



## Voluntary Carbon Standard Project Description Template

19 November 2007

[10/08/2008]

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## 1 Description of Project:

### 1.1 Project title

**Title:** Vishnuprayag Hydro-electric Project (VHEP) by  
Jaiprakash Power Ventures Ltd. (JPVL)

### 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:

The project is a run of the river hydro power project and categorized in Scope Number 1; Sectoral Scope- Energy industries (renewable/non-renewable sources) as per Sectoral scopes related approved methodologies (version 07 Oct 05|12:34)

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:

Over the crediting period of 10 years, project would generate 14681060 tCO<sub>2e</sub>.

*Since the project results in more than 1,000,000 tonnes CO<sub>2</sub> equivalent emissions reductions per year, it is a mega project*

### 1.4 A brief description of the project:

#### **Project Profile:**

Vishnuprayag Hydroelectric Project (VHEP) is a 4 x 100 MW Run-of-the-River Project located across river Alaknanda near Joshimath in district Chamoli of Uttarakhand state of India which is being implemented by Jaiprakash Power Ventures Ltd. (JPVL), a subsidiary of Jaiprakash Associates Limited (JAL). JAL is a well-known business group of India and had entered into agreement with State Government of Uttarakhand and Uttar Pradesh Power Corporation Limited (UPPCL) to implement the project.

VHEP shall have an underground power station with an installed capacity of 400 MW and shall utilize the water from river Alaknanda. The project is located at Rishikesh-Badrinath highway. The project activity doesn't involve construction of any storage dam upstream and downstream.

#### **Project Purpose:**

Project activity shall generate electricity using renewable hydel energy and sell it to Uttar Pradesh Power Corporation Limited (UPPCL). JPVL has already been entered into Power

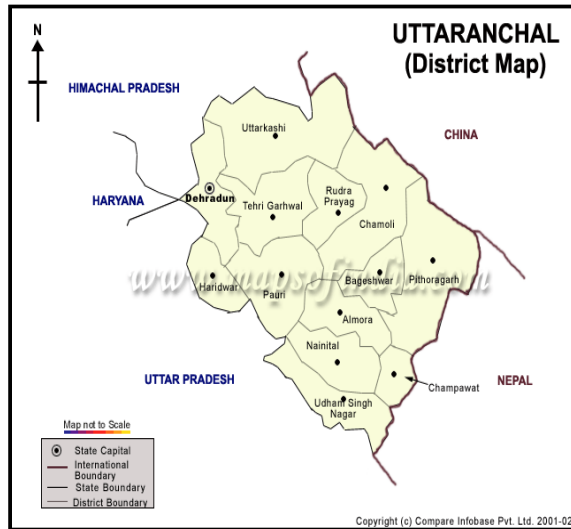
Purchase Agreement (PPA) with UPPCL for this purpose. As the project activity involves generation of electricity by renewable sources of energy it will reduce anthropogenic Green House Gases (GHG) emissions that would have been generated to supply power to grid using fossil fuel. Here it is important to mention that at present more than 70% of power at the northern grid of India is obtained by fossil fuels.

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

The project is located near Joshimath in the District of Chamoli of Uttaranchal. The project site is located at Rishikesh-Badrinath highway. Nearest railhead is Rishikesh at a distance of about 250 Km from the project site and 525 Km from Delhi. Location is depicted in following maps



Location of Uttaranchal in India



Location of Chamoli District in Uttaranchal

**1.6 Duration of the project activity/crediting period:**

Project Start date: Unit-1	:	03.06.2006
Unit-2	:	23.06.2006
Unit-3	:	16.08.2006
Unit-4	:	30.09.2006

Crediting Period start date<sup>1</sup>: 03<sup>rd</sup> June 2006  
*Credit Period* : 10 years

**1.7 Conditions prior to project initiation:**

The project is a renewable energy project which supplies power to the Northern 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 NR Grid. The power generated by the project activity displaces the power that would have otherwise been generated using fossil-fuel as in the current supply pattern of the grid. NR grid is operating with a mix of hydro, nuclear and fossil fuel power plants.

Project activity shall generate electricity using renewable hydel energy and sell it to Uttar Pradesh Power Corporation Limited (UPPCL). JPVL has already been entered into Power Purchase Agreement (PPA) with UPPCL for this purpose. As the project activity involves generation of electricity by renewable sources of energy it will reduce anthropogenic Green House Gases (GHG) emissions that would have been generated to supply power to grid using fossil fuel. Here it is important to mention that at present more than 70% of power at the northern grid of India is obtained by fossil fuels.

