Voluntary Carbon Standard
Project Description Template

19 November 2007

[25 December 2008]

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1 Description of Project:

1.1 Project title

“300MW Hydropower project by JHPL”[1]

1.2 Type/Category of the project

The project activity falls under the following types/categories of the Clean Development Mechanism under the Kyoto Protocol:

- “Consolidated baseline methodology for grid-connected electricity generation from renewable sources”

Reference: Approved consolidated baseline methodology ACM0002/Version 08, Sectoral Scope: 1, EB 44[2]

- The specified project is not a part of a grouped project

1.3 Estimated amount of emission reductions over the crediting period including project size:

Years	Annual estimation of emission reductions in tonnes of CO_2 e
2006*-2007	1052463
2007-2008	1052463
2008-2009	1052463
2009-2010	1052463
2010-2011	1052463
2011-2012	1052463
2012-2013	1052463
2013-2014	1052463
2014-2015	1052463
2015-2016	1052463
Total estimated reduction (tonnes of CO_2 e)	10524630
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)	1052463

*1st April - 31st March every year

Since the project results in more than 1,000,000 tonnes CO2 equivalent emissions reductions per year, it is a mega project.

1.4 A brief description of the project:

[1] Hence forth referred to as Baspa project

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

The Baspa project is a run-of-the-river hydro-electric power plant with an installed capacity of 300 MW. The diversion barrage of the project is located across river Baspa, at Kuppa in Himachal Pradesh. The power house is located at Karcham village in Kinnaur District. The project activity is an initiative of Jaiprakash Hydro Power Limited (JHPL) a part of the Jaypee Group. Jaypee is a well-known business group of India and had entered into agreement with State Government of Himachal Pradesh to implement the project. The purpose of the project activity is to generate electricity using renewable hydro energy and sell it to Himachal Pradesh State Electricity Board (HPSEB).

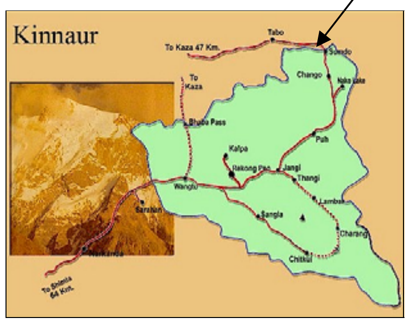
Key Features of the project activity:

1. Run-of-the river power project with no water storage with a capacity of 4 hours peaking during a period of 24 hours (design for diurnal storage) when the discharge in the river comes down to 9 cusecs during the winter season.
2. Strong sustainable development aspects of the project
3. Largest hydro project implemented by private sector in India.
4. Its barrage is at an elevation of 2600 metres, the highest altitude for any such structure to come up in India.

1.5 Project location including geographic and physical information allowing the unique identification and delineation of the specific extent of the project:

The project site is located about 210 Kms from Shimla. Shimla is connected to the project site by National Highway-22 (Hindustan Tibet Road). Nearest broad gauge railway station from the project site is Kalka which is about at a distance of 300 Kms from the project site. The geographical location of the power house is between Longitude $78^0$17' East and Latitude $31^0$50'north. Location is depicted in following maps-

Location of Himachal Pradesh in India   Location of Kinnaur district



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1.6 Duration of the project activity/crediting period:

- Project Start date: 8th June 2003 which is the start date of commercial operation of the plant
- Crediting Period start date[3]: 1st April 2006
- Credit Period: 10 years fixed crediting period

1.7 Conditions prior to project initiation:

The project is a renewable energy project which supplies power to the NEWNE Grid. In the absence of the project activity the electricity delivered to the grid would have been generated by the operation of grid-connected power plants which are mainly thermal based power stations.

1.8 A description of how the project will achieve GHG emission reductions and/or removal enhancements:

The project activity is a run-of-the-river hydro project which will supply power through NEWNE Grid. The power generated by the project activity displaces the power that would

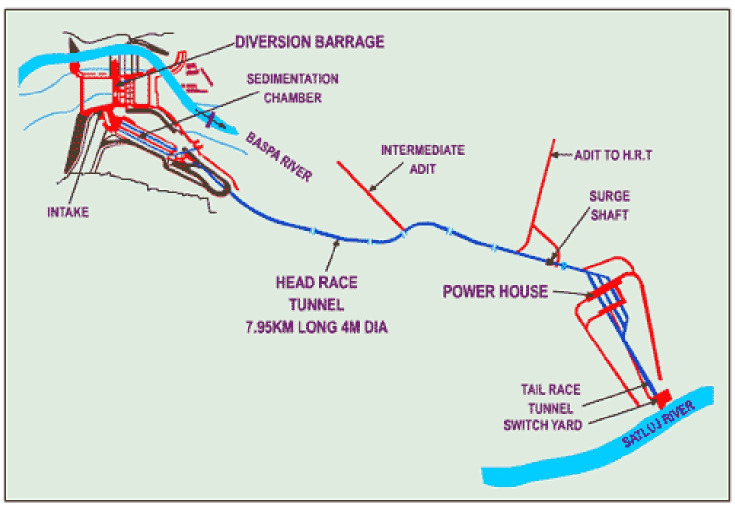
[3] As per VCS-2 guidelines

have otherwise been generated using fossil-fuel as in the current supply pattern of the grid. NEWNE grid is operating with a mix of hydro, nuclear and fossil fuel power plants.

The purpose of the project activity is to generate electricity using renewable hydro energy and sell it to Himachal Pradesh State Electricity Board (HPSEB). JHPL has already entered into Power Purchase Agreement (PPA) with HPSEB for this purpose. In the absence of the project activity, equivalent power would have been generated based on the fossil fuel intensive NEWNE grid resulting in Green House Gas emissions into the atmosphere. Here it is important to mention that at present about 70%[4] (up-to March-2004) of power at the northern grid of India is obtained by thermal power.

1.9 Project technologies, products, services and the expected level of activity:

The Baspa project is a run-of-the-river hydro-electric power plant with an installed capacity of 300 MW. The project, being a run-of-river type Hydro-Power project, would generate power by utilizing the water diverted from the flow of river Baspa. The flow in the river Baspa is contributed by several nullahs and khuds and numerous glaciers. The diversion barrage of the project is located across river Baspa, one of the major tributaries of river Satluj, at Kuppa in Himachal Pradesh. Water is diverted from the barrage to the power house through a diversion barrage. Two open sedimentation chambers are used after the diversion barrage to exclude the silt from water used for power generation. The water is passed through a head race tunnel of about 7.95 km long and steel lined pressure shaft (about 845 meters long to create a design head of 702 meters) which is branching into three penstocks for running 3 pelton turbines of 100 MW each. A surge shaft has been constructed between the head race tunnel and the pressure shaft which would be used to regulate the flow.



The power generated is stepped up to 400 KV and is evacuated by two circuits of 400 KV lines for the power station to Jhakri substation, which is about 55 Km from the site. The transmission line from the power station to Jhakri consisting of 121 towers has been installed as a part of the project. From Jhakri, 400 KV transmission system is utilized to evacuate the full output of JHPL (300 MW) hydro electric project.

Technical information of the Project activity

Parameter	Specifications

[4] http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver3.pdf

Hydrology	
Catchment area at barrage axis	967.72 sq.km
Snow catchment	514.15 sq.km
Diversion Barrage	
Type	Gated, 61 m long (4 bays of 13 m each & 3 piers of 3 m each)
Head Race Tunnel (HRT)	
Length	7950 m (excluding 103m of cut and cover portion)
Type of Section	4m dia, Modified Horse Shoe
Lining	Concrete lining
Power House	
Capacity	3 x 100 MW
Type	Underground
Size of P.H. Cavern	92 m (L) x 18m (W) x 39 m (H)
Size of Transformer Cavern	75 m (L) x 13m (W) x 20 m (H)
Tail Race Tunnel (TRT) and Unit TRT'S	
Length and Shape	475 m long, 5.6 m/ 3.6 m, D shaped
Hydraulic Turbines (HYDRO-VEVEYSA, SWITZERLAND)	
Type	Pelton
Design Head	702 m
Net Head	677.2 m to 712 m
Rated Output	103 MW
Inlet Valve	Spherical Valve, 1.5 m Dia.
Generators (SIEMENS A.G., GERMANY)	
Rated Output	111.11 MVA with 10% overload margin with higher temperature rise
Rated Voltage	13.8 kV +/- 5%
Frequency	50 Hz +/- 3%
Synchronous speed	375 rpm

1.10 Compliance with relevant local laws and regulations related to the project:

The project activity is not mandated by any local or national laws. The project proponent has obtained all required approvals as given below.

