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# VERIFICATION REPORT

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VISHNUPRAYAG HYDRO-ELECTRIC  
PROJECT (VHEP) BY JAIPRAKASH  
POWER VENTURES LIMITED.

(JPVL)

IN UTTARANCHAL (NOW  
UTTARAKHAND), INDIA

REPORT No. 2007-2045

REVISION No. 01



DET NORSKE VERITAS



## 1 INTRODUCTION

Jaiprakash Power Ventures Limited (JPVL) has commissioned DNV Certification AS to carry out the verification of emission reductions generated and reported by the run-of-the-river "Vishnuprayag Hydro-electric Project by Jaiprakash Power Ventures Limited", in India for the period 3 June 2006 to 31 March 2007. This report contains the findings from the verification and a statement for the verified emission reductions.

### 1.1 Objective

Verification is the independent review and ex-post determination by the Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the CDM project activity during a defined verification period.

### 1.2 Scope

The Verification scope is:

- Review of the calculation of the relevant grid carbon emission factor for the electricity grid applicable for the state and the additionality of the project activity.
- To verify that actual monitoring systems and procedures are in compliance with the monitoring systems and procedures described in the monitoring plan for the project activity,
- To evaluate the GHG emission reduction data and express a conclusion with a high level of assurance about whether the reported GHG emission reduction data is free from material misstatement,
- To verify that the reported GHG emission data is sufficiently supported by evidence.

The verification is meant to ensure that reported emission reductions are complete and accurate and is based on generation of renewable energy that replaces fossil-based electricity generation in the grid.

### 1.3 GHG Project Description

The purpose of the project is to harness renewable hydro power potential in the Chamoli district of Uttaranchal and enable displacement of fossil fuel based electricity generating systems. JPVL has established this run-of-the-river hydro power project and operates the project in the region. The 400 MW project comprises four of 100 MW impulse type Pelton turbines commissioned at four different phases. The project activity includes development, design, engineering, procurement, finance, construction, operation and maintenance of hydro power based electricity generation and supplying it to Uttar Pradesh Power Corporation Limited (UPPCL) in Uttar Pradesh through the northern regional grid of India. The location and details of the turbines with respect to the project activity have been verified to be as per details provided in the PDD.

The project activity will displace energy that is dispatched at the operating margin (primarily thermal energy) and also delay any planned expansion of the northern grid generation capacity by its equivalent size.




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 VERIFICATION REPORT
 

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The project has accounted for emission reductions generated by hydro power from 3 June 2006 to 31 March 2007. The power is supplied to Uttar Pradesh Power Corporation Limited (UPPCL) in Uttar Pradesh as per valid Power Purchase Agreements (PPAs)/5/ between the two entities.

The projects emission reductions are determined by multiplying the net amount of electricity generated by the project by an estimated ex-ante fixed grid emission coefficient of 0.75tCO<sub>2</sub>/MWh, taken from the CO<sub>2</sub> database for emission factors developed and published by Central Electricity Authority (CEA\*) of India. According to the project design there are no project emissions and leakage effects associated with the project.

|                                  |   |  |
|----------------------------------|---|--|
| Title of the project activity    | : | Vishnuprayag Hydro-electric Project by Jaiprakash Power Ventures Limited |
| Location of the project activity | : | Chamoli district in the state of Uttaranchal, India                      |
| Verification period              | : | 3 June 2006 to 31 March 2007   |
| Project starting date            | : | 3 June 2006  |

## 2 METHODOLOGY

The verification of the emission reductions has assessed all factors and issues that constitute the basis for emission reductions from the project, including,

- The review of the calculation of the carbon emission factor for the northern regional electricity grid of India.
- The net electricity supplied by the project activity to the Uttar Pradesh Power Corporation Limited (UPPCL) in Uttar Pradesh multiplied by the estimated grid emission factor

### *Verification Team:*

|                            |                |                              |
|----------------------------|----------------|------------------------------|
| Ma-Paa-Puratchikkanal      | DNV, Bangalore | GHG Auditor, Project Manager |
| Chandrashekara Kumaraswamy | DNV, Bangalore | Technical reviewer           |
| Michael Lehmann            | DNV, Oslo      | Sector Expert                |

### *Duration of verification:*

|  |   |                             |
|--|---|-----------------------------|
| Preparation – (monitoring report review baseline grid factor estimations etc.) | : | 4 May 2007 to 10 June 2007  |
| Site visit   | : | 13 May 2007 to 18 May 2007  |
| Reporting  | : | 1 June 2007 to 10 June 2007 |

\* CO<sub>2</sub> Baseline Database, <http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>



## 2.1 Review of Documentation

The monitoring report /1/ and the monthly electricity generation receipts from joint meter reading reports signed by UPPCL and JPVL were assessed as a part of the verification. In addition the Project Design Document /2/, in particular the baseline estimations and the monitoring plan contained in the PDD were also assessed.