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

VHEP is a run of river scheme with no storage dam upstream and downstream. The project as envisaged comprises 60m long, 17m high (above river bed) diversion barrage across river

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<sup>1</sup> As per VCS-2 guidelines

Alaknanda, two intakes and two underground sedimentation chambers 11.343 km long head race tunnel, and underground power station and 1.92 km long tail race tunnel and outfall works. The water would be delivered to the power house through a steel lined pressure shaft. A surge shaft is constructed between the head race tunnel and the pressure shaft which would be used to regulate the flow.

The project activity utilizes Impulse type Pelton turbines. In an impulse turbine, the power is generated due to high velocity water stream striking the turbine blades, which are designed in the shape of cups. The cups move as a result of the impact in the same direction as the flow. The turbine shaft is coupled with the shaft of generator.

#### Technical Details of Project

Parameter	Specifications
<b>Hydrology</b>	
Catchment area at barrage axis	1057.75 sq.km
Snow catchment	606.97 sq.km
<b>Diversion Barrage</b>	
Type	63 m long, 3 m High
<b>Intake</b>	2 in no., Discharge through intake : 63 Cumecs
<b>Sedimentation Chamber</b>	2 in no, size: 160m(L) x16m(W) x 10m(H), Particles of size 0.15 mm and above to be excluded
<b>Head Race Tunnel (HRT)</b>	
Length	11.343 m
Type of Section	4m dia, Modified Horse Shoe, circular
<b>Power House</b>	
Capacity	4 x 100 MW
Type	Underground
Size of P.H. Cavern	122m(L) x 18.5 m(W) x 38.6 m(H)
Size of Transformer Cavern	103 m(L) x 14m(W) x 22.5 m(H)
<b>Tail Race Tunnel (TRT) and Unit TRT'S</b>	
Length and Shape	1924 m long, 5.6 m x 5.7 m, D-shape

#### 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.

**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:

**Geological Risk**

- The Proposed project activity is based on ROR scheme, with no storage facilities for the lean periods. Thus, power generation from the project activity throughout the year depends completely on the water availability in the streams or indirectly on amount of rainfall. As the project site is subjected to severe winter seasons, it results in decreased water availability in the streams due to freezing. This results in poor power generation during the lean periods, affecting the GHG emission reduction capability of the project.
- During monsoon season the amount of silt carried by the streams goes up significantly, resulting in poor functioning or closure of hydro projects.
- Alaknanda river on which the project activity has been proposed has been subject to disastrous flash flood situation in 1970. The Alaknanda flood of 1970, considered to be the worst disaster of its kind in northwest India of the last century, was triggered by a cloudburst followed by flash flood in the downstream. Thus, the project project activity could also face similar situation while its implementation, affecting its GHG reduction potential.

**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 locals. 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 proponent is responsible for installation, commissioning and subsequent operation and maintenance of the project. Project proponent is also responsible for monitoring and record keeping as required for the project activity.

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**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 proposed project activity is a grouped hydro power project based on ROR scheme utilizing the renewable source i.e water for power generation. Electricity produced from the project activity would be supplied to the Northern region grid, thus it displaces the fossil fuel dominated power supply of the Northern grid with the clean source of power. Thus, project activity being based on renewable source, leading to GHG emission reductions qualifies its eligibility

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

**Social Well-being**

Project activity will generate direct and indirect employment for skilled and unskilled manpower during construction phase as well as during operational stage and thus will help in controlling migration from the region and alleviation of poverty. Project activity will also improve communication and other infrastructure facilities in the region. Further, no rehabilitation or resettlement aspect is involved in the project, as there is no displacement or dislocation of local population due to project activity.

**Economic Well-being**

Area under Project is an under-developed area in the hilly regions of Uttaranchal. The area lacks in the basic infrastructure facilities like water, roads, medical facilities, electricity etc. and much investment is needed to boost the development of the area. Project activity will bring considerable investment in the region consistent with the need of the people and will help in overall development of the region.

**Environmental Well-being**

The project is a run of the river scheme with no storage dam upstream or downstream. There are no major negative impacts involved in the project activity on the environment. Considering the size of the project environmental impacts of the projects have been studied in details. There may be marginal negative impacts on air and water quality, terrestrial flora and fauna and ecological conditions during construction phase and operational phase. A detailed Environment Management Plan has been drafted and being executed for mitigating these impacts.