Approval Name	**Approval date**	**Law under which applicable**
Ministry of Environment and Forest, GoI	17 December 1993	Forest (Conservation) Act, 1980
Techno-economic Clearance	24 April 1994	Electricity (Supply) Act, 1948
Power Purchase Agreement	4 June 1997	Electricity (Supply) Act, 1948
Himachal Pradesh State Pollution Control Board Consent	9 January 2004	Water (Prevention & Control of Pollution) Act, 1974 & Air (Prevention & Control of Pollution) Act, 1981

1.11 Identification of risks that may substantially affect the project's GHG emission reductions or removal enhancements:

Following are the risks that may substantially affect the project's GHG emissions reductions:

Hydrological barrier

Natural calamities are an underlying cause in delaying the excavation and construction works in hydro electric projects. The project activity is located in a geologically sensitive region and is often exposed to landslides, flash floods, cloudbursts and avalanches which have caused tremendous loss in the state. A brief history of some of these is discussed. In 1988, an avalanche[5] caused immense loss by blocking of districts of Shimla, Kinnaur, Lahaul and Spiti. The cloud bursts and flash floods alone project a horrifying picture. During the last 12 years (1991-2003)[6] nearly 36 major cloudbursts and flash floods have occurred in the state. Flash floods are frequent in the Sutlej river basin. Three floods that submerged the entire Satluj basin in 1997, 2000 and 2005 had affected the Satluj catchment area immensely. It not only led to damages in the area but the entire topography has also changed with heavy erosion of the riverbanks[7].

The occurrence of flash floods in river Sutlej on 31st July 2000 disrupted the transportation and communication links to the Baspa project site, which resulted into delay in the implementation of the project by 15 months[8]. In June 2005, there was a sudden breach in the artificial lake on river Parechu, in Tibet (China), which led to an unprecedented rise in the water level of river Satluj and caused flash floods in five districts of Himachal Pradesh. The flash floods caused extensive damage to roads, bridges, agricultural crops, Government & private properties and other infrastructure. Also, three hydro-electric power projects in the State viz. Naptha Jakhri, Chamera II and Baspa, had to be temporarily shut down due to heavy siltation caused by the flash floods. The heavy floods in river Baspa also damaged the downstream of the barrage works of the project activity and halted the work for a period of five months. Looking at the past occurrences, apart from the construction phase being affected significantly, heavy flash floods may also affect the operational phase of the project, thus causing considerable loss to the project proponent.

Besides the project is located in a fragile geology, which commonly results in landslides leading to loss of life, property, agricultural lands and disrupting communication links.

The Satluj river carries considerable amount of sediments during the high-flow season. Quoting an example here, the Nathpa Jhakri project suffered losses to the tune of Rs.355 crore and 1300 million units of energy on account of closure of the station due to high silt level in river Satluj since its commissioning[9]. The deposition of silt is associated with the problem of frequent shut-downs, mechanical failures, loss in efficiency resulting in the loss of output. The flow in the Baspa river is contributed by several nallahs, khuds and numerous glaciers. This brings down heavy silt deposits with it which lead to frequent wear and tear of the equipment and thus requires additional finance and efforts for the plant's operation and maintenance.

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[5] http://www.planningcommission.gov.in/plans/stateplan/sdr_hp/sdr_hpch3.pdf

[6] http://www.123himachal.com/dharamsala/links/rakesh.htm

[7] http://sjvn.nic.in/projects/rampurpdf/chap4_revised_4.pdf

[8] http://www.jhpl.com/pdfs/Advertisement%20for%20Tariff%20Petition.pdf

[9] www.thehindubusinessline.com/2005/12/22/stories/2005122202810900.htm

Silt deposition at Baspa site

Fragile geology in the area

Evacuation facility

The project activity is in a hilly area and is surrounded by dense forest which had no power evacuation facility in the nearby area. The project proponent had developed a power transmission network of 55 km to evacuate power generated in the power plant. The transmission line which consists of 121 towers passes through an elevation of 2600 meters in one of the most difficult terrain. This required additional finance from the project promoter for the periodic maintenance of the facility to enable continuous evacuation of generated power.

Lack of Infrastructure

The road blockade, as a result of landslides is a common problem in the project area especially in winter. To avoid this, project proponent had an additional investment towards the development of infrastructure facilities such as strong bridges, improvement of the National Highway - 22, approach roads, storage area for resources, vehicles, office and residential colonies for labors and plant personnel. This is an added cost to the project activity and may have to be incurred by them in future for the infrastructure's regular maintenance since the project is located in rough areas which face severe climatic conditions.

1.12 Demonstration to confirm that the project was not implemented to create GHG emissions primarily for the purpose of its subsequent removal or destruction.

The hydropower project has been installed with the aim of harnessing the under-developed hydro potential of the state. The electricity generated from the project activity meets the power demand of the State (HP). Hence, it is contributes greatly toward filling the gap of demand and supply in the Northern region.

Thus, it is evident that project proponent has initiated this project with an aim to supply electricity to the grid, and not primarily for creating GHG emissions primarily for the purpose of its subsequent removal

1.13 Demonstration that the project has not created another form of environmental credit (for example renewable energy certificates).

The project has not created any other form of environmental credit.

1.14 Project rejected under other GHG programs (if applicable):

The project has not been rejected under any other GHG programs.

1.15 Project proponents roles and responsibilities, including contact information of the project proponent, other project participants:

Roles and Responsibilities:

The project promoter is ensuring operation and maintenance of all the equipments for their efficient functioning. The entire data specific to the monitoring of the project shall be recorded and the data shall be made available to the DOE during the validation and verification process by the project proponent.

The office at Kuppa is responsible for barrage control and the operation and maintenance of hydro mechanical equipment. The Sholtu office looks into the general administration along with the liasioning with various government departments. At Jhakri substation, the Joint Meter Reading (JMR) of commercial metering at inter-connection point is jointly recorded by the representatives of JHPL and HPSEB every month.

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Website: www.jhpl.com

Mr. Kanti Prasad
Site office at Sholtu, Kinnaur

Mr. D. P. Goel
Office at Kuppa, Kinnaur

1.16 Any information relevant for the eligibility of the project and quantification of emission reductions or removal enhancements, including legislative, technical, economic, sectoral, social, environmental, geographic, site-specific and temporal information.):

The project activity contributes to the sustainable development in the following manner:

Social well being:

1. Project activity has generated direct and indirect employment for skilled and unskilled manpower during construction phase as well as during operational stage and thus helped in controlling migration from the region and alleviation of poverty.

2. The project activity's contribution of power supply towards the NEWNE grid is helping in the upliftment of the social life of the people by ensuring a sustainable and reliable source of power for the region.

Economic well being:

The Project activity has improved the infrastructural facilities like water availability, road, and medical facilities etc. The Project activity brings considerable investment in the region and helps in overall development of the region via following ways:

- Roads have been built in the vicinity of the project

- Eight bridges, spanning up to maximum of 121 metres, were constructed at various locations between Wangtoo, upstream of Nathpa on NH-22 and Kuppa barrage site).

- Funds and expertise for upgrading of existing schools in the region and for developing new ones have been provided

- Health care facilities in the form of a hospital, new dispensary, doctors and medical staff as well as free medicines have been arranged by the company in the vicinity of the project for the benefit of the people of adjoining villages.

Environmental well being:

The project activity generates clean and green power thus causing negligible emissions of green house gases. If a coal or oil-fired thermal plant of the same capacity were to be built the emission of greenhouse gases would add about 12,000 tons of Sulphur oxides (SOx), 6000 tons of Nitrogen oxides (NOx), and about 2 million tons of carbon dioxide into the atmosphere each year. By building and operating the Baspa project, much pollution is avoided. The project activity has reduced the dependence on fossil fuels for power generation thus conserving the natural reserves. The project has lead to green house gas emission reduction and hence helped in mitigating climate change.

