ALLAIN DUHANGAN HYDROELECTRIC PROJECT (ADHP)

Document Prepared By EKI Energy Services Limited

Project Title	Allain Duhangan Hydroelectric Project (ADHP)
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1 PROJECT DETAILS

1.1 Summary Description of the Project

Project Profile:

Allain Duhangan Hydroelectric Project (ADHP) proposed by AD Hydro Power Ltd. (ADPL) is a run-of the-river 192 MW hydro power project at the confluence of Allain & Duhangan rivulets at Pirni village in Manali town of Kullu district in Himachal Pradesh state of India. This is a new hydroelectric project, currently with a reservoir having a power density of 6508.4746 W/m^2. The project consists of high head underground power plant that would utilise flows from a combination of glacial snow melt and monsoon rains in these two rivulets for the purpose of harnessing hydro power.

ADPL intends to function as a merchant power plant with short term Power Purchase Agreements (PPA) of 1-3 years duration. The power generated at the project would be fed Indian Grid. A 220 kV power transmission line (of approximately 185km length) is proposed to be constructed to evacuate power from the project, to an existing substation at Nalagarh, from where it will be fed to the Indian Grid.

Construction work at project site has been started and the project activity is expected to start generation of power from June 2008. The project energy benefits have been assessed at (Central Electricity Authority CEA approved) 678.18 GWh year in 90% dependable years. The project activity has a power density factor of 6508 W/M^2.

Scenario existing prior to the implementation of project activity:

The Project activity is a new facility (Greenfield) and the electricity generated by the project will be exported to the Indian electricity grid. The project will therefore displace an equivalent amount of electricity which would have otherwise been generated by fossil fuel dominant electricity grid. The Project Proponent plans to avail the VCS benefits for the project.

In the Pre- project scenario the entire 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."

The annual average emission reduction by the project activity is estimated to be 494,668 tCO_2e and the total emission reduction over the 10 year crediting period is estimated to be 4,946,680 tCO_2e .

Project Purpose:

The purpose of the project activity is to generate electricity using renewable hydro energy and supply it to various consumers through Indian grid. In the Indian grid more than 70% of the power supplied is generated using fossil fuels (coal, Diesel, Gas etc). And as the project activity is a renewable energy based power project, it will reduce anthropogenic Green House Gases (GHG) emissions that would have been generated to supply power to Indian grid using fossil fuel. The project activity shall also contribute to sustainable development[1] in following manner:

[1] Sustainable development aspects are discussed in annex-5

- Sustainable development through utilization of renewable hydro resources available in the project region.
- Catering to power demand in Northern India by augmenting power supply in the Indian Grid.
- Conservation of natural resources (like coal, gas, petroleum fuels etc.) through use of renewable source of energy.
- Adhering & contributing to India's national policy of promoting clean power.
- Providing Employment opportunities[2] to local community during plant construction and operations.
- Development of infrastructure in the region.

Implementation of the project activity would catalyse implementation of other similar hydro power projects in India by private players.

1.2 Sectoral Scope and Project Type

The project activity falls under

Sectoral Scope: 01 - Energy industries (renewable / non-renewable sources)

Project Type : Renewable Energy Projects

Title : Consolidated baseline methodology for grid-connected electricity generation from renewable sources[3]

Reference : Approved consolidated baseline and monitoring methodology ACM0002, Version 06

This project is not a grouped project activity.

1.3 Project Eligibility

The project activity involves installation and generation of electricity using hydroelectric energy resources i.e. by using the kinetic energy water flow (renewable sources) replacing electricity supply from a fossil-fuel dominated electricity, thus leads to reductions of anthropogenic GHG emissions from atmosphere. Hence the project activity is eligible Sectoral scope 1 i.e. energy industries (renewable/ non-renewable sources) under the scope of the VCS Program.