**Technological Well-being**

The technology being used is well established, most updated and environmentally safe. Project activity uses renewable sources of energy for power generation and is comparable to best practice in the area

**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:

**Baseline Methodology:** "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"

**Reference:** Approved consolidated baseline methodology ACM0002/Version 06, Sectoral Scope: 1, Date: 19th May 2006

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

The position of the CDM project activity vis-à-vis applicability conditions in the ACM0002/Version06 is described in the following table.

<b>Applicability Conditions in the ACM0002/Version06</b>	<b>Position of the project activity vis-à-vis applicability conditions</b>
Applies to electricity capacity additions from: Run-of-river hydro power plants; hydropower projects with existing reservoirs where the volume of the reservoir is not increased.	The project activity is a grid connected run-of-the-river hydro power project
This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site;	It's a renewable energy project with no fuel-switch involved.
The geographic and system boundaries for the relevant electricity grid can be clearly identified and information on the characteristics of the grid is available; and	<p>The project activity supplies power to NR Grid, which in turn caters to electricity demand in various states in North India.</p> <p>The NR Grid encompasses all power plants supplying power through the grid to the states of Delhi, Haryana, HP, Jammu &amp; Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, and Union Territory of Chandigarh.</p> <p>Adequate data is available to estimate grid emission factor.</p>

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

	Source	Gas	Included ?	Justification / Explanation
Baseline	Grid Electricity Generation	CO <sub>2</sub>	Yes	Main emission source
		CH <sub>4</sub>	No	Excluded for simplification- this is conservative
		N <sub>2</sub> O	No	Excluded for simplification- this is conservative
Project Activity	Electricity Generation	CO <sub>2</sub> , CH <sub>4</sub> , N <sub>2</sub> O	No	The project activity is a renewable energy project and hence no emissions.

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

The project activity uses the approach described in the ACM002/Version04- “**Consolidated baseline methodology for grid-connected electricity generation from renewable sources**”

The baseline establishment is based on published data on Central Electricity Authority (CEA). The following are the basic attributes of the calculation procedure followed for calculation of GEF.

- GEF calculation is based on baseline methodology ACM0002 version 6 and is publically available on CEA website.  
<http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>
- CEA being a central authority, undertaking of Indian government, has all the first hand information availability for calculation of GEF.
- All the assumptions and calculation models are explained in user guide for the ease of CDM applicants.  
<http://cea.nic.in/planning/c%20and%20e/user%20guide%20ver1.1.pdf>

Based on Published data

Parameter	Value
OM (Operating Margin)	0.97
BM (Build Margin)	0.53
CM (Combined Margin)	0.75

Combined Margin for Northern Grid is **0.75t CO<sub>2</sub>/MWh**

## Emission Reductions

The project activity reduces carbon dioxide through displacement of grid electricity generation with fossil fuel based power plants by renewable-hydro energy based electricity. The emission reduction  $ER_y$  due to the project activity during a given year  $y$  is calculated as the difference between baseline emissions ( $BE_y$ ), project emissions ( $PE_y$ ) and emissions due to leakage ( $L_y$ )<sup>2</sup>.

### 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 VHEP is a run-of-the-river hydel project which will supply power through NR Grid. The power generated by the project activity displaces the power that would have otherwise been generated using fossil-fuel as in the current supply pattern of the grid. NR grid is operating with a mix of hydro, nuclear and fossil fuel power plants.

The project proponents have used VCS to analyze the additionality argument vis-à-vis project activity.

The VCU (Voluntary Carbon Units) criteria require that project from which emission reductions are created pass an additionality test. Through the additionality test the project proponent shall show that mitigation measures result in real reduction in greenhouse gases against a transparent emission baseline. Project additionality shall be done based on one of the criteria prescribed in VCS. The following additionality test is used:

1. *The Project is not a common practice*
2. *The project is not required by regulation.*
3. *The project is not the least cost option for providing the underlying product or service.*

This shall necessarily mean that project is analyzed vis-à-vis additionality criteria A of VCS.

1. **Common Practice Analysis:** There is minimal private sector participation in hydro power generation in India. Nearly 98% of installed capacity is with Government owned utilities. VHEP is among first few hydro power IPPs in northern region.. An analysis of total power generated in 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<sup>3</sup>.