Technological well being:

The project activity has increased awareness and interest among the private players to make investments in similar areas. The technology employed in the project activity is safe and sound.

1.17 List of commercially sensitive information (if applicable):

Not Applicable

2 VCS Methodology:

2.1 Title and reference of the VCS methodology applied to the project activity and explanation of methodology choices:

The VCS methodology applied to the project activity is:

Title: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

Reference: Approved consolidated baseline methodology ACM0002/Version 08, Sectoral Scope: 1, EB 44[10]

Title: Tool to calculate the emission factor for an electricity system
Reference: Version 01.1, EB 35

Title: Tool for the demonstration and assessment of additionality
Reference: Version 05.2, EB 39

The project primarily displaces power from the NEWNE grid. Hence, the baseline calculation is carried out as per approved large scale CDM methodology ACM0002 and the emission factor as per "Tool to calculate emission factor for an electricity system", EB 35 Annex 12.

2.2 Justification of the choice of the methodology and why it is applicable to the project activity:

Applicability criteria	Project activity
This methodology is applicable to grid-connected renewable power generation project activities that involve electricity capacity additions.	The project activity is a grid connected hydro electric power project.
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.	The project activity is the installation of a new run of the river hydro power plant with an installed capacity of 300MW.
In case of hydro power plants: - The project activity is implemented in an existing reservoir, with no change in the volume of reservoir. - The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the Project Emissions section, is greater than 4 W/m^2. - 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.	- Not applicable. This is a Greenfield project. - Not applicable. This is a Greenfield project. - The project activity is constructed as a run-of-the-river hydropower project with a design for diurnal storage having a power density of 909 W/m2. The area of the reservoir is 33 ha (FSL[11]). It is a new reservoir.
The geographic and system boundaries for the relevant electricity grid can be clearly	The geographic and system boundaries for the electricity grid are clearly identified and

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

[11] Full Supply Level

identified and information on the characteristics of the grid is available;	information on the characteristics of the grid is available. The relevant electricity grid system is NEWNE grid of India. Central Electricity Authority (CEA), a central level authority for electricity in India, monitors power generation from all dispatch centres connected to the grid system. Hence, the geographic and system boundaries of the NEWNE can be clearly identified.
Applies to grid connected electricity generation from landfill gas to the extent that it is combined with the approved "Consolidated baseline methodology for landfill gas project activities" (ACM0001)	The project activity does not involve any electricity generation from landfill gas.
5 years of historical data (or 3 years in the case of non hydro project activities) have to be available for those project activities where modification/retrofit measures are implemented in an existing power plant.	The project activity does not involve any modification/retrofit measures of an existing plant.
The methodology is not applicable to the following: • Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site; • Biomass fired power plants; • 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/m2.	The project is a run-of-the–river hydro power project and not a : -Fuel switch project -Biomass fired plant -The power density of the reservoir is 909 W/m2

2.3 Identifying GHG sources, sinks and reservoirs for the baseline scenario and for the project:

	Source	Gas	Included?	Justification / Explanation
Baseline	CO_2 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	Emission from DG sets	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
	Emission of SF6 from Circuit Breaker Compartments	SF6	Yes	Main emission source
	Emissions of CH_4 from	CO2	No	Minor emission source

	the reservoir.	CH4	No	Not applicable since project is a run-of-the-river activity with a reservoir facility for diurnal storage.
		N2O	No	Not applicable since project is a run-of-the-river activity with a reservoir facility for diurnal storage.

2.4 Description of how the baseline scenario is identified and description of the identified baseline scenario:

As per the approved consolidated methodology ACM0002, version 08, since the project activity involves the installation of a new grid-connected hydro power plant, the baseline scenario is the following:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

The project activity uses the “BASELINE METHODOLOGY PROCEDURE” as described in the applied methodology.

Identification of the baseline scenario

As per the methodology If the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin (CM) calculations described in the “Tool to calculate the emission factor for an electricity system”.

Since the project activity is the installation of a new grid-connected hydroelectric power plant hence the baseline scenario is the same as described above. In the following section Combined Margin for the grid has been calculated as per “Tool to calculate the emission factor for an electricity system”

Step 1. Identify the relevant electric power system: India’s power & electricity operations are organized into two power regions, i.e. NEWNE and South. Power generation projects have traditionally been planned and implemented on the basis of the projected demand in the region and also the availability of fuel. These regional grids have independent load dispatch centres that manage the flow of power in their jurisdiction.

The NEWNE grid is managed by the Northern, Eastern, Western and North Eastern Regional Load Dispatch Centres. These Centres under the NEWNE grid have their own power generating stations as shown in the table below. The project activity is in the state of Himachal Pradesh which is connected to NEWNE Grid. Thus the NEWNE grid has been considered for estimating the grid emission factor.

NEWNE Grid Classification			
Northern	Eastern	Western	North-Eastern

Chandigarh	Bihar	Chhattisgarh	Arunachal Pradesh
Delhi	Jharkhand	Gujarat	Assam
Haryana	Orissa	Daman & Diu	Manipur
Himachal Pradesh	West Bengal	Dadar & Nagar Haveli	Meghalaya
Jammu and Kashmir	Sikkim	Madhya Pradesh	Mizoram
Punjab	Andaman- Nicobar	Maharashtra	Nagaland
Rajasthan		Goa	Tripura
Uttar Pradesh			
Uttarakhand			

The effective generation capacity of the Northern Regional Dispatch Centre is 35726[12] MW. Thermal power contributes almost half of the total power generation and hydro power more than a third. Gas power adds about 10% of the total, with nuclear and renewable energy contributing the remaining to the total. Most of the Northern region hydro power generation is snow fed having maximum generation during summer and minimum during winter. During peak summer and winter period, the Northern region is a power deficit region and the average shortage in the region during the year 2006-2007 has been 11.21% and 12.68% in terms of energy and peak MW requirements, respectively.

Step 2. Select an operating margin (OM) method

Calculation of operating margin is based on one of the four following methods:

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM.

As per the tool any of the four methods can be used however, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production.

As observed in the CEA database, Version 4, less than 20% is provided by the low cost/ must-run power sources (hydro, biomass and nuclear power), hence project proponent has chosen to calculate Simple OM.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

• Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or

• Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

Project proponent has chosen to apply ex-ante option.

[12] Annual Grid Report 2006-07, NRLDC, www.nrldc.org/grid_reports.aspx

Step 3. Calculate the operating margin emission factor according to the selected method

(a) Simple OM

The full generation weighted average for the most recent years has been considered from the Central Electricity Authority data[13].

Operating Margin

Year	tCO_2/MWh
2005-06	1.02
2006-07	1.01
2007-08	1.00
Average	1.01

In this PDD *ex-ante* vintage has been fixed and will not be changed during the crediting period.

Step 4. Identify the cohort of power units to be included in the build margin

Calculate the Build Margin emission factor $EF_{BM,y}$ *ex-ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. The data has been taken from "CDM - Carbon Dioxide baseline database[14]" published by Central Electricity authority of India.

Build Margin

Year	tCO_2/MWh
2007-08	0.60

Step 6. Calculate the combined margin emissions factor

The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

Where:

Weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$)

$EF_{grid\ OM,\ y}$ and $EF_{grid\ BM,\ y}$ is calculated as described in Steps 1 and 2 above and are expressed in tCO2/MWh.

[13] http://www.cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm

[14] http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver4.pdf

The weighted average applied by the project participants are fixed for the entire crediting period.

Combined Margin/ Grid Emission Factor

Year	tCO_2/MWh
2005-06 OM	1.02
2006-07 OM	1.01
2007-08 OM	1.00
Average OM	1.01
Build Margin, BM	0.60
Combined Margin, CM	**0.805**

Thus the grid emission factor for the project activity is 0.805 tCO_2/ MWh and is fixed for the entire crediting period.

The project activity is generation of electricity for a grid system which is also served by other fossil and non-fossil fuel based generating units. Hence, the applicable baseline methodology for the proposed project activity is the baseline in kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2e/kWh).