As per Appendix 2 of VCS Standard V 4.0 (updated on 09-March-2020 to revise the effective dates for projects registered with an approved GHG Program),

"3) Projects registered under an approved GHG program shall only be eligible to complete a gap validation and/or transfer to the VCS Program where the project has applied for registration with the VCS Program on or before 9 March 2020, unless evidence of contracting for a VCS gap validation prior to 9 March 2020 is provided"

[2] 2000 people during plant construction and 100 people during plant operations

[3] http://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L/view.html

For this project activity, DOE/VVB contract was signed for gap validation & verification process before 09- March-2020, thus complying with the requirements.

1.4 Project Design

The project is not a multiple project activity or a grouped project activity.

Eligibility Criteria

This section is not applicable as this project activity is not a grouped project activity.

1.5 Project Proponent

Organization name	AD Hydro Power Limited
Contact person	Mr. O.P. Ajmera
Title	Vice President- Finance
Address	Street/P.O.Box: Sector-1, Building: Bhilwara Towers, A-12, Noida, Uttar Pradesh, India ZIP: 201301
Telephone	+91-120-2541810
Email	opajmera@lnjbhilwara.com

1.6 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consultant
Contact person	Anjali Rao
Title	Assistant Manager-Operations
Address	Office No 201, Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, India
Telephone	+91-8750286710
Email	anjali@enkingint.org

1.7 Ownership

For the ownership details of the project any of the following may be referred to:

1. Power Purchase Agreement between the project promoters and State Utility
2. Commissioning certificates

1.8 Project Start Date

The commercial production of the project activity started on 17/07/2010 with the commissioning of first unit, Unit II of 96MW. Another unit, Unit I was commissioned on 16/09/2010. Evacuation of power from the project plant started from 17/07/2010 using 132 kV transmission line via Bajaura substation which continued till 04/09/2010 which is conservative.

The start date for the project activity is 17/07/2010, which is the earliest date of commissioning of Unit II of the run of-river hydro power project activity.

1.9 Project Crediting Period

The crediting period of the project activity is for 10 years (fixed).

The length of crediting period is from 17/07/2010 to 31/05/2020[4]

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The project falls under large scale project category since the emission reductions are more than 300,000 tCO_2e per annum.

Project Scale	
Project	
Large project	✓

Year	Estimated GHG emission reductions or removals (tCO_2e)
Year 1	494,668
Year 2	494,668
Year 3	494,668
Year 4	494,668
Year 5	494,668
Year 6	494,668
Year 7	494,668

[4] The start date of Crediting period will be according to VCS i.e. earliest COD of the project however the end date will be same as end date of crediting period of the of registered CDM project 0862 and will abide to it.

Year 8	494,668
Year 9	494,668
Year 10	494,668
Total estimated ERs	4,946,680
Total number of crediting years	10
Average annual ERs	494,668

1.11 Description of the Project Activity

Allain Duhangan HEP is a run of the river project envisaging generation of 192 MW power by utilising the flows in Allain and Duhangan streams. It has been noted that the river flow in these streams varies significantly between 3.5 cumecs and 30 cumecs during high flow and lean flow seasons. Due to snowmelt, the river flow in these streams varies hourly with a generally higher discharge during evening/night time. Water stored during the lean season at night can thus be utilised for peak power generation in the early morning when the discharge is at its lowest. The ADHP is designed to provide a peak power generation of 4 hours each day during lean season. During high flow season, the power plant will generate on continuous basis and no storage is required.

For a 4 hour peaking generation, ADHP requires 302,400 cum storage based on an installed flow capacity of 25.3 cumecs and minimum average combined river flow of 4.3 cumecs. The total storage capacity available at ADHP is 302,400 cum comprising of:

- Storage at barrage with 41 800 cum between El 2752m and 2745m;
- Storage at desander with 23 000 cum between El 2752m and 2744m;
- Underground storage in Allain and Duhangan headrace tunnels of 25 000 cum and 7000 cum respectively between El 2752m and 2734m;
- Storage at intermediate reservoir with 205 600 cum between El 2748m and 2734m.

