300MW HYDROPOWER PROJECT BY HBPCL

Document Prepared By EKI Energy Services Limited

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[1] Due to change in ownership (from JHPL to HBPCL) of project activity, the deviation has been requested to change the project title from "300MW Hydropower project by JHPL" to "300MW Hydropower project by HBPCL". The ownership transfer documents are submitted to DOE for validation purpose.

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1 PROJECT DETAILS

1.1 Summary Description of the Project and its Implementation Status

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 was an initiative of Jaiprakash Hydro Power Limited (JHPL[2]) a part of the Jaypee Group. The purpose of the project activity is to generate electricity using renewable hydro energy and sell it to Himachal Pradesh State Electricity Board (HPSEB).

From 01/09/2015 onwards, the Himachal Baspa Power Company Ltd (HBPCL) has owned the power plant and thus new owner is acting as project proponent for the proposed project activity. The ownership transfer documents are being submitted to DOE for validation purpose.

Due to change in ownership (from JHPL to HBPCL) of project activity, the deviation has been requested to change the project title from “300MW Hydropower project by JHPL” to “300MW Hydropower project by HBPCL”

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.

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.

In absence of project activity, equivalent quantity of electricity would have been generated by fossil fuel dominated grid connected power plant. This was the scenario existing prior to implementation of project activity.

The power produced displaces an equivalent amount of power from the grid, which is fed mainly by fossil fuel fired power plants. Hence, it results in reduction of GHG emissions. GHG emission reductions from the project activity will be 1,212,379 tonnes of CO_2e and total GHG emission reductions for the chosen 10 year crediting period will be 12,123,790 tonnes of $CO_{2e.}$

The total capacity of the project activity is 300 MW and the project is commissioned on 8th June 2003.

[2] The project was initially executed by Jaiprakash Hydro Power Limited (JHPL), a special purpose vehicle (SPV) by promoter Jaiprakash Industries Limited (JIL) (Formerly, Jaiprakash Associates Limited).
Thereafter the SPV has merged to namely formed Jaiprakash Power Ventures Limited (JPVL, thus ownership document refers transfer of ownership from Jaiprakash Power Ventures Ltd (JPVL) to Himachal Baspa Power Company Ltd (HBPCL)."

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

During the current monitoring period the net electricity generated is 2,962,836.1 MWh and resulting generation of 2,697,751 VCU's. The current monitoring period involves two monitoring periods of both first crediting period and second crediting period.

Monitoring period of first crediting period is 01/09/2015 to 31/03/2016 and VCUs generated during this period is 320,153 tCO2.

Monitoring period of second crediting period is 01/04/2016 to 31/12/2017 and VCUs generated during this period is 2,377,598 tCO2.

1.2 Sectoral Scope and Project Type

The project activity falls under the following Sectoral scope and Project Type:
Sectoral Scope: 01 - Energy industries (renewable / non-renewable sources)
Project Type: I - Renewable Energy Projects
Methodology: ACM0002: Grid-connected electricity generation from renewable sources - Version 17.0[3]

The project is not a grouped project activity.

1.3 Project Proponent

Organization name	Himachal Baspa Power Company Ltd.
Contact person	Mr Rajarshi Bera
Title	Sr. Manager (Tech)
Address	Karcham Wangtoo H.E.Project, Sholtu Colony, P.O. Tapri, District – Kinnaur, PIN-172104,-Himachal Pradesh (India)
Telephone	-
Email	rajarshi.bera@jsw.in

1.4 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consulting
Contact person	Ramkrishna Patil

[3] https://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN

Title	GM-Operations
Address	EnKing Embassy, Office No 201, Plot No 48, Scheme 78, Part 2, Vijay Nagar, Indore- 452010, Madhya Pradesh, India
Telephone	T +91 731 42 89 086, M +91 9096562065
Email	ramkrishna.patil@enkingint.org

1.5 Project Start Date

8th June 2003 which is the start date of commercial operation of the plant

1.6 Project Crediting Period

First Crediting Period: 1st April 2006 to 31st March 2016

Second Crediting Period: 1st April 2016 to 31st March 2026

1.7 Project Scale and Estimated GHG Emission Reductions or Removals

Since the emission reduction is more than 300,000 tCO_2 per annum, the project is categorised as large project.

Project Scale	
Project	
Large project	✓

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	1,212,379
Year 2	1,212,379
Year 3	1,212,379
Year 4	1,212,379
Year 5	1,212,379
Year 6	1,212,379
Year 7	1,212,379
Year 8	1,212,379
Year 9	1,212,379
Year 10	1,212,379
Total estimated ERs	12,123,790
Total number of crediting years	10
Average annual ERs	1,212,379

1.8 Description of the Project Activity

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 purpose of the project activity is to generate electricity using renewable hydro energy and sell it to Himachal Pradesh State Electricity Board (HPSEB).

From 01/09/2015 onwards, the Himachal Baspa Power Company Ltd (HBPCL) has owned the power plant and thus new owner is action as project proponent for the proposed project activity. The ownership transfer documents are being to DOE for validation purpose.

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 2533.50 metres, the highest altitude for any such structure to come up in India

The project activity is a run-of-the-river hydro project which will supply power through Indian 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. INDIAN grid is operating with a mix of hydro, nuclear and fossil fuel power plants.

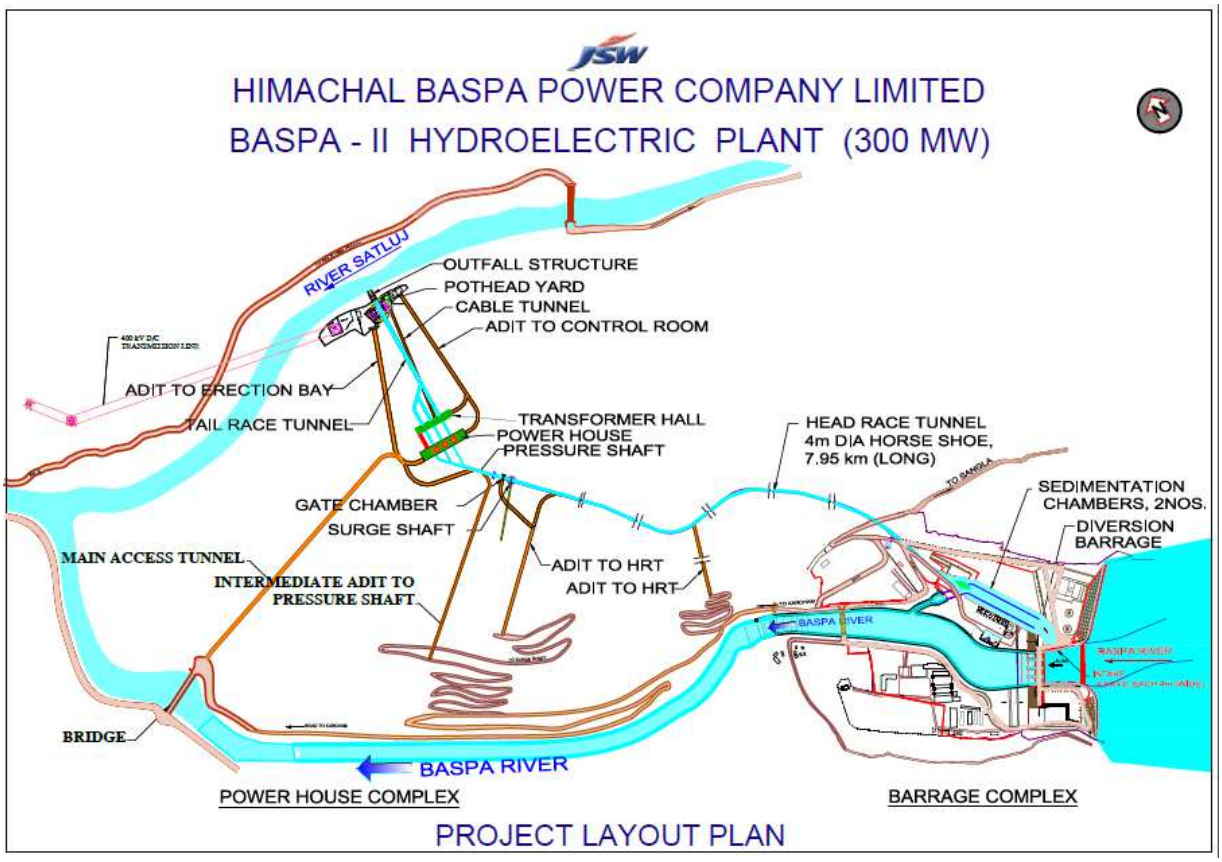
The purpose of the project activity is to generate electricity using renewable hydro energy and sell it to Himachal Pradesh State Electricity Board (HPSEB).