## 2.2 Site Visits

From 13 May 2007 to 18 May 2007, DNV carried out a project site visit at Vishnuprayag Hydro Electric Project (VHEP). During this visit, DNV verified the actual implementation of the project as described in the PDD. The commissioning certificates and the turbine details were also checked and found to be correct/4/. The electricity meters and meter test certificates of the meters were checked and found to be in order. The evidence of the reported net electricity generation was also verified, which in the project activity case is the monthly electricity generation joint meter reading reports signed by UPPCL and JPVL.

## 3 VERIFICATION FINDINGS

### 3.1 Project Implementation

The project has been implemented as planned. The 400 MW run-of-the-river hydro power project comprised of 4 units of 100 MW each, commissioned between June 2006 and October 2006. The commissioning certificates for the units were verified against the commissioning capacity details and found to be correct.

Though the commissioning dates of the units varied from June 2006 to October 2006, the generation details have been considered for the VER project period of 3 June 2006 to 31 March 2007. This data has been verified with the generation details as declared in the monthly 'Joint Meter Reading' forms. These forms are signed by the representative of JPVL and certified by the authorized signatory for UPPCL. The meter test reports and the joint inspection reports of commissioning of the project have been verified and found to be in order.

### 3.2 Project Baseline

The approved baseline methodology ACM0002 version 6- "Consolidated baseline methodology for grid connected electricity generation from renewable sources"/7/, has been adopted for the proposed project activity. The baseline methodology is applicable and justified for the proposed project as the project involves electricity capacity additions through hydro sources. The project applies the baseline methodology approach – "existing actual or historical emissions". This is deemed as appropriate as the proposed project is not representing common practice at the present time; it displaces fossil fuel based electricity that would otherwise be provided by the operation and expansion of the northern regional grid. The northern regional power sector is not dominated by generating sources with zero or low operating cost projects and their contribution is less than 50% of the total grid generation.

The baseline is the emission reductions occurring due to electricity generation through renewable sources, derived from the electricity consumed times the relevant emission factor of the selected




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 VERIFICATION REPORT
 

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grid. As the project activity is feeding the generated power to the Uttar Pradesh state grid, which is a part of the northern regional grid; the baseline for this project activity is the function of the generation mix of northern regional grid. The baseline emission factor for the northern regional grid is established *ex-ante* based on approved methodology ACM0002 using a combined margin approach.

JPVL has used the OM and BM data published in the CEA\* database, for calculating the baseline emission factor. The Central Electricity Authority, Ministry of Power, Government of India has published a database of carbon dioxide emission factors from the power sector in India based on detailed authenticated information obtained from all operating power stations in the country. This database i.e. The CO<sub>2</sub> baseline database provides information about the OM and BM factors of all the regional electricity grids in India. DNV confirms that the OM in the CEA database is calculated *ex ante* using the simple OM approach and the BM is calculated *ex ante* based on 20% most recent capacity additions in the grid based on net generation as described in ACM0002. The average of the OM for the three years 2002-03, 2003-04 and 2004-05 has been determined and verified to be 0.97 tCO<sub>2</sub>e/MWh and the BM to be 0.53 tCO<sub>2</sub>e/MWh.

As stipulated in the methodology ACM0002 version 6 May 19 2006 and as relevant for hydro energy projects, JPVL has considered a weightage for OM as 0.5 and for BM as 0.5. Accordingly, using the values for operating margin and build margin emission factors provided in the CEA database and their respective weights for calculation of combined margin emission factor, the baseline carbon emission factor (CM) has been established *ex-ante* as 0.75 tCO<sub>2</sub>e/MWh.

### 3.3 Project Additionality

The project activity has four units commissioned from June 2006 to October 2006. The additionality of the project has been based as per the requirements of VCS, version 1 standard/8/:

#### Enforcement of applicable laws and regulations:

The project is not mandated by any laws or regulations of the country or state. The hydro power project is developed voluntarily by the developer in the region and is not under any mandatory obligation.