The barrage is designed to pass a flood discharge of 760 cumecs corresponding to 100 years return period. The spillway crest is at El 2745m which allows the passage of full flood discharge at water El 2752m. During monsoon period the spillway gates will be fully opened to avoid sedimentation occurring in the barrage reservoir.

The water level in the desander is controlled by the downstream sill with crest El 2744m. To ensure good operation of desander during monsoon, the maximum water level is fixed at El 2744.3 m. During monsoon period, the intermediate reservoir will operate at maximum water level of 2742m. During non-monsoon period, the operating water level will vary between 2752 and 2738 m. The barrage and sluice gates will be closed and head regulator gates will be fully opened and any excess flow will be released through the overflow structures located in

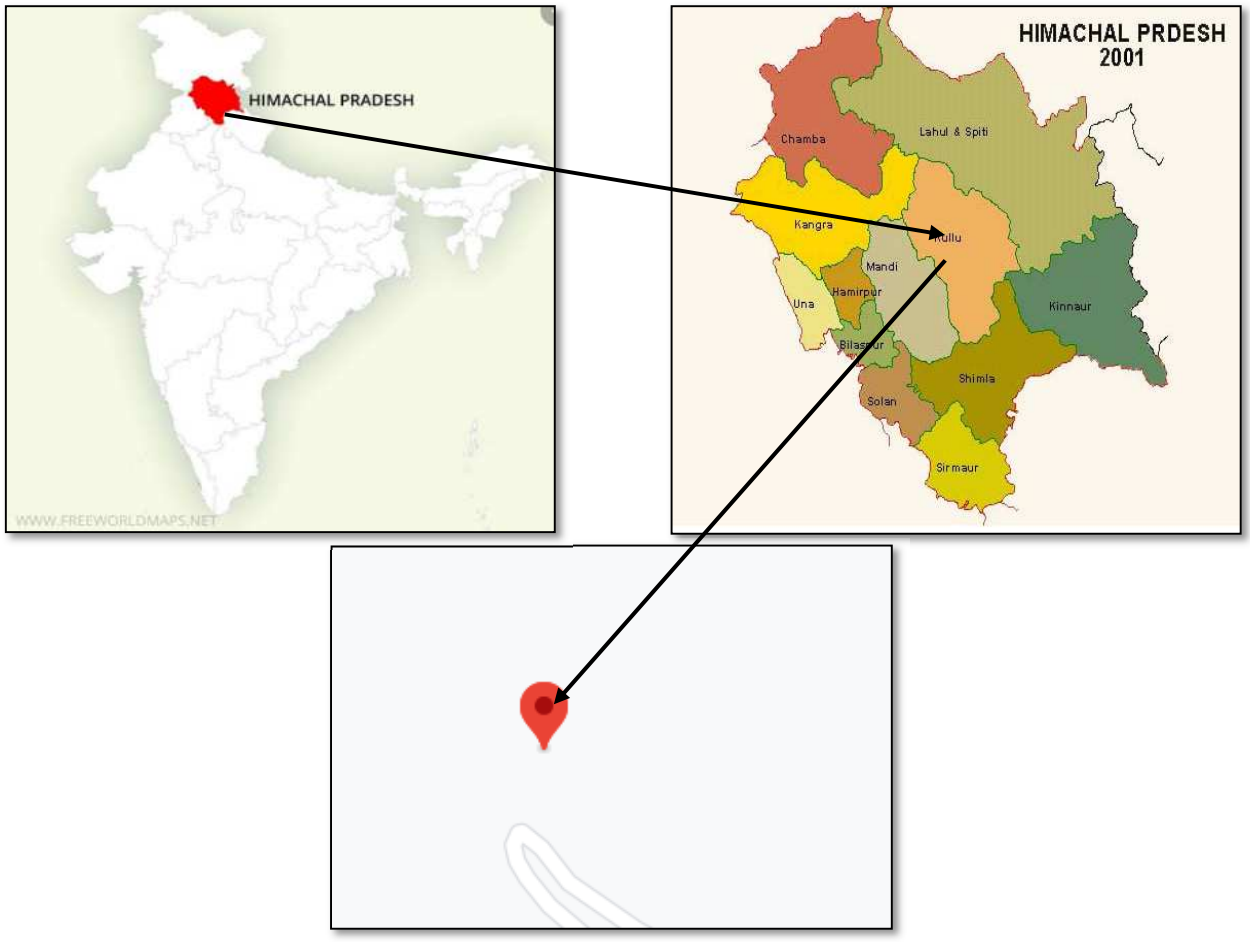
the intermediate reservoir. Due to this storage, the full reservoir level is kept identical to the high flood level corresponding to 100 year return period flood. Thus no additional submergence is envisaged due to non-monsoon peaking storage.