2.5 Description of how the emissions of GHG by source in baseline scenario are reduced below those that would have occurred in the absence of the project activity (assessment and demonstration of additionality):

The additionality of the project activity has been assessed using the "Project Test -1" of VCS 2007 which includes:

Step 1: Regulatory Surplus

The project shall not be mandated by any enforced law, statute or other regulatory framework.

The project activity is not mandated by any state or national laws[15]. The project proponent was not bound by any legislative mandate to implement the project activity.

Step 2: Implementation Barriers

The project shall face one (or more) distinct barrier(s) compared with barriers faced by alternative projects.

• Investment Barrier – Project faces capital or investment return constraints that can be overcome by the additional revenues associated with the generation of VCUs.
• Technological Barriers – Project faces technology-related barriers to its implementation.
• Institutional barriers – Project faces financial, organizational, cultural or social barriers that the VCU revenue stream can help overcome.

Institutional barrier:

The capital investment for non-conventional power projects in India is high compared to other power projects like coal, gas etc. The capital cost investment for Baspa hydro power project activity with other sources of power is tabulated below which clearly shows that cost of

[15] Electricity Act 2003, section 7

installation of hydro power projects is almost twice when compared to conventional sources of power generation.

Typical capital costs for power projects in India

Type of Power Project	Capital Cost (USD[16] Mn/MW)
Gas based	0.67
Coal based	1.00
Diesel	0.87
Wind	1.25[17]
Hydro power	1.25[18]
Baspa-Hydro	1.38 (Actual project cost)

Source: CEA report "Expert Committee Report on Fuel for Power generation".

In India arranging finances is one of the major barriers for execution of hydro power projects. The Ministry of Power[19], GoI considers financial constraint as a major road block in public private investments in this sector and this has been highlighted as the major reason for falling short of the target of hydro-electric projects during the implementation of the Eleventh Five Year National Plan.

Reasons of slippage in the capacity of hydro power

Reasons for Slippage	Capacity Slipped (MW)
Geological Surprises	510
Natural Calamities	450
Delay in award of works	823
Delay in MoEF clearance	400
Investment decision/ Funds tie up constraints/ delay in financial closure	1400
Delay in Preparation of DPR & signing of MOU with state govt	400
R&R issues	400
Court Cases	675
Total	**5058**

As seen from the table above, maximum number of slippages in the capacity resulted due to financial problems. Thus, it can be concluded that financial assistance[20] plays a crucial role in the smooth implementation of hydro projects.

[16] @ 1 USD = 40.00 INR

[17] http://www.indiatodaygroup.com/btoday/20060521/features1.html

[18] Report of the Working Group on Power for Eleventh Plan, Ministry of Power

[19] Report of the Working Group on Power for Eleventh Plan, Ministry of Power, Page 18

[20] http://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

Financial closure of the 192MW Allain Duhangan Hydro power project in Himachal Pradesh faced several difficulties

Similarly, the project promoter, JHPL faced considerable problems in arranging finance for the project. The project activity was conceptualized in the early 1990's, at a time when setting up large hydro power projects was not common in India and funding for such projects was almost non-existent. Domestic financial institutions were also wary of lending money to companies due to long gestation periods, substantial capital outlay, geological barriers, and the unpredictable time of the positive returns from projects. Further, around the same time, power was predominantly generated by SEB's and no private sector organization had ventured into the project implementation of such a scale. Given this background, the project promoters having confidence in the project decided to move ahead their project with their own equity.

The project received the approvals for MoEF and TEC Clearances to initiate the project by 1994 but a project of such a magnanimous scale required funding from financial institutions. Hence the project promoters approached various major banks to raise loan for the project such as IFCI, IDBI, LIC, PFC etc. However looking at the risk factors involved relating to long gestation period, cost overruns, hydrology, water availability, earthquakes etc, no bank was willing to sanction funds for the project. After much efforts and convincing, IFCI agreed to appraise the project in 1995, following which some other banks agreed to sanction loan to the project. But before the disbursement of this assistance, the financial institutions laid down certain pre-disbursement conditions. These conditions were laid to provide a financial security to the lenders and IFCI had agreed to sanction the largest component of the loan at that time. The conditions were:

1. Mortgage security
2. Payment through Escrow mechanism State/ Sovereign Bank Guarantee
3. Execution of the PPA with the State Government

A unique feature of this debt component was that the escrow mechanism was fairly unknown to most organizations and was just finding its way into the market almost a decade ago, yet the project promoters agreed to this condition. The second crucial requirement was to have the Power Purchase Agreement between JHPL and HPSEB in place. This was a major challenge for HPSEB as they had to sign the PPA upfront for a period of 40 years. HPSEB had never entered into such an agreement earlier with any company, and this required addressing and understanding the issues for the project's life span of 40 years. To make it more difficult for the promoters, the government changed in between and the PPA was delayed further. It took nearly two and a half years for the promoters to the sign the PPA in 1997.

By this time, the project cost had increased considerably from the original cost of Rs. 1102 crores to Rs. 1263 crores and the entire share of equity had been spent by the project promoters. With work underway at the site, the project promoters had to immediately approach new lenders to sanction the money. At this point, to re-instate the faith in the debtors for their project, the project participants raised an equity component for their project. ICICI Bank was the only bank which agreed to contribute the said equity based on certain conditions. The remaining capital granted to the project promoters was subject to the conditions discussed above.

Further in the year 2000, flash floods hit the site and disrupted the communication and transportation links to site delaying the project by a period of 15 months. During this period the cost overran by Rs. 267 crores and the financial package was revised to Rs. 1620 crores. Once again, the project promoters had to invite banks to sanction loan for their project with much difficulties. However, it was only on the basis of the lead taken by IFCI and their appraisal report, some banks came forward to grant loan to the project.

To encourage private sector participation in the power sector in the early 1990's[21], ideally 80% of the project cost must form the debt component of the project and 20%, the equity. However this was another factor which went against the project promoters. For Baspa hydro power project 30% of the total capital formed the equity for the project and 70% was contributed by the lenders with much difficulties. Thus it may be concluded arranging long-term finance for Baspa hydro power project was a tedious and cumbersome process.

Step 3: Common Practice

The project activity is the largest hydro under Independent Power Producers (IPPs) in India. An analysis of total power generated in India and Northern region shows that there are not many large scale hydro power projects promoted by private players, hence it is one of its kind in the region. The analysis is tabulated below.

Hydro power scenario for India, Northern region and Himachal Pradesh as on 31-03-2004

	Total Installed Capacity	Total Installed Hydro		Hydro			
		MW	%	Private sector		Govt. Sector	
				MW	%	MW	%
India	112683.47	29506.83	26.18	906.15	3.07	28600.68	96.93
Northern Region	31089.58	10588.39	34.05	390.2	3.68	10198.19	96.31

Source: Based on data published by Central electricity Authority (CEA), India[22]

A potential of 84000 MW was identified across India in 2004 and a 30000 MW potential for the Northern region by the Central Water Commission[23]. Of the Northern region potential, Himachal Pradesh alone had a potential of 11647 MW of which only 2545 MW (21% only) had been tapped till 2004. As seen from the table above, against the potentials identified the total installed capacity of hydro power projects in India was 29507 MW as on 31st March 2004. Against this, the private sector operated hydro projects in operation across India was 906 MW, which gives an insight of the contribution of private sector hydro power in the total hydro power generation at 3.07%, which is almost negligible.

Thus, it is evident that the installed capacity has been predominantly thermal based (69.19%) and only 26.18% is hydro since thermal power plant give higher returns on investment and there is availability of easy project finance.

The Baspa hydro power project is the first initiative by the private sector in India. Being a first of its kind in the region to implement a run-of-the-river hydro power project, the promoters faced multiple barriers relating to geological and technology which have been discussed earlier. The project activity consists of three prime components: Power house at Kuppa, the barrage and the substation at Jhakri.

The barrage is constructed at an elevation of 2600 m in a difficult terrain. The altitude at which it is constructed is not a usual practice for a run-of-the river barrage and this is the first such construction in the region. Further the construction activity took place in a filled stratum of rock, unlike the practice of constructing it in relatively loose soil. This was done to

[21] The Gazette of India, MNES

[22] http://www.cea.nic.in/power_sec_reports/general_review/0304/chap-2.pdf

[23] http://cwc.nic.in/Water_Data_Pocket_Book_2006/T8.3final.pdf

maintain a floating structure, and prevent seepage of water and soil particles so as to cause minimum wear and tear of the structure.