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<sup>2</sup> Detailed formulas given in Section D

<sup>3</sup> Other large scale projects such as AD Hydro are also going through process of CDM registration.

In the last 30 years, the proportion of hydroelectric capacity in the Indian power system has considerably reduced. It has dropped from about 46% in 1970 to 40% in 1980, 29% in 1990 and 25% in 2003<sup>4</sup>.

In the northern region as per the latest data of CEA, the hydro power plants contribute approximately 30% to the total installed capacity of northern grid. The hydro power plants usually operate at much lower plant load factors as compared to thermal plants. As per actual statistics the hydro power projects contribute about 24 % of total net generation in Northern Grid <sup>5</sup>. In 2004-05 approximately 1416MWh is contributed by private power producers from a total generation of 47467MWh in northern sector by hydro power plants i.e. approximately 3%<sup>6</sup>.

Lack of private sector participation in hydro power sector is due to engineering difficulties and hydrological risks leading to overall financial unattractiveness of the projects, Further, most hydro projects in India had run up high capital costs, faced considerable implementation delays and run into geological related problems. In addition, private power generation in India has a chequered past, since state utilities are the usual off takers and the financial standing of most state owned utilities is in a parlous state. Given this background most private investors are vary of venturing into hydro power development in India.

**2. The project is not required by regulation:**

- There is no law or regulation which makes the implementation of project activity mandatory. The project activity is in compliance with state and centre laws.
- There is no regulation in India that imposes either formal or voluntary targets, to be met by such project activity.
- Carbon credits are not a by product of this project activity under any of the relevant GHG mitigation protocols.
- The emission reductions from project activity have not been used against any kind of voluntary corporate emission reduction targets.
- The project is not an energy efficiency project.

**3. Least Cost Option analysis:** Development of hydro project entails high capital cost, long gestation period, difficult terrains, geological risks and hydrological risks. This becomes clear by the fact that India has hydro power potential of around

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<sup>4</sup> [As per Ministry of Power data](#)

<sup>5</sup> [CEA website: GEF calculation data](#), excel sheet provided

<sup>6</sup> CEA website: GEF calculation data, excel sheet provided

150,000 MW<sup>7</sup> out of which only 17% has been exploited despite low Operation & Maintenance (O&M) cost involved in the operation of the projects.

Typical capital costs for power projects in India:

Type of Power Project	Capital Cost ( USD Mn/MW)
Gas based	0.82 <sup>8</sup>
Coal based	0.93 <sup>9</sup>
Wind	1.4 <sup>9</sup>
Co-generation	0.90 <sup>9</sup>
Vishnuprayag Project	1.04

As the project activity generates financial benefits by selling electricity to UPPCL which will supply the electricity to various customers through NR Grid, an investment analysis on returns from power generation of project activity shall be discussed.

Project activity entails high capital cost and IRR to equity without considering emission reductions benefits is only 8.8% which is low also due to extended gestation period of project activity unlike conventional fuel based power sources. The extension of gestation periods means that generation and realization of revenue from electricity sale will be delayed in comparison to conventional fuel based power sources.

As per Central Electricity Regulatory Commission (CERC)<sup>10</sup> the post tax ROE for IPPs in India is 16% including thermal and hydro power sources. The tariff calculations for VHEP are based on the ROE of 16%. There is notional loss of money during gestation phase. All this when accounted for in cash flow calculations gives low IRR to equity. The IRR for VHEP is around 8.8% which is to the lower side as compared to the ROE of 16% for either IPP developed thermal power plants. Thereby project proponents have considered VEP option for the project activity and subsequently reduce the gap between expectations and actual returns. The IRR of 8.8% is based on following assumptions.

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<sup>7</sup> [As per Ministry of Power data – Page 3 of document](#)

<sup>8</sup> TERI Energy Directory and yearbook 2003-04, copy provided.