PP 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 INDIAN 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 Indian grid of India is obtained by thermal power.

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 885 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

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

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 (300 MW) hydroelectric project.

Technical information of the Project activity

Parameters	**Specifications**
Hydrology	
Catchment area at barrage axis	967.72 sq.km
Snow catchment	514.15 sq.km
Design flood (1 in 100 Years)	1150 Cumec
Minimum discharge for 90%	9.4 Cumec
Diversion Barrage	

Type	Gated, 61 m long
Length of Barrage	70 m (4 bays of 13m each, 3 Piers of 3m each
Height of Barrage from deepest foundation	21.15 m (EL. 2533.50 to EL. 2512.35m at 40m D/S of
Maximum Pond Level	EL. 2531.50m
Minimum Pond Level	EL. 2527.50m
Live Storage at FRL	75.00 Ha-m
Average River bed level at barrage site	EL. 2519.00m
Intake	
Crest Level	EL. 2525.00m
No. of intake bays	4 bays each 4 m wide (Plus 2 bays for Baspa Stage-I)
Discharge through intake	65 cumec
SEDIMENTATION CHAMBER AND FLUSHING DUCTS	
Particle Size to be Excluded	(+) 0.2 mm
Flow through velocity	0.3 m/s
Desilting tanks	2 Nos.
Size of tank	138.5m (L) x17m (W) x16m (H)
Flushing discharge	13 cumec
Size of Flushing tunnel	0.84mx1.8m (H) (2 Nos.)
Head Race Tunnel (HRT)	
Length	7950 m (excluding 103m of cut and cover portion)
Type of Section	4m dia, Modified Horse Shoe
Design Discharge	52 cumec
Slope in tunnel	1 in 114
Lining	Concrete lining
SURGE SHAFT	
Type	Underground
Diameter	6m/8m
Height	121m
PRESSURE SHAFT	
No. & Type	One number, steel lined 3.1 m dia 885m long with two bifurcations U/S of Power House
Unit Penstock	3 Nos, 1800 mm dia
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 T.H. Cavern	75 m (L) x 13m (W) x 20 m (H)
GENERATION	
In 90% dependable year	1213 MU per annum
In 50% dependable year	1391.61 MU per annum
Tail Race Tunnel (TRT)	
Length and Shape	250m long, 5.6m d-shaped
Hydraulic Turbines (HYDRO-VEVEY, SWITZERLAND)	
Type	Pelton
Design Head	702 m
Rated Output	103 MW
Normal Speed	375 rpm
No. of Jets	4
Generators (SIEMENS A.G., GERMANY)	
Rated Output	111MVA with 10% overload margin with higher temperature rise
Rated Voltage	13.8 kV +/- 5%
Frequency	50 Hz +/- 3%
Synchronous speed	375 rpm
MAIN UNIT TRANSFORMERS (BHEL)	
No. & Capacity	3x41 MVA, Single Phase
BUS DUCTS (SIEMENS A.G., GERMANY)	
Type	Isolated phase, Continuous type
Rated Voltage	15 kV
Rated Current	6000 A (Main) / 4000A (Delta)
Cooling	Natural
E.O.T. CRANES (WMI CRANES LTD.)	
No. & Capacity	1x 210/25/10 tonne
Span	18.8 m
55 Km long, 400kV D/C Transmission Line between Baspa-II to Jhakri - Total scope including Benching work, Foundation work, Tower Erection Work, Stringing Work and Revetment Work at 121 Locations involving crossing of the valley 13 times	

1.9 Project Location

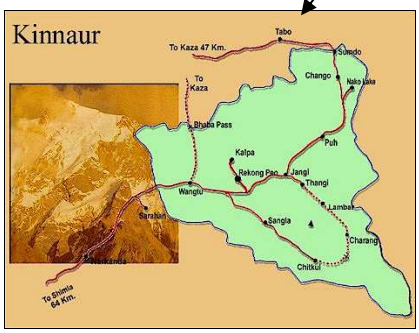
The project site is located about 210 Kms from Shimla. Shimla is connected to the project site by National Highway-22 (Hindustan Tibet Road). Nearest broad gauge railway station from the project site is Kalka which is about at a distance of 300 Kms from the project site. The geographical location of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



Location of Himachal Pradesh in India



Location of Kinnaur district



1.10 Conditions Prior to Project Initiation

The project is a renewable energy project which supplies power to the INDIAN 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.

The baseline scenario is same as the conditions existing prior to the project initiation. Please refer section 2.4 of this document for baseline scenario.

1.11 Compliance with Laws, Statutes and Other Regulatory Frameworks

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

1.12 Ownership and Other Programs

1.12.1 Project Ownership

For the ownership details of the project following documents can be referred:

1. Ownership Document of Himachal Baspa Power Company Limited from Jaiprakash Power Ventures Limited (JPVL) (formerly known as Jaiprakash Hydro Power Limited (JHPL))
2. Joint Meter Reading report (JMR) from Himachal Pradesh State Electricity Board Limited on the name of Himachal Baspa Power Company Limited (HBPCL)

1.12.2 Emissions Trading Programs and Other Binding Limits

The project reduces GHG emissions from activities that are not included in an emissions trading program or any other mechanism that includes GHG allowance trading, and include details about any such programs or mechanisms. Thus this section is not applicable.

1.12.3 Other Forms of Environmental Credit

The project has neither registered in other national and international environment mechanism nor creating any other form of environmental credit.

1.12.4 Participation under Other GHG Programs

Project has neither registered nor seeking registration under any other GHG programs.

1.12.5 Projects Rejected by Other GHG Programs

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

1.13 Additional Information Relevant to the Project

Eligibility Criteria

This is not a grouped project.

Leakage Management

As per methodology ACM0002 version 17, for hydro projects no any leakage is applicable. Hence project participants do not need to consider leakage in applying this methodology.

Commercially Sensitive Information

No any commercially sensitive information has been excluded from the public version of the project description and briefly describe the items to which such information pertains.

Sustainable Development

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 INDIAN 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 greenhouse 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 greenhouse 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.