The operation rules for the peaking storage reservoir operation depend on both the seasons during the year and on daily flow variations. The following operation rules are adopted for run of the river type ADHP project:

- Priority for Peaking Energy - The reservoir water level is kept at the maximum level possible in order to generate the maximum energy during the peaking hours: for ADHP during the non-monsoon seasons, the maximum water level – El 2752m; during monsoon season, the maximum water level for barrage is fixed at El 2745 m and the intermediate reservoir operation was fixed as El. 2742.0 m;
- During the flood season, the target water level in the intermediate reservoir is fixed at El. 2 742.0 m. This permits storing a small quantity of the excess flow in the river during lean season;
- The ecological discharge is deducted from the river flow.
- The spillway will be fully opened when the combined river flow (Allain and Duhangan river flows) is greater than 13.5 m3/s, normally between May and September and the water level will be restricted to El 2745m.
- The spillway gates will be full closed when the combined river flow is less than 3.5\ m^3/s (Normally between October and April);
- When the combined river flow is less than 7.2 m3/s, the storage of the barrage reservoir of 41 800 m3 will be needed for peaking generation. In this case the head regulator gates will be closed.
- About one half hour after starting the peaking generation, one gate of the head regulator will be opened to discharge about 5.8 m3/s in two hours. After 2.5 hours, the barrage storage will be empty.
- It is assumed that two gates of the head regulator will be heated: one for normal operation; and one as stand-by. The gates will be operated from the powerhouse.

1.12 Project Location

The project is located in Pirni village near Manali Town in the District of Kullu of Himachal Pradesh. The project site is located about 60 Kms from Bhuntar airport and 50 Kms. from the town of Kullu. Both these towns are located along the National Highway-21. Bhuntar is 500 Kms from national capital Delhi by road. The physical location of the project activity is shown in the following figure.



State, District, Tehsil	Pirni, Manali, Kullu, Himachal Pradesh, India
Longitude	32°13'36" N
Latitude	77°12'35"E
Nearest rail head	Joginder Nagar
Nearest Airport	Kullu Manali Airport
Nearest National Highway	NH - 21

1.13 Conditions Prior to Project Initiation

This is a Greenfield project. Electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources. Thereby the project activity reduces the dependence on fossil fuel based generation units and as there are no associated emissions with this project it contributes to the reduction of greenhouse gases (GHG) emissions.

Please refer section B.4 of the registered PDD. The web link for the same is mentioned below: https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The Project has received all the necessary approvals for development and commissioning of the project activity from the State and central and is in compliance to the local or national laws and regulations.

The relevant national laws and regulations pertaining to generation of hydro energy in India are:

- Electricity Act 2003
- National Electricity Policy 2005
- National Tariff Policy 2016
- Hydropower Policy, 2008
- CERC Regulations - Terms and Conditions of Tariff Regulations, 2019

The hydro project activity complies with Central & State Government Policies and Regulations issued by Regulatory Commissions on Hydro Power[5]

The project activity is not mandatory by any local or national laws. However the project complies with technical, engineering and commissioning, environmental regulations. Please refer section B.3 of the PDD of UNFCCC registered CDM project with Ref No: 0862[6]

Environment Impact Assessment (EIA) was done to meet the regulatory requirements of Ministry of Environment and Forest, Government of India (MoEF) and was again conducted in the later years to meet the requirements of IFC and to comply with the procedural requirements of MoEF.