<sup>9</sup> Expert Committee report by CEA on cost of Power based on different fuels, page – xi, Appendix I

<sup>10</sup> CERC established an ROE of 16% for IPPs in 2001 (annual report 2001, page -17)

<b>Key Assumptions</b>			
<b>SN</b>	<b>Parameter</b>	<b>Value</b>	<b>Remarks</b>
1	Power Generation	2060.50 GWh <sup>11</sup>	Based on 90% Dependable year and 95% plant availability. (Based on 23 years hydrological data analysis)
2	Saleable power	1795.11 GWh	After auxiliary power consumption of 0.5%, Transformation losses of 0.5%, 12% Free power supply to State Electricity Board
3	Project Cost	INR 1901crores	
4	Debt/Equity Ratio	30%/70%	
5	Income Tax relief	First 10 years <sup>12</sup>	To be availed over 15 years from commissioning
6	O&M Costs	1.5% of project cost <sup>13</sup>	Escalation factor of 6% p.a. starting from second year of operation
7	Tariff	Rs. 1.94/kWh	Levelized for 30 years

For a similar kind of project activity which is based on coal or other conventional fuel, the cost of setting up (i.e. capital investment) shall be lesser than a hydro power project. Moreover gestation period for thermal power projects is lesser than hydro power projects. From this we can conclude that there is:

1. Additional capital required to set a hydro power project over a conventional thermal project for same installed capacity.
2. The notional loss due to long gestation periods is higher for hydro power projects.

There fore, if the tariff has to be calculated for coal based power plant with same installed capacity and similar structure of debt and equity, the tariff will come out to be lower on account of point no. 1 stated above. This is because tariff is calculable keeping in view 16% return to equity for a power sector investment at the time of project conceptualization/PPA finalization. So a conventional fuel based power project would have definitely got lower tariff structure with respect to VHEP.

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<sup>11</sup> Based on design generation at time of project conceptualization

<sup>12</sup> As per Income Tax act 80 A.

<sup>13</sup> Tariff calculations are based on design generation at time of project conceptualization.

So from the perspective of UPPCL or JPVL, the project activity is not a least cost option.

This clearly demonstrates that project activity being a renewable source power and additional in terms of Criteria A, shall add to greenhouse gas reductions in real sense.

### 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:

**Monitoring Methodology:** Consolidated Monitoring methodology for grid-connected electricity generation from renewable sources

**Reference:** Approved consolidated monitoring methodology ACM0002/Version 06, Sectoral Scope: 1, Date: 19th May 2006

#### 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<sub>2</sub> that the project activity has achieved.

Emission Reduction Estimation:

Parameters	UoM	Value
Capacity	MW	400
Running hours	per day	24
Working days	per year	328*
PLF	%	60%
Auxiliary consumption	%	0.5%

\*In a 90% dependable year

Gross power generation in a year by the project activity: 2060.5 GWh

Saleable power generation in a year by the project activity: 1795.11 GWh

Combined Margin Grid Emission Factor = 0.75 tCO<sub>2</sub>/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:

$$BE_y = 2060.5 \text{ GWh} \times 0.95 \times 750 \text{ tCO}_2/\text{MWh} = 1468106 \text{ tCO}_2/\text{year}$$

Project emission:

The project emission includes the CH<sub>4</sub> emission from the reservoir. Since the project activity is a run-of-the-river project without any reservoir, so project emission PE<sub>y</sub>=0.

Leakage:

As specified in ACM0002, project participants do not need to consider leakage in applying this methodology. L<sub>y</sub>=0.

Emission reduction calculation:

Emission reduction is calculated as follows:

$ER_y = BE_y - PE_y - L_y$
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Since PE<sub>y</sub> = 0 and L<sub>y</sub>=0, hence Emission reduction for the year y, ER<sub>y</sub> = BE<sub>y</sub>

Hence Emission Reductions from the project activity are: 1346332.5 tCO<sub>2</sub>/ year

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

*Describe each data and parameter using this table.*

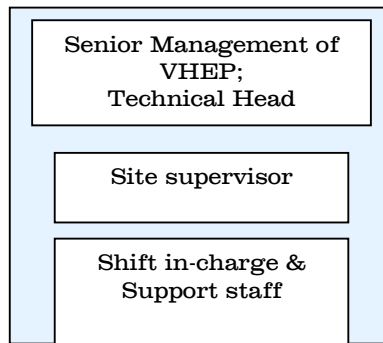
<b>Data / Parameter:</b>	<b>EG<sub>y</sub></b>
Data unit:	MWh
Description:	Electricity supplied to the grid by the project activity during the year y
Source of data to be used:	Electricity meters maintained by state departments
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1957475
Description of measurement methods and procedures to be	The measurements are done from electricity meters maintained by state authorities. There is a pair of meters viz. main meter and check meter provided on each transmission line. The readings of these meters are taken as

applied:	basis for calculation of emission reductions
QA/QC procedures to be applied:	Electricity meters are properly maintained with regular testing and calibration schedules developed as per the technical specification requirements to ensure accuracy. Electricity supply data to the grid could also be cross-checked with the invoices for sale of electricity to the consumers. Billing is done by Govt agencies, and these bills would form basis of emission reduction estimations.
Any comment:	