Further Information

Not Applicable

2 APPLICATION OF METHODOLOGY

2.1 Title and Reference of Methodology

The VCS methodology applied to the project activity is:

Title: "Grid-connected electricity generation from renewable sources --- Version 17.0"
Reference: Large-scale Consolidated Methodology, Grid-connected electricity generation from renewable sources, Version 17.0[5], Sectoral scope(s): 01, EB 89

Title: Tool to calculate the emission factor for an electricity system, Version 06.0, EB 97[6]

The project primarily displaces power from the INDIAN 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 97, Annex 7.

2.2 Applicability of Methodology

The project activity involves generation of grid connected electricity from hydro power energy. The project activity has an installed capacity of 300 MW primarily displaces power from the INDIAN grid. The project status is corresponding to the methodology ACM0002 and applicability of methodology ACM0002 are discussed below:

Applicability Criterion	Project Case
This methodology is applicable to grid-connected renewable power generation project activities that: • install a Greenfield power plant; • involve a capacity addition to (an) existing plant(s); • involve a retrofit of (an) existing operating plants/units; • involve a rehabilitation of (an) existing plant(s)/unit(s) or • involve a replacement of (an) existing plant(s)/unit(s).	The project activity is a Renewable Energy Project i.e. Hydro Power Project which falls under applicability criteria option 1(a) i.e., Install a Greenfield power plant; Hence the project activity meets the given applicability criterion.
The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without 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. Hence it falls under this applicability criteria.
In the case of capacity additions, retrofits, rehabilitations or replacements (except for wind, solar, wave or tidal power capacity addition projects the existing plant/unit started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions	The proposed project activity does not involve any capacity additions, retrofits or replacements and therefore this condition is not applicable.

[5] https://cdm.unfccc.int/methodologies/DB/8W400U6E7LFHHYH2C4JR1RJWWO4PVN
[6] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v6.pdf

and defined in the baseline emission section, and no capacity expansion, retrofit, or rehabilitation of the plant/unit has been undertaken between the start of this minimum historical reference period and the implementation of the project activity;	
In case of hydro power plants, one of the following conditions shall apply: • The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or • The project activity is implemented in existing single or multiple reservoirs, where the volume of the reservoir(s) is increased and the power density calculated using equation (3), is greater than 4 W/m^2; or • The project activity results in new single or multiple reservoirs and the power density, calculated using equation (3), is greater than 4 W/m^2.	Since this is a Greenfield field project the first two options are not applicable. 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/m^2. The area of the reservoir is 33 ha (FSL11). It is a new reservoir. Therefore third option is applicable.
The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (3), is lower than or equal to 4 W/m^2, all of the following conditions shall apply: • The power density calculated using the total installed capacity of the integrated project, as per equation (4), is greater than 4 W/m^2; • Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; • Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m^2 shall be; ✓ Lower than or equal to 15 MW; and ✓ Less than 10 per cent of the total installed capacity of integrated hydro power project.	The project activity is a standalone hydro power project therefore this point is also not applicable.
In the case of integrated hydro power projects, project proponent shall: • Demonstrate that water flow from upstream power plants/units spill directly to the downstream reservoir and that collectively constitute to the generation capacity of the integrated hydro power project; or • Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without the construction of reservoirs. The purpose of water balance is to demonstrate the requirement of specific combination of reservoirs constructed under CDM project activity for the optimization of power output. This demonstration has to be carried out in the specific scenario of water availability in different seasons to optimize the water flow at the inlet of power units. Therefore this water balance will take into account seasonal flows from river, tributaries (if any), and rainfall for minimum five years prior to implementation of CDM project	The project activity is constructed as a run-of-the-river hydropower project. Therefore, the said criteria is not applicable

activity.	
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/units	The project activity is a greenfield activity which generates electricity from potential energy of water stored, there is no switching from fossil fuel involved. The project activity is not biomass fired power plant.
In the case of retrofits, rehabilitations, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, that is to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance".	This project activity is a greenfield activity which generates electricity from run-of-the–river, this is not the case of retrofits, rehabilitations, replacements or capacity additions.
Applicability conditions of "Tool to calculate the emission factor for an electricity system"	
This tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity that is where a project activity supplies electricity to a grid or a project activity that results in savings of electricity that would have been provided by the grid (e.g. demand-side energy efficiency projects).	This condition is applicable. OM, BM and CM are estimated using the tool for calculating baseline emissions.
Under this tool, the emission factor for the project electricity system can be calculated either for grid power plants only or, as an option, can include off-grid power plants. In the latter case, the conditions specified in "Appendix 2: Procedures related to off-grid power generation" should be met. Namely, the total capacity of off-grid power plants (in MW) should be at least 10 per cent of the total capacity of grid power plants in the electricity system; or the total electricity generation by off-grid power plants (in MWh) should be at least 10 per cent of the total electricity generation by grid power plants in the electricity system; and that factors which negatively affect the reliability and stability of the grid are primarily due to constraints in generation and not to other aspects such as transmission capacity.	Since project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
In case of CDM projects the tool is not applicable if the project electricity system is located partially or totally in an Annex I country.	The project activity is located in India, a non-Annex I country. Therefore, this criterion is not applicable for the project activity.
Under this tool, the value applied to the CO2 emission factor of biofuels is zero.	Each project activity is grid connected renewable energy project and CO_2 emission factor is not considered for biofuels.

2.3 Project Boundary

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	For dry or flash steam geothermal power plants, emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam.	CO_2	No	Not applicable as project is hydro project and not geothermal power plants.
		CH_4	No	Not applicable as project is hydro project and not geothermal power plants.
		N_2O	No	Not applicable as project is hydro project and not geothermal power plants.
	For binary geothermal power plants, fugitive emissions of CH4 and CO2 from non-condensable gases contained in geothermal steam	CO_2	No	Not applicable as project is hydro project and not geothermal power plants.
		CH_4	No	Not applicable as project is hydro project and not geothermal power plants.
		N_2O	No	Not applicable as project is hydro project and not geothermal power plants.
	For binary geothermal power plants, fugitive emissions of hydrocarbons such as n-butane and isopentane (working fluid) contained in the heat exchangers	Low GWP hydrocarbon/ refrigerant	No	Not applicable as project is hydro project.
	CO2 emissions from combustion of fossil fuels for electricity generation in solar thermal power plants and geothermal power plants	CO_2	No	Not applicable as project is hydro project and not solar thermal power and geothermal power plant.
		CH_4	No	Not applicable as project is hydro project and not solar thermal power and geothermal power plant.
		N_2O	No	Not applicable as project is hydro project and not solar thermal power and geothermal power plant.

Source		Gas	Included?	Justification/Explanation
	For hydro power plants, emissions of CH4 from the reservoir	CO_2	No	Not applicable since project is a run-of-the- river activity with a reservoir facility for diurnal storage
		CH_4	No	Not applicable since project is a run-of-the- river activity with a reservoir facility for diurnal storage
		N_2O	No	Not applicable since project is a run-of-the- river activity with a reservoir facility for diurnal storage

2.4 Baseline Scenario

Updated baseline for the second crediting period in line with the "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period." Version 03.0.1.

This tool provides a stepwise procedure to assess the continued validity of the baseline and to update the baseline at the renewal of a crediting period, as required by paragraph 280 to 294 of standard "CDM project standard for project activities" version 01.0 & 49 (a) of the modalities and procedures of the clean development mechanism.

The tool stipulates the following steps to be carried out.