All impacts of the project activity have been analysed in the detailed EIA study and their impacts have been classified based on the significance. To mitigate and control the impacts project proponents have developed a detailed Environmental and Social Management and Monitoring Plan.

Since commissioning, project activity is running satisfactorily and in compliance with all and any relevant local, regional and national laws, statutes and regulatory frameworks.

1.15 Participation under Other GHG Programs

1.15.1 Projects Registered (or seeking registration) under Other GHG Program(s)

Project has been registered with UNFCCC Clean Development Mechanism program, registration reference number is 0862[7]. PP also submitted undertaking for Project neither has nor intends to

[5] http://www.cbip.org/ExternalFile/Hydro_Regulations_Policies.pdf

[6] https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

[7] https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

generate any form of GHG related environmental credit for GHG related environmental credit for GHG emission reductions or removals claimed under the VCS program.

1.15.2 Projects Rejected by Other GHG Programs

The project is not rejected by any other GHG programs.

1.16 Other Forms of Credit

1.16.1 Emissions Trading Programs and Other Binding Limits

India is Non-annex1 country and there is no compliance with an emission trading program or to meet binding limits on GHG emissions for this project activity. The project is registered under CDM and UNFCCC (Registration ID 0862[8]). The project is also approved by the DNA and a copy of the approval is also submitted to the DOE. Project Proponent has submitted undertaking that they will not claim same GHG emission reductions of the project from CDM and VCS. PP would not use net GHG emission reductions by the projects for compliance with emission trading program to meet binding limits on GHG emissions.

1.16.2 Other Forms of Environmental Credit

Project has been registered with UNFCCC under Clean Development Mechanism program. Registration reference number is 0862[9]. Project Proponent has submitted undertaking for not availing other forms of environmental credit for the same crediting period under consideration.

1.17 Additional Information Relevant to the Project

Leakage Management

Project does not involve any leakage emissions as this is Hydro power project, Hence Leakage Management Plan and risk mitigation measures are not required.

Commercially Sensitive Information

There is no commercially sensitive information accounted for the determination of baseline, net GHG removals and for demonstration of additionality for the present project activity.

Sustainable Development

The four indicators1 stipulated by the NCDMA (National CDM Authority) which is the DNA (Designated National Authority) of India, for defining sustainable development are:

[8] https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

[9] https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

- Social well being
- Economic well being
- Environmental well being
- Technological well being

The Project participant contribution from the project activity towards sustainable development in accordance to NCDMA is explained below:

Social well-being:

- The project is implemented in a rural area that does not have proper roads and other infrastructure facilities. The project activity would augment infrastructural development like roads etc. in the area, thus benefitting local communities.
- The project activity would lead to enhanced direct and indirect employment opportunities at all levels from unskilled to skilled workers.

Economic well-being:

- The project activity involves capital investments, thus leading to the overall development of the region.
- The project activities would also lead to enhanced business opportunities for local stakeholders like consultants, suppliers, manufacturers, contractors etc. All this would lead to improved financial security and overall development of the region.

Environmental well-being:

- The project activity being run-of-the-river power project will have minimum environmental impact as compared to a reservoir based hydro power plant.
- Contribute in bridging the demand-supply gap of electricity by producing green energy
- The electricity generated by the project activity will be supplied to the Southern grid, which otherwise would have been generated by fossil fuel fired power plants in the grid.
- The project activity also helps in conservation of depleting fossil fuels which at present are predominantly used for power generation.

Technical well-being:

The project activity is a clean and eco-friendly type of power generation in comparison to fossil fuel based projects. This not only helps reduce environmental pollution but also helps in conserving fossil fuels.

Further Information

There are no information or incidents that will have bearing on the eligibility of the project, the net GHG emission reductions or removals, or the quantification of the project's net GHG emission reductions or removals.