### 3.4 Description of the monitoring plan

#### **Project Management Plan:**

A project team would be constituted with participation from relevant departments. People will be trained on emission reduction concept and monitoring plan. This team will be responsible for data collection and archiving. This team will meet periodically to review project activity check data collected, emissions reduced etc. On a weekly basis, the monitoring reports will be checked and discussed by the seniors team members/managers. In case of any irregularity observed by any of the team member, it shall be informed to the concerned person for necessary actions. On monthly basis, these reports shall be forwarded at the management level.



**Senior Management of VHEP/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 report generation

#### **Data Monitoring:**

The methodology requires monitoring of the following:

- Electricity generation from the project activity;
- The Combined Margin shall be based on the published value by Central Electricity authority as explained in section B.2

***Completeness-***

For Electricity generation data: The project activity will install the latest state-of-art monitoring and control equipment that measure, record, report, monitor and control various key parameters. Real time data collection will happen using these control systems. An hourly log of data will also be prepared by the shift in-charge. A daily report of aggregation of these data will also be prepared. Parameters monitored are the total power generated, power exported to the grid and auxiliary power consumed (other parameters like head availability, grid issues, frequency etc will also be maintained hourly in the log).

For data requirement to calculate OM & BM: NREB/NRLDC publishes yearly reports regarding the performance of the power plants attached to the NR grid. Apart from these reports, CEA and MOP also publish yearly power plants performance data.

***Reliability-***

For electricity generation data: automatic control meters for power generation and exports will be regularly maintained. The regular plant operating & maintenance procedures will also include process of regular meter testing, calibration & maintenance.

Actual power generation data will also be metered using power output meter at the substation. The billing invoices for the power sold and meter readings could be used to validate the data accuracy.

***Frequency-***

The measurement is recorded and monitored on a continuous basis. An hourly log is prepared by the shift in-charge. At the end of the day, hourly data is aggregated in a daily report.

***Meter Details***

There is a provision of two transmission lines provided by UPPPCL. Each of these lines is fitted with a pair of meters i.e. Main Meter and Check Meter.

Accuracy of Meters: 0.2

External CT Ratio: 1000/1A

External PT Ratio: 400 kV/110V

Multiplication factor for KWh: 3636.36

## 4 GHG Emission Reductions:

### 4.1 Explanation of methodological choice:

The project activity meets the applicability criteria of the 'Approved baseline methodology ACM0002'. (Please refer to Section B.2. for details). The applicability criteria of the 'Approved monitoring methodology ACM0002' are identical to those of the 'Approved baseline methodology ACM0002'. Therefore the project activity has used the 'Approved monitoring methodology ACM0002' in conjugation with the 'Approved baseline methodology ACM0002' for the project activity.

The project activity would monitor following as per the guidance provided in the approved methodology (ACM0002):

- Electricity generation from the proposed project activity;
- Calculation of Combined margin emission factor, consistent with "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002).

### **Calculation of baseline emission factor**

CEA published data has been used. CEA has used estimation procedure provided in ACM 0002. Brief description of this procedure is provided below.

The baseline emission factor ( $EF_y$ ) is calculated as a combined margin ( $CM$ ), consisting of the combination of operating margin ( $OM$ ) and build margin ( $BM$ ) factors according to the following three steps. Calculations for this combined margin are based on data from an official source.

### **STEP 1: Calculate the Operating Margin emission factor**

Simple OM approach is the most appropriate calculations method because in the NR grid mix, the low-cost/must run resources constitutes less than 50% of total grid generation. Simple OM factor is calculated as under.