The power generated is transmitted to the UPPCL grid attached to the northern regional electricity grid of India. The project activity is not the choice of least cost option of power provision by the regional load dispatch centre to the end-users.

#### Common practice analysis:

It has been demonstrated that the private sector participation in the development of hydro power plants, especially, large scale projects is very low in India and also in the northern region. And VHEP is one of the few IPPs in the northern region supplying electricity to the grid. This is substantiated through data published by the CEA (2004-05) that in the northern region the total power generation from hydro sources is only 24% and contribution from the IPPs is just 4% in the region. This low penetration of IPPs have been attributed to the financial unattractiveness,

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\* CO<sub>2</sub> Baseline Database, <http://cea.nic.in/planning/c%20and%20e/Government%20of%20India%20website.htm>




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 VERIFICATION REPORT
 

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high capital cost, geological risks, engineering difficulties and also unhealthiness of state utilities who are the sole buyers of power from IPPs.

DNV is able to confirm that the power generated as per CEA data in 2004-05 from hydro sources is 35 884 MWh and that from Hydro power IPPs is 1 416 MWh, which is around 3.9%. Thus, the private sector participation in hydro power generation cannot be viewed as a common practice scenario in the region.

**Comparison analysis which demonstrates that the hydro generation is not the least cost option for to the off-takers:**

The project is not a least cost option for power and this as been demonstrated through the existence of investment barriers. The cost of the project has been compared with various other fuel based power generation alternatives as given in the following table and VHEP have demonstrated that the capital cost per MW for the VHEP project is 1.04 USD Mn/MW compared to the dominant technology of coal based plants at 0.93 USD Mn/MW in the region. Thus the investment cost for the project is much higher than the coal or gas based plants.

| Type of Power Project | Capital Cost*<br>( USD Mn/MW) |
|-----------------------|-------------------------------|
| Gas based             | 0.82                          |
| Coal based†           | 0.93                          |
| Wind                  | 1.4                           |
| Co-generation         | 0.90                          |
|                       | Project Cost<br>( USD Mn/MW)  |
| Vishnuprayag Project  | 1.04                          |

The VHEP has also used the investment analysis, using the equity IRR, as a basis to assess the financial attractiveness of the project activity. It has been demonstrated that the equity IRR of the project activity without sale of emission reductions is 8.8% which is lower than the benchmark IRR of 16% for independent power producers (IPP) as per Central Electricity Regulatory Commission (CERC) regulations.

The CERC regulations and the financial analysis for IRR have been verified by DNV and found to be appropriate.

**Carbon credits should not be the byproduct from the creation of an ancillary environmental asset and/or financial instrument (e.g. renewable energy credits):**

The project carbon credits are not a byproduct by creation of ancillary environmental asset. The carbon credits are the only credits that are generated by the project activity.

**The emission reductions from the Project must not have been used against any voluntary corporate emission reduction targets:**

\* TERI Energy Directory and yearbook 2003-04, Table 4.89, page number 473.

† Expert Committee report by CEA on cost of Power based on different fuels, page – xi, Appendix I




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 VERIFICATION REPORT
 

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India is not mandated by any carbon emission targets and the project activity doesn't have any voluntary corporate emission reduction target.

The project activity is thus deemed additional to those that would have otherwise occurred.

### 3.4 Completeness of Monitoring

The only monitoring indicator, i.e., the net electricity generation, has been monitored with tested energy meters as described in the monitoring plan of the PDD.

### 3.5 Accuracy of emission reduction calculations

The main meter and check meters are installed by JPVL and the ownership has been transferred after commissioning to UPPCL for future maintenance. The monthly meter readings (both main and check meters) are taken jointly by the parties on the last day of the month at 12 noon. At the conclusion of each meter reading an appointed representative of the UPPCL and JPVL sign a document indicating the amount of kilowatt-hours indicated by the meter. This is then translated in a format (Joint Energy Meter Reading) and signed by UPPCL and JPVL which clearly indicates the net electricity exported and becomes the basis for calculations of the emission reductions.

Each meter is jointly inspected and sealed on behalf of the parties and is not interfered-with by either Party except in the presence of the other party or its accredited representatives. The general conditions set out for metering, recording, meter readings, meter inspections, test & checking and communication are as per the PPA (power purchase agreement) with UPPCL. If the variation between the main meter and the check meter during any of the monthly meter readings is more than the permissible limit for meters of 0.2% accuracy class, all the meters are retested and calibrated. Test and joint inspection reports have been verified.