Another unique feature of this project which is not a common practise is the construction of a 55km long transmission line from the powerhouse at Kuppa to the substation at Jhakri. Prior to implementation of the Baspa project no other project promoter had built such a long transmission line of 440 kV in the region. Until the Electricity Act, 2003 the private sector had no access to laying down the transmission line network and this was only under the purview of the Government of Himachal Pradesh. However, since the project was close to completion and power generated would need to be evacuated, the promoters built the transmission line. This required immense morale support from the PP's end as this was executed in one of the most difficult terrain for a hydropower project.

In an area with extreme climatic conditions and abrupt changes in weather, this commendable effort required fine-tuned planning, expertise and execution of the plan in a proper and effective manner by the project promoter. Eight bridges and 121 towers were built apart from proper infrastructure and logistics for the movement of machinery, heavy equipments, raw materials, personnel and labors. In addition, all the electromagnetic and hydraulic equipment for the project was developed by the in-house expertise of JHPL unlike most proponents who import such machinery.

Thus, though hydro-power is a common practice in the region, but the fact that it is the first successful private sector project in India despite all the barriers it faced makes it a unique project in the region. In addition the project is a pace-setter and has set ground for new hydro power projects to come up in the region by improving the logistics and overcoming all odds.

Summary:

Based on the discussion points above, it is prudent to conclude that the project is additional. Despite the implementation delays due to lack of infrastructure, arranging long term finance for the project, increased capital costs, hydrological barriers, difficult geology and technical challenges the project activity work progressed and was commissioned, making it the first large scale project to be executed by a private sector company in India.

Key Milestones of Baspa Hydropower project:

MoU signing with GoHP – November 1991
Implementation Agreement – October 1992
MoEF Clearance – December 1993
Techno-Economic Clearance - April 1994
Power Purchase Agreement – June 1997
Commercial Operation of project – June 2003

3 Monitoring:

3.1 Title and reference of the VCS methodology (which includes the monitoring requirements) applied to the project activity and explanation of methodology choices:

The monitoring methodology applied to the project activity is:

Title: "Consolidated monitoring methodology for grid-connected electricity generation from renewable sources"

Reference: Approved consolidated monitoring methodology ACM0002/Version 08, Sectoral Scope: 1, EB 44

3.2 Monitoring, including estimation, modelling, measurement or calculation approaches:

The purpose of monitoring the project is to assess the annual emission reductions in tonnes of CO_2 that the project activity has achieved.

Emission Reduction Estimation: $ER_y = BE_y - PE_y - L_y$

Baseline Emission calculation:

Parameters	UoM	Value
Capacity	MW	300
Running hours	per day	24
Working days	per year	365
PLF	%	50%
Auxiliary consumption	%	0.5%

Gross power generation in a year by the project activity: 300*24*365*.50 = 1314000 MWh

Auxiliary power consumption in a year by the project activity: 1314000*0.5% = 6570 MWh

Net power generation in a year by the project activity: 1314000-6570 = 1307430 MWh

Combined Margin Grid Emission Factor = 0.805 tCO2/MWh (for actual calculation, the latest available data and the data for the corresponding year will be used to calculate the baseline emissions)

The baseline emission for the project activity is calculated as follows:

BE_y= 1307430 MWh × 0.805 tCO_2/MWh = 1052481 tCO_2/year

Project emission:

The project emission includes the CH_4 emission from the reservoir. Since the project activity is a run-of-the-river project with a reservoir facility for diurnal storage, the calculation for project emissions as per the methodology is as follows:

Parameters	UoM	Value
Capacity	MW	300
Running hours	per day	24
Reservoir area	ha	33

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

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 reservoir is a newly installed facility and does not result in the increase of existing reservoirs, Cap_{BL} and A_{BL} can be assumed to be zero. The reservoir area is 33 ha (FSL).

Thus,

$$PD = \frac{Cap_{PJ}}{A_{PJ}}$$

$$= \frac{300*1000*1000}{33*10000}$$

$$= 909 \text{ W/m2}$$

As per the methodology if the power density (*PD*) of the power plant is greater than 10 W/m2 then the project emissions are zero.

Hence the project emissions are PE_y=0.

However, there are possible sources of project emissions at the site which are discussed below.

1. Diesel consumption in the DG sets at the site.

The records are made on a daily basis in the DG operation logbook. There are two 625 KVA capacity DG sets of Cummins India Limited make. This has been included in the project emission calculation from the project activity. The basis for calculation is the values of density of diesel and emission factor for diesel. PE_{y1} is the project emission from the DG sets.

$$PE_{y1} = Q_{diesel} \times \ell_{diesel} \times EF_{diesel} / 1000$$

Where

Q_{diesel} = Quantity of diesel consumed, litre

ℓ_{diesel} = Density of diesel, 0.860 kg/ litre[24]

EF_{diesel} = Emission factor of diesel, 3.186 tCO2e/ tonne (IPCC Default value)

and

$$EF_{diesel} = NCV_{diesel} \times COEF_{diesel}$$

Where;

NCV_{diesel} = Net calorific value of diesel; TJ/ 10^ tonne (43.0 - IPCC default)[25]

[24] http://www.iocl.com/Products/DieselSpecifications.pdf, page 1, sl.no. xiv. Maximum value of density i.e. 0.860 kg/ l has been considered for the conservative estimation of project emissions for diesel combustion.

$COEF_{diesel}$ = Effective CO2 emission factor of diesel; tCO2e/ TJ (74.1 - IPCC default)

2. 22 kV Transmission line

The project site at Sholtu is connected via a 22 kV line which supplies power from the HPSEB substation to the site to meet the daily electricity requirements. The reading is measured by the energy meters at the substation and monthly invoices are used to account for the project emissions. PE_{y2} is the project emission from the 22 kV line which is used for supplying electricity at the site.

$PE_{y2} = E_{22\ kV} * EF_{grid} / 1000$

Where
$E_{22\ kV}$ = Electricity consumed at the site in kWh
EF_{grid} = Grid Emission Factor for NEWNE Grid

3. Emissions of SF6

At the project site the PP stores some quantity[26] of SF6 required to top up the circuit breaker compartments in case of any pressure drop. PP would monitor the quantity of SF6 filled into the circuit breaker compartments from the storage cylinders during monitoring period and would account for project emissions.

$PE_{y3} = Q_{SF6} \times GWP_{SF6}$

Where
Q_{SF6} = Quantity of SF6 topped up from cylinders into circuit breaker compartments; tonnes
GWP_{SF6} = Global Warming Potential of SF6 (23900)

Thus Project Emissions $PE_y = PE_{y1} + PE_{y2} + PE_{y3}$

Leakage:
As specified in ACM0002, *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 (for hydroelectric projects – see applicability conditions above).*

Hence project participants do not need to consider leakage in applying this methodology.

Thus $L_y = 0$

Emission reduction calculation:

Emission reduction is calculated as follows:

$$\boxed{ER_y = BE_y - PE_y - L_y}$$

[25] Source of IPCC default value: 2006 IPCC guidelines for National GHG Inventories - Table 1.2 for NCV value of diesel, and Table 1.4 for effective CO2 emission factor for diesel

[26] The PP stores 5 number of SF6 cylinders at the site. The quantity of SF6 in the four cylinders is 38.4 kg each and the quantity in the fifth cylinder is 590 kg.