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

The baseline scenario remains unchanged and is in compliance with all the relevant mandatory national and/or sectoral policies.

Step 1.2: Assess the impact of circumstances

The baseline scenario identified at the validation of the project activity was the 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 into the grid. Thus this project activity was a voluntary investment which intends to replace equivalent amount of electricity at grid from renewable source. PP was not bound to incur this investment; hence absence of project activity (i.e. the investment) does not lead to any continued baseline practice for PP within their scope whereas the continued operation of the project activity would continue to replace equivalent amount of electricity at grid. Hence, the same baseline as identified in the previous crediting period is still valid for the project. Therefore, the assessment of the changes in market characteristics is not required for the renewal of the project's crediting period under CDM.

Nevertheless, there is an impressive growth attained by the Indian Power Sector within the recent years, the installed capacity has grown from mere 1,713 MW in 1950 to 267,637 MW as on 31.03.2015, consisting of 188897.78 MW Thermal, 31692.14 MW Renew and 5,780 MW Nuclear. Sector-wise details of installed capacity are shown in Table 1. However, it is evident from Table 1[7] that the installed capacity is predominantly coal based and therefore, is a major source of carbon dioxide emissions in India. Hence, there exists scope for reducing the CO_2 emissions in the country by increased use of renewable energy sources. Furthermore, project participant has considered the latest available CO_2 Baseline Database (CEA database, version 12) at the time of requesting renewal of the crediting period for establishing the baseline emission factor, which itself considered all the new circumstances. Hence, the new circumstances do not have an impact on the baseline emission.

Table 1: Sector- wise installed capacity (MW) as on 31.03.2015 (CEA Database version 12)

Sector	Hydro	Thermal				Nuclear	Renew.	Total
		Coal	Gas	Diesel	Total			
State	27482.00	58100.50	6974.42	602.61	65677.53	0.00	3803.67	96963.20
Central	11091.43	48130.00	7519.73	0.00	55649.73	5780.00	0.00	72521.16
Private	2694.00	58405.38	8568.00	597.14	67570.52	0.00	27888.47	98152.99
All India	41267.43	164635.88	23062.15	1199.75	188897.78	5780.00	31692.14	267637.35

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested

As explained in step 1.2, the baseline scenario was the electricity import/generation from the power plants connected to the electricity grid. Therefore this condition is not applicable to the project activity.

Step 1.4: Assessment of the validity of the data and parameters

This step stipulates that "Where emission factors, values or emission benchmarks are used and determined only once for the crediting period, they should be updated, except if the emission factors, values or emission benchmarks are based on the historical situation at the site of the project activity prior to the implementation of the project and cannot be updated because the historical situation does not exist anymore as a result of the CDM project activity."

In the context of the present project activity the emission factor has been updated along with the approach used to calculate the emission factor.

Step 2: Update the current baseline and the data and parameters

As evident from the explanation provided above the baseline scenario remains unchanged. Only the approach used to calculate the baseline emission factor is updated as per the latest version available at the time of PDD submission for renewal.

In line with the paragraph 288 of the standard "CDM project standard for project activities" version 01.0, the impact of new relevant national and/or sectoral policies and circumstances on the baseline taking into account relevant EB guidance with regard to renewal of the crediting period

[7] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

at the time of requesting renewal of crediting period; and the correctness of the application of an approved baseline methodology for the determination of the continued validity of the baseline or its update, and the estimation of emission reductions for the applicable crediting period

Impact of the national and/or sectoral policies and circumstances upon the baseline scenario of the project activity

The Government of India enacted the Electricity Act in the year 2003 to harmonize and rationalize the provisions in the then existing laws. The Act consolidated the laws relating to generation, transmission, distribution, trading and use of electricity. With the Enactment of the act, the then existing laws viz, The Indian Electricity Act 1910, The Electricity Supply Act, 1948 and The Electricity Regulatory Commissions Act, 1998 were repealed. The Electricity Act 2003 was in force at the time of the completion of the baseline study for the registered PDD.

Section 3 of the said act required the Central Government to prepare the national electricity policy and tariff policy, in consultation with the State Governments and the Authority for development of the power system based on optimal utilization of resources such as coal, natural gas, nuclear substances or materials, hydro and renewable sources of energy. In accordance with the section 3 of the Electricity Act 2003, the Central Government notified the National Electricity Policy on 12th February 2005 which was in force at the time of completion of the baseline study as stated in the registered PDD of the project activity. This policy has not been revised since then and is currently in force as well.

In addition to the above policies, State Electricity Regulatory Commissions (SERCs) have announced preferential tariffs and Indian Renewable Energy Development Agency (IREDA) provides term loan assistance towards establishing biomass power projects. All these fiscal and financial incentives were in force at the time of completion of the baseline study for the registered PDD of the project activity and still continue to exist.

However, in spite of the financial incentives given by the government to renewable power projects in India the generation from the low cost must run resources connected to the Indian Grid has not increased to such an extent that this would lead to more than 50% contribution from the low cost must run resources towards the total generation from the Indian Grid.

The approved consolidated baseline methodology, ACM0002 version 17.00 has been used to determine the baseline and the estimation of emission reductions for the applicable crediting period. As referred in the methodology "*Tool to calculate the emission factor for an electricity system*" *(version 06.0)* has been used to determine continued validity of the baseline based on combined margin (CM) calculations.

In light of the above discussion it is to be concluded that in accordance with relevant guidelines stipulated in the paragraph 288 of the standard "CDM project standard for project activities" version 01.0, national and/or sectoral policies and circumstances had been considered towards formulating the OM & BM baseline scenario .Hence the baseline scenario as applied for the present project activity remains justified.

As per the approved consolidated methodology ACM0002, *if the project activity is the installation of a new grid-connected renewable power plant/unit, 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 involved setting up of hydro power project to harness the power of water to produce electricity and supply to the grid. In the absence of the project activity, the equivalent

amount of power would have been supplied by the Indian grid which is fed mainly by fossil fuel fired plants.

In the absence of the project activity, the equivalent amount of power would have been drawn from the Indian grid. Hence, the baseline for the project activity is the equivalent amount of power from the Indian grid.

The combined margin ($EF_{grid,CM,y}$) is the result of a weighted average of two emission factor pertaining to the electricity system: the operating margin (OM) and build margin (BM). Calculations for this combined margin must be based on data from an official source[8] (where available) and made publically available.

The combined margin of the Indian grid used for the project activity is as follows:

Parameter	Value	Nomenclature	Source
$EF_{grid,CM,y}$	0.9273 tCO_2/MWh	Combined margin[9] CO_2 emission factor for the project electricity system in year y	Calculated as the weighted average of the operating margin (0.25) & build margin (0.75) values, sourced from Baseline CO2 Emission Database, Version 12.0, May 2017 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,OM,y}$	0.9843 tCO_2/MWh	Operating margin CO_2 emission factor for the project electricity system in year y	Calculated as the last 3 year (2013-14, 2014-15, 2015-16) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 12.0, May 2017 published by Central Electricity Authority (CEA), Government of India
$EF_{grid,BM,y}$	0.9083 tCO_2/MWh	Build margin CO_2 emission factor for the project electricity system in year y	Baseline CO_2 Emission Database, Version 12.0, May 2017 published by Central Electricity Authority (CEA), Government of India

2.5 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[10]. The project proponent was not bound by any legislative mandate to implement the project activity.