$EF_{OM, simple, y}$  is calculated as 3-year average (2002-03, 2003-04, 2004-05), based on the most recent statistics available at the time of PDD submission,

$$EF_{OM, simple, y} = \frac{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}{\sum_j GEN_{j,y}}$$

Where

$GEN_{j,y}$  : The electricity (MWh) delivered to the grid by source j

$COEF_{i,j,y}$  : The CO<sub>2</sub> emission coefficient of fuel i (t CO<sub>2</sub> / mass or volume unit of the fuel), calculated as described below and

$F_{i,j,y}$  : The amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y, calculated as described below

J, Refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports from the grid

The CO<sub>2</sub> emission coefficient  $COEF_i$  is obtained as

$$COEF_i = NCV_i \otimes EF_{CO_2,i} \otimes OXID_i$$

Where

$NCV_i$  : The net calorific value (energy content) per mass or volume unit of a fuel i

$EF_{CO_2,i}$  : The CO<sub>2</sub> emission factor per unit of energy of the fuel i (IPCC default value)

$OXID_i$  : The oxidation factor of the fuel (IPCC default value)

The amount of fuel  $F_{i,j,y}$  is obtained as

$$F_{i,j,y} = GGEN_{j,y} * DSHR_y \div NCV_i$$

where:

$GGEN_{j,y}$  = Gross Power Generation from the power source j in the year y (MWh)

$DSHR_{j,y}$  = Design Heat Rate of the power source j in the year y

$NCV_i$  = Net calorific value per mass or volume unit of a fuel i

For most of the power plants design heat rate is taken wherever information is available. For other plants regional average regional design heat rate is taken.

**STEP 2: Calculate the Build Margin emission factor ( $EF_{BM,y}$ )** as the generation-weighted average emission factor (t CO<sub>2</sub>/MWh) of a sample of power plants m of NR grid, as follows:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \times COEF_{i,m}}{\sum_m GEN_{m,y}}$$

Where

$F_{i,m,y}$ ,  $COEF_{i,m}$  and  $GEN_{m,y}$  - Are analogous to the variables described for the simple OM method above for plants m.

Calculation of the Build Margin emission factor  $EF_{BM,y}$  ex-ante are 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 the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently (This sample group is larger than group consisting of the five power plants that have been built most recently)

Further, power plant capacity additions registered as CDM project activities have been excluded from the sample group m of NR grid mix.

**STEP 3: Calculate the baseline emission factor  $EF_y$**  as the weighted average of the Operating Margin emission factor ( $EF_{OM,y}$ ) and the Build Margin emission factor ( $EF_{BM,y}$ ):

$$EF_y = W_{OM} \otimes EF_{OM,y} \oplus W_{BM} \otimes EF_{BM,y}$$

where the weights  $w_{OM}$  and  $w_{BM}$ , by default, are 50% (i.e.,  $w_{OM} = w_{BM} = 0.5$ ), and  $EF_{OM,Simple,y}$  and  $EF_{BM,y}$  are calculated as described in Steps 1 and 2 above and are expressed in t CO<sub>2</sub>/MWh.

### Calculation of Baseline Emissions

$$BE_y = EF_y \times EG_y$$

Where

$BE_y$  : Baseline emissions due to displacement of electricity during the year y in tons of CO<sub>2</sub>

$EG_y$  : Electricity supplied to the grid by the project activity during the year y in MWh, and

$EF_y$  : CO<sub>2</sub> baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO<sub>2</sub>/MWh.

For this methodology, it is assumed that transmission and distribution losses in the electricity grid are not influenced significantly by the project activity. They are therefore neglected

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

Baseline emissions are estimated to be 1468106 tCO<sub>2</sub>/year

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

No emissions from the project activity are envisaged.

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

Emissions reductions enhancement through the project activity are estimated to be 1468106 tCO<sub>2</sub>/year

### 5 Environmental Impact:

Project activity is a 400 MW hydel scheme across river Alaknanda. A detailed analysis of impacts of the project activity over different aspects of environment has been done at the time of conceptualization of project activity by Department of Science and Technology, Government of India. Project activity doesn't involve construction of any storage dam upstream or downstream. It's a run-of-the-river hydel scheme and doesn't have potential negative impacts on environment either during construction or operational phase. Based on the reports the project proponents have come up with a detailed Environment Management Plan.

In impact of project activity was analysed in the following sectors.

- Meteorology and Air Quality
- Geology and Landslide Hazard
- Seismicity
- Water Quality
- Terrestrial and Aquatic Ecology
- Land Use

In addition increase in probabilities of other natural hazards like flood, cloudburst, forest fire and safety issues was also analysed. Summary of all findings of the study across all these areas have been given in following section.