### 3.6 Quality of evidence to determine emission reductions

The net amount of electricity of 970 917 939 kWh and thus the claimed emission reductions of 728 188 tCO<sub>2</sub>e reported for the period 3 June 2006 to 31 March 2007 was verified by reviewing the presented electricity generation joint meter reading reports of UPPCL and JPVL.

The energy generated and emission reductions claimed for the proposed period were as shown in the following table:

| Period                          | Energy Generated (kWh) | Emission Reductions (tCO <sub>2</sub> ) |
|---------------------------------|------------------------|---|
| 3 June 2006 to 31 December 2006 | 810 769 009            | 608 076                                 |
| 1 January 2007 to 31 March 2007 | 160 148 930            | 120 112                                 |

Sufficient evidence was presented for the reported net electricity generation after certification of commissioning by UPPCL.



### 3.7 Management System and Quality Assurance

Monitoring and reporting of electricity generation is part of normal operations of JPVL. The quality of meter readings is assured through calibration of electricity meters and through cross checking of readings between the main meters and the check meters.

## 4 VERIFICATION STATEMENT

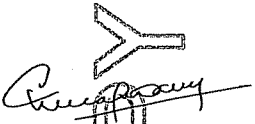
DNV Certification AS has performed a verification of emission reductions reported for the "Vishnuprayag Hydro-electric Project by Jaiprakash Power Ventures Limited" project managed by JPVL for the period 3 June 2006 to 31 March 2007.

In our opinion the GHG emissions reductions reported for the project in the monitoring report of 16 May 2007 are fairly stated.

The GHG emission reductions were calculated correctly on the basis of the baseline and monitoring methodology provided in the PDD of 25 May 2007.

Det Norske Veritas Certification AS is able to certify that the emission reductions from the 'Vishnuprayag Hydro-electric Project by Jaiprakash Power Ventures Limited, a hydro power project at Chamoli district in Uttaranchal state of India managed by JPVL during the period 3 June 2006 to 31 March 2007 amount to 728 188 tCO<sub>2</sub> equivalent.

The verification of reported emission reductions is based on the information made available to us and the engagement conditions detailed in this report. DNV Certification AS cannot guarantee the accuracy or correctness of this information. Hence, DNV Certification AS cannot be held liable by any party for decisions made or not made based on this report.

  
Manager  
Climate Change Services  
DET NORSKE VERITAS AS



## 5 REFERENCES

### Category 1 Documents:

*Documents provided by the Project Participants that relate directly to the GHG components of the project. These have been used as direct sources of evidence for the initial verification conclusions, and are usually further checked through interviews with key personnel.*

- /1/ Monitoring Report of Vishnuprayag hydro-electric project by Jaiprakash power ventures Limited dated 16 May 2007.
- /2/ Project Design Document - Vishnuprayag Hydro-electric Project by Jaiprakash Power Ventures Limited dated 25 May 2007.
- /3/ Uttaranchal Pollution Control Board – ‘No objection certificate’ dated 6 March 2003.
- /4/ JPVL: Commissioning certificates of the 4 units dated 13 October 2006, 31 August 2006, 14 July 2006 and 17 June 2006
- /5/ JPVL: Amendment to power purchase agreement signed with UPPCL, September 2002 and approved by UPERC, June 2003

### Category 2 Documents:

*Background documents related to the design and/or methodologies employed in the design or other reference documents. Where applicable, Category 2 documents have been used to cross-check project assumptions and confirm the validity of information given in the Category 1 documents and in verification interviews.*

- /6/ International Emission Trading Association (IETA) & the World Bank's Prototype Carbon Fund (PCF): *Validation and Verification Manual*. <http://www.vvmanual.info>
- /7/ ACM0002 – Approved Consolidated baseline and monitoring methodology
- /8/ IETA: *Voluntary Carbon Standards- 1 Manual*

### Persons interviewed:

*Persons interviewed during the verification, or persons contributed with other information that are not included in the documents listed above.*