[8] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

[9] As per para 87 b) of "Tool to calculate the emission factor for an electricity system , Version 06.0.0, EB 97, Annex 7, All other projects: W_{OM} = 0.5 and W_{BM} = 0.5 for the first crediting period, and W_{OM} = 0.25 and W_{BM} = 0.75 for the second and third crediting period

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

Typical capital costs for power projects in India

Types of Power Project	Capital Cost (USD Mn/MW)
Gas Based	0.67
Coal Based	1.00
Diesel	0.87
Wind	1.25[11]
Hydro Power	1.25[12]
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[13], GOI consider financial constraint as a major road block in public private investment 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/ Fund tie up constraints/ delay in financial closure	1400

[10] Electricity Act 2003, section 7
[11] http://www.indiatodaygroup.com/btoday/20060521/features1.html
[12] Report of the Working Group on Power for Eleventh Plan, Ministry of Power
[13] Report of the Working Group on Power for Eleventh Plan, Ministry of Power, Page 18

Delay in Preparation of DPR & signing of MOU with state government	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[14] plays a crucial role in the smooth implementation of hydro projects.

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

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

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[15], 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			
				Private Sector		Govt. Sector	
		MW	%	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[16]

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[17]. 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

[15] The Gazette of India, MNES
[16] http://www.cea.nic.in/power_sec_reports/general_review/0304/chap-2.pdf
[17] http://cwc.nic.in/Water_Data_Pocket_Book_2006/T8.3final.pdf

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 2533.50 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 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

It is to be noted that this PDD is revised for Renewable Crediting Period, hence there is no change is made in additionality section.

2.6 Methodology Deviations

Not applicable.

3 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

3.1 Baseline Emissions

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 = 1,314,000 MWh
Auxiliary power consumption in a year by the project activity: 1314000*0.5% = 6,570 MWh

Net Power Generation in a year by the project activity: 1,314,000-6,570 = 1,307,430 MWh

Combined Margin Grid Emission Factor = 0.9273 tCO_2/MWh (for actual calculation, the latest available data and the data for the corresponding year will be used to calculate the baseline emissions)

22kV Transmission line for import:

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 Net electricity supplied to grid. For ER estimation, the same is not considered, however in actual it will be monitored and will considered for calculation of net electricity supplied to grid.

The baseline emission for the project activity is calculated as follows:
BE_y= 1,307,430 MWh × 0.9273 tCO_2/MWh = 1,212,379 tCO_2/year

3.2 Project Emissions

PE_y= Project emission due the project activity in a year

For most renewable energy power generation project activities, PEy = 0.

As per para 38 of ACM0002 Version 17, For all renewable energy power generation project activities, emissions due to the use of fossil fuels for the backup generator can be neglected.

The project emission includes the CH4 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 W/m^2

As per the methodology if the power density (PD) of the power plant is greater than 10 W/m^2, then the project emission are zero.

Hence the project emission are PE_y =0

3.3 Leakage

As per methodology, No other leakage emissions are considered. The emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, transport etc.) are neglected

3.4 Estimated Net GHG Emission Reductions and Removals

Baseline calculation:

The project activity is generation of electricity using Hydro potential energy and exporting the same to the INDIAN 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:

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

Where,

BE_y = Baseline emissions in year y (tCO_2/yr).

EG_y = Net 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 = 0.9273 tCO_2/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/m^2, so project emission PE_y=0

Leakage emission calculation:

As per methodology, no leakage emissions are applicable.

Emission reduction is calculated as follows:

$ER_y = BE_y – PE_y - L_y$

$ER_y = BE_y$

Year	Estimated baseline emissions or removals (tCO_2e)	Estimated project emissions or removals (tCO_2e)	Estimated leakage emissions (tCO_2e)	Estimated net GHG emission reductions or removals (tCO_2e)
Year 1	1,212,379	0	0	1,212,379
Year 2	1,212,379	0	0	1,212,379
Year 3	1,212,379	0	0	1,212,379
Year 4	1,212,379	0	0	1,212,379
Year 5	1,212,379	0	0	1,212,379
Year 6	1,212,379	0	0	1,212,379
Year 7	1,212,379	0	0	1,212,379
Year 8	1,212,379	0	0	1,212,379
Year 9	1,212,379	0	0	1,212,379
Year 10	1,212,379	0	0	1,212,379
Total	12,123,790	0	0	12,123,790

4 MONITORING

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,\ CM,y}$
Data unit	tCO_2/MWh
Description	Combined Margin Grid emission factor for the project activity
Source of data	Calculated from CEA database, Version 12, May 2017[18]
Value applied	0.9273
Justification of choice of data or description of measurement methods and procedures applied	The data are obtained from "CO2 Baseline Database for Indian Power Sector" version 12.0, published by the Central Electricity Authority, Ministry of Power, Government of India. The combined margin emissions factor is calculated as follows: $EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$ Where: $EF_{grid,BM,y}$= Build margin CO2 emission factor in year y (tCO2/MWh) $EF_{grid,OM,y}$= Operating margin CO2 emission factor in year y

[18] http://www.cea.nic.in/reports/others/thermal/tpece/cdm_co2/user_guide_ver12.pdf

	(tCO2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 25% W_{BM} = Weighting of build margin emissions factor (%) = 75% The above weighing is as per "Tool to calculate the emission factor for an electricity system", version 06.0.0 for other projects (hydro in this case) and for second crediting period
Purpose of Data	The data is used for baseline emission calculation.
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	$EG_{PJ,y}$ / $EG_{facility,y}$
Data unit	MWh
Description	Net Electricity supplied to the grid by the project activity during the year y
Source of data	Joint Meter Reading (JMR) by SEB
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 have been installed at the power house of project activity. 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 are taken at the power house of the project activity in the presence of SEB officials and the PP representative.
Frequency of monitoring/recording	Monitoring Frequency: Continuous Recording Frequency: Monthly
Value applied	Provide an estimated value for the data/parameter
Monitoring equipment	Type of meters: Energy Meter
QA/QC procedures to be applied	Two sets of meters (main & check meters) are used for measuring the electricity export to the grid and electricity import from the grid. The calibration of all the meters will be undertaken at required intervals (once is five years as per CEA notification) and faulty meters will be duly replaced immediately. The meter accuracy class and calibration interval is under purview of state electricity board and PP do not have any control on it. It is also noted that monitoring procedure is under control of state electricity board and

	PP do not have any control on it. The available parameter to PP is the net electricity supplied to grid and same parameter is mentioned as monitoring parameter The Net electricity exported to the grid will be cross checked against the invoice raised by the PP towards the DISCOM.
Purpose of data	Calculation of Baseline Emission
Calculation method	Net Energy Generation = Total energy export to the Grid – Total energy import from the grid
Comments	-