#### Meteorology and Air Quality:

Impact Area	Nature of Impact	Targets/ Interests	Magnitude and Extent	Overall Significance
Micro-	Changes in	Impact over	Very minor	Minor

Climatic changes	temperature and humidity	agriculture	changes that can sometimes be beneficial in cold areas	
Evaporation Loss	Evaporation loss as specific height of storage loss over the years	Change in precipitation of the area	Insignificant to change precipitation of the area	Minor
Air Quality	Increase in dust and sand in air during construction	Air quality in the project area	During construction marginal effects on air as quantum of dust and sand may be increased but no air pollution during operation	Minor

*Geology and Landslide Hazard:*

<b>Impact Area</b>	<b>Nature of Impact</b>	<b>Targets/ Interests</b>	<b>Magnitude and Extent</b>	<b>Overall Significance</b>
Landslide	Increase in chances of landslides	Regional areas	Study shows that hilly area in which project activity is located is landslide prone but there will not be significant increase in landslides due to project activity subject to adoption of certain safety measures.	Moderate

*Seismicity:*

<b>Impact Area</b>	<b>Nature of Impact</b>	<b>Targets/ Interests</b>	<b>Magnitude and Extent</b>	<b>Overall Significance</b>
Earthquake Occurrence	Probability of earthquake in the project area		Project structure could be categorized as quite safe. The proposal of having underground powerhouse is sound from this point of view.	Minor

Water Quality and Availability:

<b>Impact Area</b>	<b>Nature of Impact</b>	<b>Targets/ Interests</b>	<b>Magnitude and Extent</b>	<b>Overall Significance</b>
Water Quality Degradation	Increased sediment loads and silt being released in water	<ul style="list-style-type: none"> <li>▪ Submergence</li> <li>▪ Construction of power house</li> <li>▪ Pollution due to oil &amp; grease flowing to river</li> </ul>	<ul style="list-style-type: none"> <li>▪ Submergence is confined to natural banks &amp; will be insignificant</li> <li>▪ Power house to be constructed underground</li> <li>▪ Pollution due to oil &amp; grease will be limited to construction phase only</li> </ul>	Minor
Water Availability	Lack in water availability downstream the barrage	Design Discharge of water from barrage	Analysing flow duration analysis and flow duration curves it has been proposed to discharge 0.15 cumec water from barrage	Minor

Terrestrial and Aquatic Ecology:

<b>Impact</b>	<b>Nature of</b>	<b>Targets/</b>	<b>Magnitude and</b>	<b>Overall</b>
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Area	Impact	Interests	Extent	Significance
Forestry	Acquisition of reserved and civil forest land		To offset the environmental impacts due to acquisition compensatory afforestation is planned in early stages of the project	Moderate
Aquatic Resources	Barrier in migratory path of fish both upstream and downstream	Fishes and Fisheries in the nearby area	<ul style="list-style-type: none"> <li>▪ Evidence of migration of fishes upstream isn't established.</li> <li>▪ Since no commercial fishing is taking place in project area there will be no effect on fisheries</li> </ul>	Minor

Air Quality:

Impact Area	Nature of Impact	Targets/ Interests	Magnitude and Extent	Overall Significance
Air quality	Vehicular traffic and construction & maintenance of roads are the major	Nearby villages. Workers onsite. Vegetation and Wildlife.	Generally Local/Regional impact. Dust emissions should be quickly suppressed to insignificant levels. Impact on site accommodation some distances from project Component locations.	Moderate during construction/Minor otherwise

6 Stakeholders comments:

*Project promoter takes feedback from nearby community on a regular basis. People from local villages/community are invited to discuss about the project activity and its benefits and effects on them.*

*However a detailed stakeholder consultation process has been conducted over past 6 months. A well known NGO has conducted this detailed consultation process. Detailed report is available for validation.*

#### **Received Comments**

- No negative comment on the project
- Project activity helps in generation of employment for local community (3600 people during plant construction and 300 people during plant operations & maintenance)
- Infrastructure development in the local area leading to enhancement of quality of life for the people
- Energy security for the region
- Availability of power in the state would lead to industrial development which will again lead to employment generation

## **7 Schedule:**

Commercial Operation Date of the project: 17<sup>th</sup> June 2006.  
Crediting period start date: 17<sup>th</sup> June 2006

## **8 Ownership:**

### **8.1 Proof of Title:**

For providing the ownership details of the company, the annual reports will be provided.

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

Not Applicable

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