3.3 Data and parameters monitored / Selecting relevant GHG sources, sinks and reservoirs for monitoring or estimating GHG emissions and removals:

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net Electricity supplied to the grid by the project activity during the year y
Source of data to be used:	Joint Meter Reading (JMR) by SEB
Value of data applied for the purpose of calculating expected emission reductions	1307430
Description of measurement methods and procedures to be applied:	For the measurement of net energy delivered to the grid, two transmission lines are provided. Each transmission line has a set of main meter and check meter. The meters are capable of metering export and import data separately. The net electricity delivered to the grid would be the difference of export and import energy. The JMR Readings form the basis for calculation of the emission reductions. The JMR Readings taken at the HPSEB substation are taken in the presence of SEB officials and the PP representative. Monitoring Frequency: Monitoring is continuous with monthly recording of data.
QA/QC procedures to be applied:	The main meters and the check meters are maintained and calibrated annually. During monthly monitoring of energy delivered, if the difference between the respective main meter and check meter exceeds the maximum error for such meters then both meters shall be tested in turn. During testing, if both the meters are found to be working beyond the permissible limits of error, then the energy delivered for the previous billing month shall be corrected to account for this error. The meters shall be calibrated or replaced with spare meters immediately. During annual calibrations, if the main meter is found to be within the permissible limits of errors, and the check meter is found to be beyond the permissible limits of errors, the main meter shall be used for energy delivered. In case, during the annual tests, the main meter is found to be beyond the permissible limit of error but check meter is found to be within the

	permissible limit of error, then check meter reading shall be used for energy delivered. In case, during annual tests, both, the main meter and the check meter are found to be beyond the permissible limit of error, then the meters shall be replaced with spare set of calibrated meters. The energy delivered for this period (from the date of last calibration) shall be corrected for the maximum error in meters.
Any comment:	-

Data / Parameter:	$\mathbf{Q_{SF6}}$
Data unit:	tonne
Description:	Quantity of SF6 loss during the year y
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions	0
Description of measurement methods and procedures to be applied:	SF6 is stored in cylinders[27] at the project site and are used to top up the circuit breaker compartments in event of pressure drop inside. The quantity of SF6 thus filled into the system shall be estimated based on difference in cylinder weight before and after any such topping up. The PP will install an electronic balance by March 2009 which will be used to weigh the cylinders. Monitoring Frequency: Annually
QA/QC procedures to be applied:	The cylinders are weighed on spring balance. The spring balance is calibrated annually with standard weights. The balance can weigh two tonnes and has a least count of 20 kgs. In-case of error in the balance, the actual weight is the difference between the observed weight and the error. The PP shall continue to weigh the cylinders with the spring balance till the proposed electronic balance is installed by the PP by June 2009. This electronic meter will be calibrated annually.
Any comment:	-

Data / Parameter:	$P_{\mathbf{BAY\ VT}}$

[27] The PP stores 5 number of SF6 cylinders at the site. The quantity of SF6 in the four cylinders is 38.4 kg each and the quantity in the fifth cylinder is 590 kg.

<table>
<tr><td>Data unit:</td><td>bar</td></tr>
<tr><td>Description:</td><td>SF6 gas pressure in the BAY VT</td></tr>
<tr><td>Source of data to be used:</td><td>Measured</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions</td><td>3.05 (at 20 Degree C)</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The pressure of SF6 of the bay is annually checked with the help of a Digital pressure indicator (DPI-700) instrument. If the value of pressure is found to be below 3.05, it will require topping up.

Monitoring Frequency: Daily monitoring with monthly records or when abnormalities are observed.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The correctness is checked on the site on an annual basis.

DPI-700 is a hand held instrument and is checked at site before measurement of the gas pressure of the bay.

The correctness of DPI-700 is checked by measuring the pressure of SF6 Gas Cylinder and comparing it with the pressure measured by the built-in dial gauge of the filling machine.

<table>
<tr><td colspan="2">Details of the SF6 Calibration Equipment</td></tr>
<tr><td>DPI-700</td><td>Pressure Dial Gauge</td></tr>
<tr><td>Make: Druck Limited</td><td>Make: Wika</td></tr>
<tr><td>Range: 0-20 bars</td><td>Range: 0-25 bars</td></tr>
</table>
</td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

Data / Parameter:	$P_{breaker}$
Data unit:	bar
Description:	SF6 gas pressure in the Breaker
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions	4.95 bar (at 20 Degree C)
Description of measurement methods and procedures to be applied:	The pressure of SF6 of the breaker is annually checked with the help of a Digital pressure indicator (DPI-700) instrument. If the value of pressure is found to be below 4.95, it will require topping up. Monitoring Frequency: Daily monitoring with monthly records or when abnormalities are observed.
QA/QC procedures to be applied:	The correctness is checked on the site on an annual basis.

<table>
<tr><td></td><td>DPI-700 is a hand held instrument and is checked at site before measurement of the gas pressure of the bay.

The correctness of DPI-700 is checked by measuring the pressure of SF6 Gas Cylinder and comparing it with the pressure measured by the built-in dial gauge of the filling machine.

<table><tr><th colspan="2">Details of the SF6 Calibration Equipment</th></tr><tr><td>DPI-700</td><td>Pressure Dial Gauge</td></tr><tr><td>Make: Druck Limited</td><td>Make: Wika</td></tr><tr><td>Range: 0-20 bars</td><td>Range: 0-25 bars</td></tr></table></td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

<table>
<tr><td>Data / Parameter:</td><td>$P_{\mathbf{feeder}}$</td></tr>
<tr><td>Data unit:</td><td>bar</td></tr>
<tr><td>Description:</td><td>SF6 gas pressure in the Feeder</td></tr>
<tr><td>Source of data to be used:</td><td>Measured</td></tr>
<tr><td>Value of data applied for the purpose of calculating expected emission reductions</td><td>4.55 bar (at 20 Degree C)</td></tr>
<tr><td>Description of measurement methods and procedures to be applied:</td><td>The pressure of SF6 of the feeder is annually checked with the help of a Digital pressure indicator (DPI-700) instrument. If the value of pressure is found to be below 4.55, it will require topping up.

Monitoring Frequency: Daily monitoring with monthly records or when abnormalities are observed.</td></tr>
<tr><td>QA/QC procedures to be applied:</td><td>The correctness is checked on the site on an annual basis.

DPI-700 is a hand held instrument and is checked at site before measurement of the gas pressure of the bay.

The correctness of DPI-700 is checked by measuring the pressure of SF6 Gas Cylinder and comparing it with the pressure measured by the built-in dial gauge of the filling machine.

<table><tr><th colspan="2">Details of the SF6 Calibration Equipment</th></tr><tr><td>DPI-700</td><td>Pressure Dial Gauge</td></tr><tr><td>Make: Druck Limited</td><td>Make: Wika</td></tr><tr><td>Range: 0-20 bars</td><td>Range: 0-25 bars</td></tr></table></td></tr>
<tr><td>Any comment:</td><td></td></tr>
</table>

Data / Parameter:	$\mathbf{Q_{diesel}}$

Data unit:	Litre
Description:	Quantity of diesel consumed during the year y
Source of data to be used:	Measured
Value of data applied for the purpose of calculating expected emission reductions	0
Description of measurement methods and procedures to be applied:	For measuring diesel consumption, a level gauge has been provided on the fuel injection tank of each DG set.
QA/QC procedures to be applied:	The D.G. sets (2 x 625 KVA) have static graduated level gauges on the fuel injection tanks. Graduations on the level gauge have been marked by pouring diesel in tank using standard measuring jar (the capacity of the jar is 5 litres and the graduations on the tube are also having graduations of 5 litres). The level of the graduated glass tubing on the tank corresponds to the diesel level and the consumption is regularly recorded in the log book and can be verified. Monitoring Frequency: Daily monitoring with monthly recording of data.
Any comment:	There are two tanks of 320 litres (80 cm tank height) and 280 litres (75 cm tank height) respectively. The DG sets are of Cummins India Limited make. The diesel is procured centrally from the store and is drawn on requisition for DG sets. Diesel consumption and running hours of the DG sets (on an average 10 hours daily) are recorded daily in the log-books. The consumption may be verified with the log books.