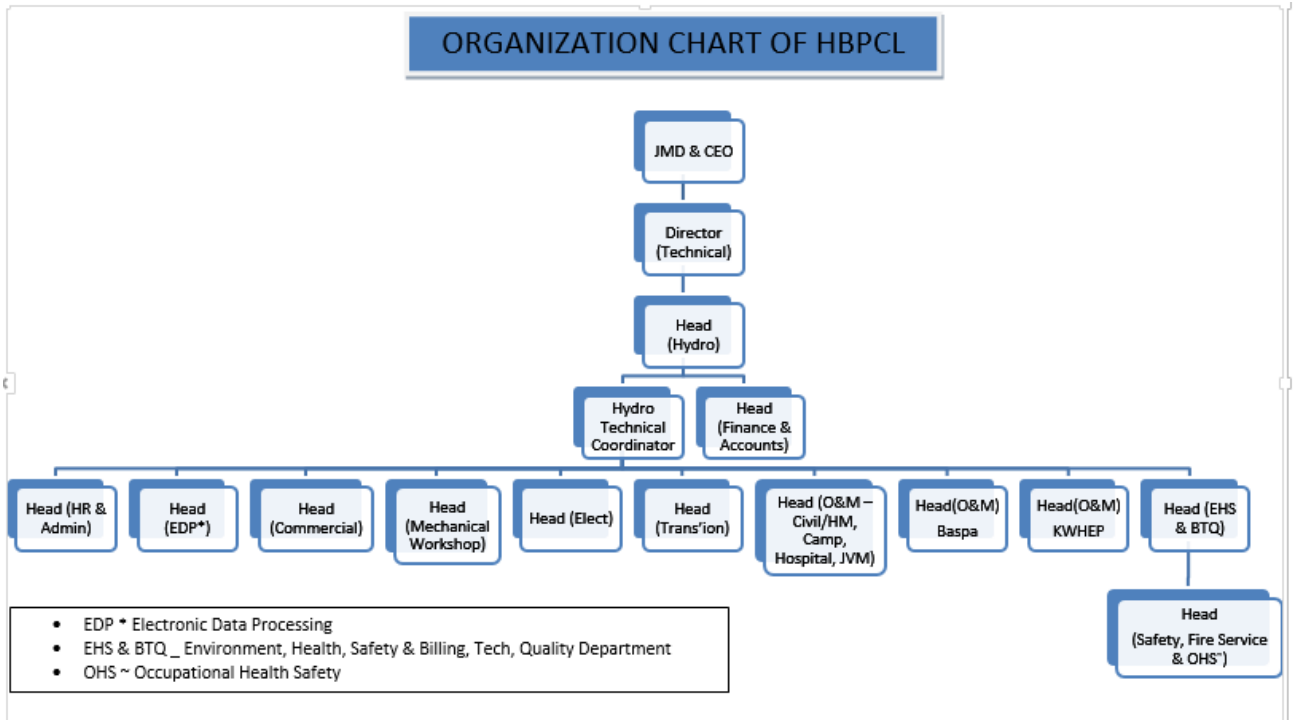
4.3 Monitoring Plan

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 project site, the JMR of commercial metering at inter-connection point is jointly recorded by the representatives of PP and HPSEB every month. To account the transmission loss between project site and Jhakri sub- station, the net electricity supplied to grid measured at project site has been deducted at 0.65%. This is as per state electricity board regulations.

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:



Data Monitoring:

The methodology requires monitoring of the following:

- Net Electricity generation from the project activity;

All the main meters and check meters are tested by a reputed agency on a periodic basis. In case 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 as per CEA notification. 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 data and parameters monitored.

5 SAFEGUARDS

5.1 No Net Harm

The Environment Impact Assessment study was conducted for the project activity and judicious efforts to cause minimal impacts on the surrounding environment and to maintain the natural balance.

5.2 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 µg/m3. 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.

5.3 Local Stakeholder Consultation

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[19] 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

[19] 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

3. To understand stakeholder perceptions
4. Stakeholder awareness of project related issues

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.

The comments received from the stakeholders have been summarized below:

- 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.

A detailed stakeholder consultation process has been conducted during VCS registration of project activity as described above. The PP also placed an grievance register onsite in where the stakeholder can put down his/her complain and the same if found genuine will be addressed immediately

5.4 Public Comments

The Project activity is already listed on VCS registry http://www.vcsprojectdatabase.org/#/project_details/92 and does not require to be listed for public comments. Thus this section is not applicable for Renewable Crediting Period for second crediting period.

6 ACHIEVED GHG EMISSION REDUCTIONS AND REMOVALS

6.1 Data and Parameters Monitored

The current monitoring period covers both first crediting period and second crediting period, hence separate section is mentioned for respective monitoring periods of first and second crediting period.

The monitoring parameters for first crediting period (01/09/2015 to 31/03/2016) is as below

The ex-ante monitoring parameter for first crediting period as per registered VCS PD dated 25/12/2008 are as below

1. Grid emission factor for the project activity having value of 0.805 tCO_2/MWh.
2. Density of diesel having value of 0.860 Kg/liter
3. Emission factor of diesel having value of 74.1 tCO2/TJ
4. Global Warming Potential of SF6 having value of 23900

The below is ex-post monitoring parameter for first crediting period are as per registered VCS PD dated 25/12/2008 and are described as below

Data / Parameter	EG_y
Data unit	MWh
Description	Net Electricity supplied to the grid by the project activity during the year y
Value applied:	398011.0
Comments	-

Data / Parameter	Q_{SF6}
Data unit	tonne
Description	Quantity of SF6 loss during the year y
Value applied:	Provided in Appendix II: Records of SF6 Cylinders Weights
Comments	-

Data / Parameter	$P_{BAY\ VT}$
Data unit	bar
Description	SF6 gas pressure in the BAY VT
Value applied:	Provided in Appendix III: Results of GIS pressure measurement
Comments	-

Data / Parameter	$P_{breaker}$
Data unit	bar
Description	SF6 gas pressure in the Breaker
Value applied:	Provided in Appendix III: Results of GIS pressure measurement
Comments	-

Data / Parameter	P_{feeder}
Data unit	bar
Description	SF6 gas pressure in the Feeder
Value applied:	Provided in Appendix III: Results of GIS pressure measurement
Comments	-

Data / Parameter	Q_{diesel}
Data unit	Litre
Description	Quantity of diesel consumed during the year y
Value applied:	5,338
Comments	-

Data / Parameter	$E_{22\ kV}$
Data unit	kWh
Description	Electricity consumed during the year y
Value applied:	286,449
Comments	-

The monitoring parameters for monitoring period (01/04/2016 to 31/12/2017) of second crediting period is as below

The ex-ante monitoring parameter for second crediting period is combined margin grid emission factor having value as 0.9273 tCO_2/MWh.

The below is ex-post monitoring parameter for second crediting period is Net Electricity supplied to the grid by the project activity during the year y and described as below

Data / Parameter	$EG_{PJ,y}$ / $EG_{facility,y}$
Data unit	MWh
Description	Net Electricity supplied to the grid by the project activity during the year y
Value applied:	2564001.174
Comments	Please refer Appendix 1 for calibration details for current monitoring period

6.2 Baseline Emissions

Baseline Emissions for current monitoring period (01/09/2015 to 31/03/2016) of first crediting period is as below

Baseline Emissions (BEy)

BEy = EFy X EGy

Where

BEy: Baseline emissions due to displacement of electricity during year y in tons of CO_2

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

EFy: CO_2 baseline emission factor for the electricity displaced due to the project activity was fixed ex ante in the PD as 0.805 tonne CO_2/MWh.

Energy supplied to Grid (EGy)

The energy supplied to grid is measured using electricity meters installed at the have been installed at the power house of project activity. The net electricity delivered to the grid is based on the JMR readings taken in the presence of the plant personnel and HPSEB official.

BEy = EGy X EFy

= 398,011.0 MWh X 0.805 t CO_2/MWh

= 320,398.8570 t CO_2

Baseline Emissions for current monitoring period (01/04/2016 to 31/12/2017) of second crediting period is as below

Baseline Emissions (BEy)

BEy = EFy X EGy

Where

BEy: Baseline emissions due to displacement of electricity during year y in tons of CO_2

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

EFy: CO_2 baseline emission factor for the electricity displaced due to the project activity was fixed ex ante in the PD as 0.9273 tonne CO_2/MWh.