- /9/ Mr. Mahesh C. Maheshwari, JPVL stationed in New Delhi, India
- /10/ Mr. Sanjiv K. Goel, JPVL stationed in New Delhi, India
- /11/ Mr. S.M. Dhir, JPVL, stationed in VHEP, Chamoli, Uttaranchal (now Uttarakhand), India
- /12/ Mr. Shivapriya, JPVL, stationed in VHEP, Chamoli, Uttaranchal (now Uttarakhand), India
- /13/ Mr. Harshpreet Singh, Emergent Ventures India (P) Ltd, Gurgaon, Haryana, India
- /14/ Mr. Lokesh Chandra Dube, Emergent Ventures India (P) Ltd, Gurgaon, Haryana, India

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| <i>Table of Content</i> |  | <i>Page</i> |
|-------------------------|--|-------------|
| 1                       | INTRODUCTION .....                                   | 1           |
| 1.1                     | Objective  | 1           |
| 1.2                     | Scope  | 1           |
| 1.3                     | GHG Project Description                              | 1           |
| 2                       | METHODOLOGY .....                                    | 2           |
| 3                       | VERIFICATION FINDINGS .....                          | 3           |
| 3.1                     | Project Implementation                               | 3           |
| 3.2                     | Project Baseline                                     | 3           |
| 3.3                     | Project Additionality                                | 4           |
| 3.4                     | Completeness of Monitoring                           | 6           |
| 3.5                     | Accuracy of emission reduction calculations          | 6           |
| 3.6                     | Quality of evidence to determine emission reductions | 6           |
| 3.7                     | Management System and Quality Assurance              | 7           |
| 4                       | VERIFICATION STATEMENT .....                         | 7           |
| 5                       | REFERENCES .....                                     | 8           |



### *Abbreviations*

|                   |  |
|-------------------|--|
| BM                | Build Margin   |
| CEF               | Carbon Emission Factor                                 |
| CEA               | Central Electricity Authority of India                 |
| CERC              | Central Electricity Regulatory Commission              |
| CO <sub>2</sub>   | Carbon dioxide   |
| CO <sub>2</sub> e | Carbon dioxide equivalent                              |
| DNV               | Det Norske Veritas                                     |
| GHG               | Greenhouse gas(es)                                     |
| GWP               | Global Warming Potential                               |
| IPCC              | Intergovernmental Panel on Climate Change              |
| IPP               | Independent Power Producers                            |
| JPVL              | Jaiprakash Power Ventures Limited                      |
| MP                | Monitoring Plan  |
| MVP               | Monitoring and Verification Plan                       |
| NGO               | Non-governmental Organisation                          |
| ODA               | Official Development Assistance                        |
| OM                | Operating Margin                                       |
| PDD               | Project Design Document                                |
| PPA               | Power Purchase Agreement                               |
| UNFCCC            | United Nations Framework Convention for Climate Change |
| UPPCL             | Uttar Pradesh Power Corporation Limited                |
| VER               | Verified Emission Reductions                           |
| VHEP              | Vishnuprayag Hydro Electric Project                    |





## VERIFICATION REPORT

|  |   |
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| Client:<br>Jaiprakash Power Ventures Limited | Client ref.:<br>Mahesh C. Maheshwari  |

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DNV Certificatio AS

Veritasveien 1,  
1322 HØVIK, Norway  
Tel: +47 67 57 99 00  
Fax: +47 67 57 99 11  
http://www.dnv.com  
Org. No: NO 945 748 931 MVA

**Summary:**

DNV Certification AS has performed a verification of emission reductions reported from the 'Vishnuprayag Hydro-electric Project by Jaiprakash Power Ventures Limited', managed by JPVL for the period 3 June 2006 to 31 March 2007.

In our opinion the GHG emissions reductions reported for the project in the monitoring report dated 16 May 2007 are fairly stated.

The GHG emission reductions were calculated correctly on the basis of the baseline and monitoring methodology provided in the PDD of 25 May 2007 (version 2).

Det Norske Veritas Certification AS is able to certify that the emission reductions from the 'Vishnuprayag Hydro-electric Project by Jaiprakash Power Ventures Limited', a run-of-the river hydro power project in Uttaranchal (now Uttarakhand), India, managed by Jaiprakash Power Ventures Limited (JPVL) during the period 3 June 2006 to 31 March 2007 amount to 728 188 tCO<sub>2</sub> equivalent.

The verification of reported emission reductions is based on the information made available to us and the engagement conditions detailed in this report. DNV Certification AS can not guarantee the accuracy or correctness of this information. Hence, DNV Certification AS cannot be held liable by any party for decisions made or not made based on this report.

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