately INR 17.90 crore & the cost of its up-gradation by 1.9MW is approximately INR 11.46 crore only none of the projects fall under the purview of the EIA notification hence, documentation on analysis of environmental impacts is not required by the host party.

Project Impacts

1) **Impacts due to Construction**

Impact on human settlements, flora and fauna

The effects of the projects construction on the human floral and faunal aspects were negligible. There is no displacement of any local inhabitants and very small area of private land is required for project. Therefore, no rehabilitation measures were required.

Air and Water Pollution

The only anticipated air pollution was during the construction phase of the projects due to dust levels in air. Simple procedures like spraying water to keep dust and SPM levels low were followed during construction.

2) **Impact due to project operation**

Land inundation

The project activity is run-of-river project; therefore it doesn't involve any storage reservoir. Thus, the project operation would not lead to any inundation of surrounding area.

ENVIRONMENTAL IMPACT ASSESSMENT

The preliminary environmental impact assessment study has been carried out for the Baragran project findings of the study are described below:

- The proposed Baragran project is the run-of-river scheme and hence doesn't involve any water impoundment and submergence.

- Since the area between diversion weir and power house is sparsely populated, the project shall not cause any displacement of human population.

- Part catchment area upstream of diversion site comprises of protected forests viz. Haripani & Shilagarh none of the project components shall interfere with these forests.

- The project having no submergence and impoundment shall not have any effect on the micro climate of the area because of its small magnitude.

- The construction of the project greatly promotes the socio-economic development of the area. The electricity from the project will be supplied to the HPSEB for distribution to the villages around the project area who hitherto were depending on forest produce for their energy needs. Also with the availability of cheap & reliable electricity, economic development of the Apple Valley will get a big boost.

- Plantations will be done in the project area for which adequate provision has been made in the cost estimates under head 'M – Plantation'.

No adverse environmental impact has been envisaged in the project activity, still all the necessary clearances from the state pollution control board, public works department, department of irrigation and local villages as well the ministry of environment and forests has been obtained.

SECTION G. Stakeholders' comments

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

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KKKHPL organised stakeholder consultation meeting with individual village panchayat (elected body of representatives administering the local area) in the area with the objective to inform the interested stakeholders on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity. Invitation for stakeholder consultation meetings were sent out requesting the members of village panchayat to participate and communicate any suggestions/objections regarding the project activity in writing. On the day of meeting, KKKHPL representatives presented the salient features of the company and the project activity to the participants and requested their suggestions/objections. The opinions expressed by them were recorded and are available on request.

The other stakeholders identified for the project activity are as under:

1. Local Population
2. Himachal Pradesh State Pollution Control Board
3. Himachal Pradesh State Electricity Board
4. Consultants
5. Equipment Suppliers

Stakeholders list includes the government and non-government parties, which are involved in the project activity at various stages. At the appropriate stage of the project development, KKKHPL consulted/would consult stakeholders / relevant bodies to get the comments. The comments received are available on request.

G.2. Summary of the comments received:

>>

Local population comprises of the local people in and around the project area. The roles of the local people are as a beneficiary of the project. The project activity would provide good direct employment opportunities to the local person, which is encouraging the project.

The project doesn't require displacement of any local population. The distance between the electrical substation for power evacuation and the plant is rather small; hence installation of transmission lines would not create any inconvenience to the local population.

Thus the project will not cause any adverse social impacts on local population. Rather, it will help in improvising their quality of life. KKKHPL has already completed the necessary consultation and documented the approval by local population for this project.

HPSCB has prescribed standards of environmental compliance and monitors the adherence to the standards. HPSPCB have issued Consent to Establish (CTE) to Baragran HEP project under the provisions of Water (Prevention and Control of Pollution) Act, 1974 / Air (Prevention and Control of Pollution) Act 1981.

As a buyer of power, the HPSEB is a major stakeholder in the project. They hold the key to the commercial success of the project. KKKHPL has already signed Power Purchase Agreement (PPA) with HPSEB.

Project consultants were involved in the project activity to take cake of the previous pre contract and post contract issue / activities like preparation of basic and detailed engineering documents, preparation of tender documents, and selection of vendors/suppliers. They would be further involved in supervision of project operation, implementation, successful commissioning and trial run.

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

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In view of various direct and indirect benefits (social, economical, environmental), no concerns were raised during the consultation with stakeholders, hence it is not required to take due account of the comments.

The relevant comments and important clauses mentioned in the project documents like Detailed Project Report (DPR), environmental clearances, power purchase agreement, local stakeholders comments etc., were considered in the preparation of CDM project design document.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	KKK Hydro Power Limited
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Represented by:	
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding is involved in the project activity. Equity is provided by KKKHPL and debt has been arranged form Indian Financial Institution.

ABBREVIATIONS

BM	Build Margin
CEA	Central Electricity Authority
CTE	Consent to Establish
CO_2	Carbon dioxide
EIA	Environmental Impact Assessment
GHG	Greenhouse Gas
KKKHPL	KKK Hydro Power Limited
HPSEB	Himachal Pradesh State Electricity Board
HPSPCB	Himachal Pradesh State Pollution Control Board
IPCC	Inter Governmental Panel on Climate Change
IREDA	Indian Renewable Energy Development Agency
Kg	Kilogram
Km	Kilometer
kW	Kilo-Watt
kWh	Kilo Watt Hour
MW	Mega Watt
OM	Operating Margin
PPA	Power Purchase Agreement
PDD	Project Design Document
SHR	Station Heat Rate
UNFCCC	United Nations Framework Conventions on Climate Change

List of References

S.No.	Particulars of the reference
1.	Kyoto Protocol to the United Nations Framework conventions on Climate Change
2.	Website of United Nations Framework conventions on Climate Change (UNFCC), http://unfccc.int
3.	UNFCCC document: Clean Development Mechanism, Simplified Project Design Document For Small Scale project activities (SSC-PDD), Version 02
4.	UNFCCC document: Simplified modalities and procedures for small-scale clean development mechanism project activities
5.	UNFCCC document: Indicative simplified baseline and monitoring methodologies for selected small scale CDM project activity categories, Version 07
6.	UNFCCC document: Determining the occurrence of debundling
7.	Power sector profile for Northern region as on 30.11.04-Ministry of Power
8.	Website of Ministry of Power (MoP), Govt. of India www.powermin.nic.in
9.	Central Electricity Authority (CEA), Govt. of India www.cea.nic.in
10.	http://www.hpseb.com/