Energy supplied to Grid (EGy)

The energy supplied to grid is measured using electricity meters installed at the have been installed at the power house of project activity. The net electricity delivered to the grid is based on the JMR readings taken in the presence of the plant personnel and HPSEB official.

BEy = EGy X EFy

= 2,564,825.1 MWh X 0.9273 tCO_2/MWh

= 2,378,362.2821 tCO_2

Total baseline emissions for complete monitoring period is 2,698,761.1391 tCO_2

6.3 Project Emissions

Project Emissions for current monitoring period of first crediting period is as below

A) Emissions from Diesel Consumption (PEy1)

There are two 625 KVA capacity DG sets of Cummins India Limited make. The records of diesel consumption are made on a daily basis in the DG operation logbook. This has been included in the project emission calculation from the project activity. Project Emissions from diesel consumption are found using the formula given below.

PEy1 is the project emission from diesel consumption.

$PEy1 = Q_{diesel} \times \ell_{diesel} \times EF_{diesel} / 1000$

Where

Q_{diesel} = Quantity of diesel consumed, litre

ℓ_{diesel} = Density of diesel, 0.860 kg/ litre[20]

EF_{diesel} = Emission factor of diesel, 3.186 tCO_2e/ tonne[21] (IPCC Default value)

Month	Diesel consumption	Project emissions (PEy1)

[20] http://www.iocl.com/Products/DieselSpecifications.pdf

[21] 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 carbon oxidation factor and default carbon content for diesel.

Unit	(litres)	(tCO_2)
Sep-15	76	0.20824
Oct-15	127	0.34797
Nov-15	379	1.03844
Dec-15	1530	4.19214
Jan-16	896	2.45500
Feb-16	1790	4.90453
Mar-16	540	1.47958
Total	**5,338**	**14.6259**

PEy1 = 14.6259 tCO_2e

B) Emissions from 22 KV Transmission line (PEy2)

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[22].

PEy2 is the project emission from the 22 kV line which is used for supplying electricity at the site.

$PEy2 = E_{22\ kV} * EF_{grid} / 1000$

Where

E_{22kV} = Electricity consumed at the site in kWh

EF_{grid} = Grid Emission Factor for NEWNE Grid, 0.805 tCO_2/MWh (fixed ex ante in PD)

Month	Power consumption	Project emissions (PEy2)
Unit	**(KWh)**	**(tCO_2)**
Sep-15	7830	6.30
Oct-15	8970	7.22
Nov-15	21119	17.00
Dec-15	48020	38.66
Jan-16	65900	53.05
Feb-16	70830	57.02
Mar-16	63780	51.34
Total	**286449.00**	**230.5914**

PEy2 = 230.5914 tCO_2e

C) Emissions from SF6 (PEy3)

[22] Monthly invoices are used to monitor these emissions, 22 kv line bill, has the data that has been used in the estimation of PEy2

At the project site the PP stores some quantity of SF6 which may be required to top up the circuit breaker compartments in case of any pressure drop as per the monitoring parameters. The PP monitors the SF6 pressure parameter on the SCADA system to account for abnormalities[23]. In case of any leakage or any abnormality observed in any of the units, the alarm trips on the SCADA system and the PP records the pressure in the various units. The tripping of the alarm is directly related to the pressure conditions of the breaker, bay and feeders at the respective pressures as given below:

Monitoring Parameter	Description	Value
$P_{BAY\ VT}$	SF6 gas pressure in the BAY VT	3.05 bar
$P_{breaker}$	SF6 gas pressure in the Breaker	4.95 bar
P_{feeder}	SF6 gas pressure in the Feeder	4.55 bar

The table shows the minimum pressure which must be maintained in the compartments to prevent the alarm from tripping and thus leakage of SF6. The monthly statements maintained by the PP show that some leakage of the gas took place in the current monitoring period.

Annual readings of pressure are taken at bay, breaker and feeder using the Digital pressure indicator (DPI). These were taken on 20/11/2015, for bay and 20/11/2015, for breaker and 20/11/2015, for feeder no abnormality was being reported from the pressure system. The pressure in all three – bay, feeder and breaker, was within the required limit. Thus, there was no need for SF-6 top ups during this verification period.

PEy3 is the project emission on account of leakage of SF6 from the circuit compartments.

$PEy3 = Q_{SF6} \times GWP_{SF6}$

Where

Q_{SF6} = Quantity of SF6 topped up from cylinders into circuit breaker compartments; tonnes

GWP_{SF6} = Global Warming Potential of SF6 (23900)

The SF6 cylinders were installed at the site during the commissioning of the project by Alstom.

As indicated in the PD, an electronic balance has been installed on site in March 2009.

Sr. No.	Weight of SF6 in cylinder before this verification period	Weight of SF6 in cylinder after this verification period	Weight of SF6 consumed	Project Emissions from SF6 consumption (PEy3)
	Kg	Kg	tonnes	(tCO_2)
1	1046.2	1046.2	0	0
2	68.2	68.2	0	0
3	67.6	67.6	0	0

[23] SF6 -SCADA logs and wts of cylinders, forms the basis for the SF6 monitoring.

4	73.6	73.6	0	0
5	73.4	73.4	0	0
Total	**1329**	**1329**	**0**	**0**

There is no change in weight of gas in cylinders through this verification period and the SF6 alarm log shows that no top up was needed in this verification period.

Since, in the current monitoring period of the project activity, the PP was not required to top up the compartments with SF6, hence project emission due to SF6 is zero.

PEy3 = 0 tCO_2e

Total Project Emissions for current monitoring period of first crediting period:

PEy1 + PEy2 + PEy3 = 14.6259 + 230.5914 + 0 = 245.2174 tCO_2

Project Emissions for current monitoring period (01/04/2016 to 31/12/2017) of second crediting period is as below

As per ACM0002 Version 17 methodology, no project emissions are applicable for the hydro project activity.

6.4 Leakage

Leakage Emissions for first crediting period is as below

As per the registered VCS PD methodology, 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). Project participants do not need to consider these emission sources as leakage in applying this methodology.
Thus Ly = 0

Leakage Emissions for second crediting period is as below

As per methodology ACM0002 Version 17, No leakage emissions applicable for hydro projects. Hence project participants do not need to consider leakage in applying this methodology.
Thus Ly = 0

6.5 Net GHG Emission Reductions and Removals

The project activity current monitoring period involves part of first crediting period and part of second crediting period. The monitoring period of first crediting period is 01/09/2015 to 31/03/2016 and monitoring period of second crediting period is 01/04/2016 to 31/12/2017.