2 SAFEGUARDS

2.1 No Net Harm

Environment Impact Assessment (EIA) was done to meet the regulatory requirements of Ministry of Environment and Forest, Government of India (MoEF) and was again conducted in the later years to meet the requirements of IFC and to comply with the procedural requirements of MoEF.

All impacts of the project activity have been analysed in the detailed EIA study and their impacts have been classified based on the significance. To mitigate and control the impacts project proponents have developed a detailed Environmental and Social Management and Monitoring Plan.

Since commissioning, project activity is running satisfactorily and in compliance with all and any relevant local, regional and national laws, statutes and regulatory frameworks.

Please refer to section F.1 and F.2 of the PDD of UNFCCC registered CDM project with Ref No: 0862. The web link for the same is given below:

https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

2.2 Local Stakeholder Consultation

Proposed project activity is a large scale hydro power project. Due to size of the project activity it has drawn attention of a large section from stakeholders. But as it is a run-of-river project there is no substantial displacement of people. However, considering it as social responsibility project proponents have undergone a social impact survey with the help of professional experts and consulted with different sections of stakeholders and invited them to provide their opinion on the project activity.

SIA was based on a variety of information collected from primary as well as secondary sources.

Primary Information:

AD Hydro Power Ltd. (ADPL) organised stakeholder consultation with the objective to inform the interested stakeholders on the environmental and social impacts of the project activity and discuss their concerns regarding the project activity. The project proponent invited the local stakeholders for their feedback and comments on 28-04-2004 with the help of public notice, and thereafter also conducted a stakeholder consultation meeting in village Prini & Jagatsuk on 20-05-2004 & 21-05-2004 respectively. The primary information was collected through visits to the affected villages for meetings with the Gram Panchayat, household survey, consultations with villagers and focused group discussions with women and below poverty line (BPL) persons. At each village a pre-determined set of information was collected.

At the Gram Panchayat level following information was sought to be extracted through discussion.

Demographic profile

- Average land holding and asset ownership pattern, income levels, occupation

- Accessibility and linkages
- Key development issues
- Opinion on the proposed project

The Sarpanch (Village Chief) was present in the meetings.

Consultations with villagers and focused groups were also designed to seek the following information:

Socio-economic Impacts

- Loss of income, livelihood
- Access to fuel wood
- Job prospects
- Development of the area
- Influx of additional people in the area
- Opportunity for infrastructure development through the project
- Opportunities for social and economic development of the area

Public Health

- Common diseases
- Access to health facilities
- Any epidemic/ outbreak

Religious/ Archaeological

- Religious sites in the vicinity
- Archaeological sites
- Access/ influence

Gender

- Role and status of women in the community
- Division of labour within the households
- Potential impact on the women

At the household level also information were sought out about social classification, family details at individual level, project impacts, loss of common property resources etc.

Secondary Information:

The secondary sources of information included various documents published by the government of Himachal Pradesh such as district census handbook, statistical abstract, economic survey report and relevant laws/acts and policies. The National Thermal Power Corporation (NTPC)'s scheme for rehabilitation and resettlement of the Kol Dam project was also referred since it was accepted by the Himanchal Pradesh (HP) government as a benchmark for projects undertaken by other agencies. Unpublished material included land records at the Patwari's office and land use records at the District Collector's office. Field visits included visit to office of the Sub Divisional Magistrate (SDM) and Block Development Officer (BDO) to know about the development initiatives being planned for the area, to Patwari's office to understand procedure of land transfers, land acquisition and procure for calculating the land prices. Visit to state capital

Shimla included meetings with horticulture department to understand the procedure for valuation of apple trees, cropping pattern across the Tehsil/ district and maximum/ minimum yield. Meetings with Tribal development department were held for understanding special provisions for Schedule Tribe in project area.