Data / Parameter:	$E_{22\ kV}$
Data unit:	kWh
Description:	Electricity consumed during the year y
Source of data to be used:	Monthly HPSEB invoices/ bills
Value of data applied for the purpose of calculating expected emission reductions	1856 kWh (Average value based on historical data from Jan 2007 – September 2008)
Description of measurement methods and procedures to be applied:	The energy meter at the substation is used to measure the reading. Monitoring Frequency: Daily monitoring with monthly records by SEB.
QA/QC procedures to be applied:	The meters are calibrated on a periodic basis by HPSEB.
Any comment:	-

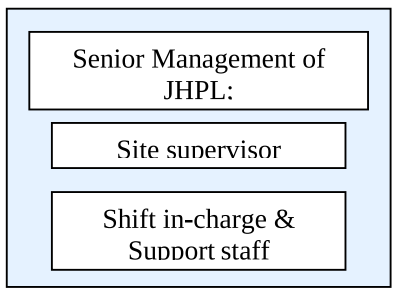
3.4 Description of the monitoring plan

Project Management Plan:

A project team is constituted with participation from relevant departments at the site. It is comprises of personnel at the Kuppa barrage, and the Sholtu office. This team is responsible for data collection and archiving. They meet periodically to review the project activity, and check the data collected, etc. The Kuppa office is responsible for barrage control and the operation and maintenance of hydro mechanical equipment. The Sholtu office looks into the general administration along with the liaisoning with various government departments viz civil administration, horticulture etc and is overall incharge of the Baspa plant along with the barrage, transmission lines and co-ordination with HPSEB. At the Jhakri substation, the JMR of commercial metering at inter-connection point is jointly recorded by the representatives of JHPL and HPSEB every month.

The JMR reports are checked and discussed by the senior team members/managers periodically. In case of any irregularity observed by any of the team member, it is informed to the concerned person for necessary actions. The project site also has a digital system SCADA for the overall monitoring of the project.

The management structure is as given in the diagram below:



Senior Management of JHPL/Technical Head: Overall responsibility of compliance with the Project activity monitoring plan.

Site Supervisor: Responsibility for completeness of data, reliability of data (calibration of meters), and monthly report generation.

Shift In-charge: Responsibility of daily generation

Data Monitoring:

The methodology requires monitoring of the following:

- Electricity generation from the project activity;

All the main meters and check meters are tested by a reputed agency on a periodic basis. Incase of any faulty readings observed appropriate corrective action will be taken. If the error is found to be beyond the permissible limits, the PP will inform the respective agency so as to immediately rectify the error in the instrument.

Metering System:
The project activity comprises of two transmission lines for energy exported to the grid. Each transmission line has a main meter and a check meter, which are calibrated annually. These are tri-vector meters of Secure make with digital display and are of 0.2 accuracy class. There is a separate import meter for the 22kV line which is used to supply power to the Sholtu site. This meter is under the purview of HPSEB and is maintained by them.

Completeness and Reliability:
The project activity has installed the latest state-of-art monitoring and control equipment that measure, record, report, monitor and control various key parameters. Real time data monitoring by SCADA takes place using these control system. All the monitoring equipments undergo the process of regular meter testing and calibration as under Section 3.3.The JMRs for the power exported from the project activity and the HPSEB bills/ invoices of the 22 kV line are used to validate the data accuracy.

Frequency:
The frequency is as explained in section 3.3.

4 GHG Emission Reductions:

4.1 Explanation of methodological choice:

Baseline calculation:
The project activity is generation of electricity using Hydro potential energy and exporting the same to the NEWNE grid system. For the baseline determination, project participants account CO_2 emissions from electricity generation in fossil fuel fired power that is displaced due to the project activity calculated as follows:

$$\boxed{BE_y = EG_y \times EF_{grid,CM,y}}$$

Where,
BE_y = Baseline emissions in year y (tCO2/yr).
EG_y = Electricity supplied by the project activity to the grid (MWh).
$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using the latest version of the "Tool to calculate the emission factor for an electricity system".
It has been calculated and fixed ex-ante in the PDD (value applied = 0.805 tCO2/MWh).

Project emission calculation:
The project emission includes the CH_4 emission from the reservoir. Since the project activity is a run-of-the-river project with a reservoir with a power density of 909 W/m2, so project emission PE_y=0.

However, there are possible sources of project emissions at the site which are discussed below.

1. Diesel consumption in the DG sets at the site.

The records are made on a daily basis in the DG operation logbook. This has been included in the project emission calculation from the project activity. The basis for calculation is the values of density of diesel and emission factor for diesel. PE_{y1} is the project emission from the DG sets.

$PE_{y1} = Q_{diesel} \text{ x } \ell_{diesel} \text{ x } EF_{diesel} / 1000$

Where
Q_{diesel} = Quantity of diesel consumed, litre

ℓ_{diesel} = Density of diesel, 0.860 kg/ litre[28]
EF_{diesel} = Emission factor of diesel, 3.186 tCO2e/ tonne[29] (IPCC Default value)

2. 22 kV Transmission line

The project site at Sholtu is connected via a 22 kV line which supplies power from the substation of HPSEB to the site to meet the daily electricity requirements. The reading is measured by the energy meters at the substation and monthly invoices are used to account for the project emissions. PE_{y2} is the project emission from the 22 kV line which is used for supplying electricity at the site.

$PE_{y2} = E_{22\,kV} * EF_{grid} / 1000$

Where
$E_{22\,kV}$ = Electricity consumed at the site in kWh
EF_{grid} = Grid Emission Factor for NEWNE Grid

3. Emissions of SF6

At the project site the PP stores some quantity[30] of SF6 which may be required to top up the circuit breaker compartments in case of any pressure drop. PP would monitor the quantity of SF6 filled into the circuit breaker compartments from the storage cylinders during monitoring period and would account for project emissions.

$PE_{y3} = Q_{SF6} \times GWP_{SF6}$

Where
Q_{SF6} = Quantity of SF6 topped up from cylinders into circuit breaker compartments; tonnes
GWP_{SF6} = Global Warming Potential of SF6 (23900)

Thus the total Project Emissions $PE_y = PE_{y1} + PE_{y2} + PE_{y3}$

Leakage:
As specified in ACM0002, *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 (for hydroelectric projects – see applicability conditions above).*

Hence project participants do not need to consider leakage in applying this methodology.

Thus $L_y = 0$

Emission Reduction Calculation:
The project activity mainly reduces carbon-di-oxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. The emission reductions ER_y by the project activity during a given year y is the difference between baseline emissions (BE_y), project emissions (PE_y) and emissions due to leakage (L_y) as follows.

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[28] http://www.iocl.com/Products/DieselSpecifications.pdf, page 1, sl.no. xiv. Maximum value of density i.e. 0.860 kg/ l has been considered for the conservative estimation of project emissions for diesel combustion.

[29] Source of IPCC default value: 2006 IPCC guidelines for National GHG Inventories - Table 1.2 for NCV value of diesel, and Table 1.4 for effective CO2 emission factor for diesel.

[30] The PP stores 5 number of SF6 cylinders at the site. The quantity of SF6 in the four cylinders is 38.4 kg each and the quantity in the fifth cylinder is 590 kg.

$ER_y = BE_y – PE_{y1} – PE_{y2} – PE_{y3} - L_y$

4.2 Quantifying GHG emissions and/or removals for the baseline scenario:

The baseline emission for the project activity is calculated as follows:

BE_y= 1307430 MWh × 0.805 tCO_2/MWh = 1052481 tCO_2/year

Year	Estimation of baseline emissions (tCO2e)
2006*-2007	1052481
2007-2008	1052481
2008-2009	1052481
2009-2010	1052481
2010-2011	1052481
2011-2012	1052481
2012-2013	1052481
2013-2014	1052481
2014-2015	1052481
2015-2016	1052481
Total (tonnes of CO2e)	10524810

*1st April – 31st March every year

4.3 Quantifying GHG emissions and/or removals for the project:

Year	Estimation of project activity emissions (tCO2e)	Estimation of leakage (tCO2e)
2006*-2007	17.93	0
2007-2008	17.93	0
2008-2009	17.93	0
2009-2010	17.93	0
2010-2011	17.93	0
2011-2012	17.93	0
2012-2013	17.93	0
2013-2014	17.93	0
2014-2015	17.93	0
2015-2016	17.93	0
Total (tonnes of CO2e)	**179.29**	0