The vintage wise VCUs based on monitoring periods of first and second crediting period is as below

Year	Baseline	Project	Leakage	Net GHG emission

	emissions or removals (tCO_2e)	emissions or removals (tCO_2e)	emissions (tCO_2e)	reductions or removals (tCO_2e)
01/09/2015 to 31/12/2015	257877.03	74.97	0.00	**257802**
01/01/2016 to 31/03/2016	62521.82	170.25	0.00	**62351**
01/04/2016 to 31/12/2016	1156291.06	0.00	0.00	**1156291**
01/01/2017 to 31/12/2017	1221307.23	0.00	0.00	**1221307**
Total	**2697997.15**	**245.22**	**0.00**	**2697751**

The comparison of actual emission reductions and estimated emission reductions for respective monitoring period of first and second crediting period are as below

ER Comparison for Monitoring period of first crediting period	
Start Date of monitoring period	1-Sep-15
End Date of Monitoring Period	31-Mar-16
Number of Days for Current Monitoring Period	213
Annual (365 Days) estimation as per Registered PDD	1052463
ER Estimation for Current Monitoring Period	**614177**
Actual ER for Current Monitoring Period of first crediting period	320153
% Variation in Actual Vs Estimated ER	-47.87%

ER Comparison for Monitoring period of second crediting period	
Start Date of monitoring period	1-Apr-16
End Date of Monitoring Period	31-Dec-17
Number of Days for Current Monitoring Period	640
Annual (365 Days) estimation as per Registered PDD	1212379
ER Estimation for Current Monitoring Period	**2125815**
Actual ER for Current Monitoring Period of first crediting period	2377598
% Variation in Actual Vs Estimated ER	11.84%

The variation is due to change in plant load factor and the same is dependent on water availability. Thus it is not under control of PP and no changes in project design. There is no any adverse impact on additionality due to this change on PLF,

APPENDIX 1: CALIBRATION DETAILS

The calibration details of the meters involved in the project activity are as below

Energy Meter Details Baspa-II HEP-300MW								
Sr. No.	Energy Meter Sr. No	Duration of Operation					Date of Calibration	REMARKS
		Installation date	Feeder No.	Meter Usage	Removal Date	Against old meter		
1	HPU06260	8-Dec-17	I	Main	Presently in Operation	HPU06213	5-Dec-17	Calibration done at PGCIL, Jallandhar
2	HPU06261	8-Dec-17	II	Main		HPU06214	5-Dec-17	
3	HPU06262	8-Dec-17	I	Check		HPU06215	6-Dec-17	
4	HPU06263	8-Dec-17	II	Check		HPU06216	6-Dec-17	
5	HPU06213	20-Dec-16	I	Main	8-Dec-17	HPU02547	20-Dec-16	Calibrated at Baspa HEP in Situation
6	HPU06214	20-Dec-16	I	Check	8-Dec-17	HPU02548	20-Dec-16	
7	HPU06215	20-Dec-16	II	Main	8-Dec-17	HPU02549	20-Dec-16	
8	HPU06216	20-Dec-16	II	Check	8-Dec-17	HPU02550	20-Dec-16	
9	HPU02547	5-Jan-16	I	Main	20-Dec-16	UPU01237	2-Jan-16	Calibration done at PGCIL, Jallandhar
10	HPU02548	5-Jan-16	I	Check	20-Dec-16	UPU01238	2-Jan-16	
11	HPU02549	5-Jan-16	II	Main	20-Dec-16	UPU01239	2-Jan-16	
12	HPU02550	5-Jan-16	II	Check	20-Dec-16	UPU01240	2-Jan-16	
13	UPU01237	7-Jan-15	I	Main	5-Jan-16	HPU02547	6-Jan-15	Calibrated at KW HEP (Calibration Certificate Copy Attached)
14	UPU01238	7-Jan-15	II	Main	5-Jan-16	HPU02548	6-Jan-15	
15	UPU01235	7-Jan-15	I	Check	5-Jan-16	HPU02549	6-Jan-15	
16	UPU01236	7-Jan-15	II	Check	5-Jan-16	HPU02550	6-Jan-15	

APPENDIX 2: Records of SF6 Cylinders Weights

Cylinder Number	Weight of SF6 in cylinder before this verification period in Kg	Weight of SF6 in cylinder on 31/03/2016 i.e end date of first crediting period in Kg	Weight of SF6 consumed in tonnes
1	1046.2	1046.2	0
2	68.2	68.2	0
3	67.6	67.6	0
4	73.6	73.6	0
5	73.4	73.4	0
Total	**1329**	**1329**	**0**

APPENDIX 3: Results of GIS Pressure Measurement

GIS Pressure Measurements for the year 2015

Amb. Temp. 28°C **20-11-2015**

UNIT-1

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	5.95	5.96	5.96	3.92	3.95	3.94	3.90	3.91	3.90	3.90	3.90	3.92
Gas pressure diff.	0.07	0.08	0.08	0.08	0.11	0.10	0.06	0.07	0.06	0.06	0.06	0.08

UNIT-2

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	5.97	5.96	5.97	3.92	3.94	3.94	3.91	9.90	3.98	3.94	3.94	3.92
Gas pressure diff.	0.09	0.08	0.09	0.08	0.10	0.10	0.07	6.06	0.14	0.10	0.10	0.08

UNIT-3

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	5.98	5.98	5.98	3.94	3.92	3.94	3.92	3.92	3.94	3.93	3.94	3.96
Gas pressure diff.	0.10	0.10	0.10	0.10	0.08	0.10	0.08	0.08	0.10	0.09	0.10	0.12

Ambient Temp:28°C **20.11.2015**

BUS COUPLER & LIGHTING ARRESTER

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G5(bar)			G6(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	5.96	5.95	5.97	3.92	3.93	3.94	3.93	3.93	3.98	3.93	3.93	3.91	3.95	3.93	3.97
Gas pressure diff.	0.08	0.07	0.09	0.08	0.09	0.10	0.09	0.09	0.14	0.09	0.09	0.07	0.11	0.09	0.13

BUS VT

COMPARTMENT	G1(bar)			G2(bar)			G3(bar)			G4(bar)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84	3.84
Measured gas pressure	3.94	3.94	3.95	3.93	3.92	3.95	3.96	3.96	3.94	4.10	4.07	4.01
Gas pressure diff.	0.10	0.10	0.11	0.09	0.08	0.11	0.12	0.12	0.10	0.26	0.23	0.17

Ambient Temp:24°c **20.11.2015**

FEEDER-1

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)			G5(bar)			G6(bar)			G7(bar) (At 26°C)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	5.69	5.69	5.69	5.62	5.62	5.62	5.62	5.62	5.62	5.47	5.47	5.47
Measured gas pressure	5.94	5.96	5.97	3.92	3.92	3.92	3.92	3.92	3.92	5.81	5.81	5.81	5.89	5.95	5.62	5.79	5.79	5.79	6.12	6.16	6.12
Gas pressure diff.	0.06	0.08	0.09	0.08	0.08	0.08	0.08	0.08	0.08	0.12	0.12	0.12	0.27	0.33	0.00	0.17	0.17	0.17	0.65	0.69	0.65

FEEDER-2

COMPARTMENT	G0(bar)			G1(bar)			G2(bar)			G4(bar)			G5(bar)			G6(bar)			G7(bar) (At 26°C)		
PHASE	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B	R	Y	B
Desired gas at 24 °c	5.88	5.88	5.88	3.84	3.84	3.84	3.84	3.84	3.84	5.69	5.69	5.69	5.62	5.62	5.62	5.62	5.62	5.62	5.47	5.47	5.47
Measured gas pressure	5.97	5.96	5.97	3.94	3.94	3.94	3.92	3.91	3.92	5.78	5.80	5.79	5.82	5.82	5.83	5.86	5.86	5.92	5.67	6.15	6.10
Gas pressure diff.	0.09	0.08	0.09	0.10	0.10	0.10	0.08	0.07	0.08	0.09	0.11	0.10	0.20	0.20	0.21	0.24	0.24	0.30	0.20	0.68	0.63