*1st April – 31st March every year

4.4 Quantifying GHG emission reductions and removal enhancements for the GHG project:

Year	Estimation of project activity	Estimation of baseline	Estimation of leakage	Estimation of overall

	emissions (tCO2e)	emissions (tCO2e)	(tCO2e)	emission reductions (tCO2e)
2006*-2007	17.93	1052481	0	1052463.22**
2007-2008	17.93	1052481	0	1052463.22
2008-2009	17.93	1052481	0	1052463.22
2009-2010	17.93	1052481	0	1052463.22
2010-2011	17.93	1052481	0	1052463.22
2011-2012	17.93	1052481	0	1052463.22
2012-2013	17.93	1052481	0	1052463.22
2013-2014	17.93	1052481	0	1052463.22
2014-2015	17.93	1052481	0	1052463.22
2015-2016	17.93	1052481	0	1052463.22
Total (tonnes of CO2e)	**179.29**	10524810	0	**10524632.21**

*1st April – 31st March every year
**1052463.22 ~ 1052463

5 Environmental Impact:

The host party for the project activity is India. At the time when Baspa project was implemented, there was no specific requirement of prior consideration of an EIA study for large hydro power projects as per MoEF guidelines. However, in order to receive financing for the project, it was a requirement of the lenders to have an EIA study conducted for this project. Hence it was necessary for JHPL to carry out an EIA study which was done by a well- known organization, NEERI (National Environmental Engineering and Research Institute) in 2002. In addition, another study for the purpose of a social audit was done by Sharnam Seva Samiti in the year 2007. The environmental studies were undertaken to study the impacts of project activity on environment. The environmental impacts associated with the project activity are as follows:

Air and Noise environment: The air quality and noise levels were assessed at different stations in the project area. All stations recorded SPM concentration below the central pollution board standard. The levels of gaseous air pollutants, viz. SO_2 and NO_2 were below the detectable limit of 6 $\mu g/m^3$. The noise levels for the residential area were in the range of 40 to 50 dBA and in sensitive areas i.e. schools and hospitals were in the range of 40 to 45 dBA and are well within the Central Pollution Control Board standards for residential and sensitive areas.

Water environment: The water quality of Baspa River for physical, chemical and heavy metal concentration is within permissible limits as per CPCB standard. There is no organic pollution as no major sources of domestic or industrial discharge in the river. Bacteriological quality of ground water sources does not show faecal contamination.

Land environment: The total land required for various activities of the project is 65.1584 ha and include forest land (44.1795 ha), Govt. land (7.0675 ha) and private land (13.9111 ha). The forest land to be utilised does not cover extensive forest or trees or endangered species.

Biological environment: The project activity does not cause any significant disturbance to the ecosystem. The plant species of the project area are neither endemic nor rare and endangered. There are no any significant adverse impacts of the project activity on wildlife, mammals, reptiles and migratory birds in the project area. Further, Rukcham-Chitkul wildlife sanctuary is located at 5 km off the Baspa site and does not have any adverse impact on the sanctuary due to the project activity. The baseline status of the aquatic environment with reference to flora and fauna in the Sutlej has been studied. The Shannon diversity Index and Palmer's pollution Index values show that the river water is not polluted with sub-optimal levels of nutrients.

Socio-economic environment: The impact of construction on local labour force availability is highly significant. Increased income resulted in increased imports of labourers to the area and further income was generated by servicing the workforce. The construction of the power project triggers an all-round increase in development activities such as housing, transport and education and those have significant positive impact on the life style of the population. In sum the overall impact of the project on the socio-economic environment is expected to highly beneficial and positive.

Summary:

The work on the Environmental Management Plan (EMP)as per the NEERI report for the project is ongoing. The project proponent has sanctioned Rs. 20 crores to GoHP as per the CAT Plan and along with the GoHP officials has undertaken efforts to re-vegetate the area. Almost 50% of the compensatory afforestation work is completed with a survival rate of 75-80% of the plants. The project proponent has constructed cement walls along the side of the river banks and roads to stabilize the area and prevent erosion. The PP has also installed an effluent treatment plant at the Sholtu site to treat the domestic wastewater from colonies before discharging it into the river. The PP also maintains a flow of 5 cusecs while releasing the water to maintain the downstream flow as per the Power Purchase Agreement. Thus it may be concluded that the project promoters have made judicious efforts to cause minimal impacts on the surrounding environment and to maintain the natural balance.

6 Stakeholders comments:

A detailed stakeholder consultation process has been conducted by JHPL. A well known NGO, Sharnam Sewa Samiti, Uttar Pradesh, India has conducted the detailed social audit[31] in 2007. Prior to this, NEERI had conducted a public meeting with the stakeholders.

The stakeholders identified for the project activity are as follows:

1. Local People
2. Gram Panchayat members of seven villages directly coming under the purview of the project
3. District and state level government officials
4. NGO representatives
5. Representatives of JHPL

A public meeting was organised at PWD rest house, Karcham by the project proponent with the assistance of NEERI. The discussions mainly aimed at–

1. Significant impact in the region due to the project
2. Possible impacts in the long run
3. To understand stakeholder perceptions
4. Stakeholder awareness of project related issues

The comments received from the stakeholders have been summarized below:

[31] Baspa Hydro Eelectric Project, Stakeholder Consultation and Impact Assessment. The detailed report on the consultation is available for validation. This study was done in addition to the EIA conducted by NEERI, which was not a mandatory requirement by MoEF at that time.

- The entire mountainous belt, right from Jammu and Kashmir to the North East, is fragile in nature and therefore any human activity is bound to result in some changes. However such impacts take a long time to appear and good compensatory practices may contribute in mitigating the impacts.
- It was also proposed that especial Ecological Task Force would be setup in the region to undertake compensatory afforestation related works. One such Task Force is already stationed in the State and the survival rate of plants is recorded to be nearly 80%.
- The construction of Baspa project and continuous operation included local manpower working at the same plant site. Since, the project provided good direct and indirect employment opportunities the local populace is encouraging and providing complete support to the project activity.
- The presence of the project has also ensured that the roads, even during heavy snowfall, are cleared immediately. Thus the accessibility to and from the village has improved significantly.
- The project does not require any major displacement of local population. The project activity has acquired land from local population and local population have been given compensation for this. So project activity has not received any adverse comment from their side.
- Infrastructure development in the local area due to the project activity is leading to enhancement of quality of life for the people.
- That there are no apparent trends to indicate that the project has resulted in adversely affecting the livelihood, health, availability of water and other necessities of life in the region.

No major issue which would affect the life of the local community or raise any environment related problems in the region by the implementation of the project activity were identified during the discussion with stakeholders. All the minor issues were addressed and also the concerned departments are keeping a tight vigil for assessing any changes likely that may take place.

The stakeholder issues are of prime concern and in general, the PP ensures that the project activity should not impact the stakeholders in the area. The PP has a transparent mechanism of ensuring that all stakeholder issues are addressed. A stakeholder may approach the senior official at the site (General Manager) to address his concerns. The official will make all efforts to clear the issues with the stakeholder, however if it not addressed satisfactorily to his/ their level, then the PP will appoint a team to conduct an in-depth study of the concern and an action must be taken.

7 Schedule:

The chronological plan for the project activity is as follows:

MoU signing with GoHP – November 1991
Implementation Agreement – October 1992
MoEF Clearance – December 1993
Techno-Economic Clearance - April 1994
Power Purchase Agreement – June 1997
Commercial Operation of project – June 2003
VCS Crediting period start date: 1st April 2006
Duration of crediting period: 10 years fixed
Lifetime of the project: 40 years

The PP will monitor the parameters as explained in Section 3.3. The PP plans to conduct annual verifications to quantify the emission reductions (VCUs) from the project activity and report them in a transparent manner.

8 Ownership:

8.1 Proof of Title:

For the ownership details of the Baspa project following may be referred:

1. Annual report 2007-08 of the company http://www.jhpl.com/communication/AnnualReport2007-08.pdf , page 10
2. Project Proponent's Website link: http://www.jhpl.com/
3. Power Purchase Agreement (PPA) between Himachal Pradesh State Electricity Board (HPSEB) and Jaiprakash Hydro Power Limited (JHPL)
4. Reappraisal Report for sanction of loan to the Baspa project by The Industrial Finance Corporation of India Ltd (IFCI)
5. Commissioning certificates
6. Purchase Orders

8.2 Projects that reduce GHG emissions from activities that participate in an emissions trading program (if applicable):

Not Applicable