Please refer to section E.1 and E.2 of the PDD of UNFCCC registered CDM project with Ref No: 0862. The web link for the same is given below.

https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

As a part of continual improvement process, feedback from the associated stakeholders is vital, therefore a dedicated Visitor register cum grievance register has been placed at the project site which is accessible to stakeholders to provide their feedback on the project. It is appropriate publicly accessible location at which local stakeholders can provide their feedback on the project. This location is also conducive to continuous and regular checks for stakeholder comments. However, no any grievances received during the current monitoring period. Since no any grievances received, no any mitigation measures are required.

Since conception of project design, the project activity does not receive any negative feedback during ongoing communication which leads to changes in project design of project activity. Thus there is no any updates to the project design due to stakeholder feedback.

During the current monitoring period, positive feedback are received regarding site operation. No any grievances received during the current monitoring period, therefore, no any mitigation measures are required. In-case of grievances, the nature of probable resolution is discussed with the plant head office and implemented by the site incharge

2.3 Environmental Impact

Please refer to section F.1 and F.2 of the PDD of UNFCCC registered CDM project with Ref No: 0862. The web link for the same is given below:

https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

2.4 Public Comments

The project has been listed for Global Stakeholder consultation.

2.5 AFOLU-Specific Safeguards

This section is not applicable here as this project activity is a non-AFOLU project activity.

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

Methodology Title: "Consolidated baseline methodology for grid-connected electricity generation from renewable sources".
Reference: ACM0002, Version 06, Sectoral Scope: 1[10]

The methodology has been referred from the list of approved methodologies for CDM project activities in the UNFCCC website

http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

Methodological Tool: This methodology also draws upon of the Tool for demonstration and assessment of additionality Version 01[11]

3.2 Applicability of Methodology

S. No.	Applicability Conditions in the ACM0002/ Version06	Position of the project activity vis-à-vis applicability conditions
1.	Applies to electricity capacity additions from: Run of-river hydro power plants; hydro power projects with existing reservoirs where the volume of the reservoir is not increased.	The project activity is a grid connected run-of-the river hydro power project.
2.	New hydroelectric power projects with reservoirs having power densities (installed power generation capacity divided by the surface area at full reservoir level) greater than 4 W/m^2	This is a new hydroelectric project with a reservoir having a power density of 6508.4746 W/m^2.
3.	This methodology is not applicable to project activities that involve switching from fossil fuels to renewable energy at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at the site.	It is a renewable energy project with no fuel-switch involved.
4.	It is a renewable energy project with no fuel-switch involved.	The project activity supplies power to NR Grid which in turn caters to electricity demand in various states in North India. The NR Grid encompasses all power plants supplying power through the grid to the states of Delhi, Haryana, HP, Jammu & Kashmir, Punjab, Rajasthan, Uttar Pradesh, Uttaranchal, and Union Territory

[10] https://cdm.unfccc.int/UserManagement/FileStorage/CDMWF_AM_BW759ID58ST5YEEV6WUCN5744MN763

[11] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v5.2.pdf/history_view

		of Chandigarh. Adequate data is available to estimate grid emission factor.

3.3 Project Boundary

The project site:

The project activity boundary covers the point of water supply to the point of power generation and export to the grid, where ADHP has a full control. Thus, the project boundary includes the water level over the intake, penstock, flow control valves, turbine, generator, control systems, auxiliary consumption units, synchroniser and the power evacuation system (Switch yard, transmission line) at the project activity site.

Electricity Grid:

NR Grid (Now Indian Grid) has a pool of state & private owned power generating plants. The units are owned by central government, respective state governments, and private enterprises and in some cases jointly owned. Data about all these plants have been considered while estimating the grid emission factor. It also includes the electricity imports from other regional grids. The states in the NR grid are Delhi, Chandigarh, Haryana, Uttaranchal, Himachal Pradesh, Punjab, Rajasthan, J&K and Uttar Pradesh.

Therefore northern regional grid (Now Indian grid) of India would be part of the geographical and system boundary for the project.

Source		Gas	Included?	Justification/Explanation
Baseline	Grid Electricity Generation	CO_2	Yes	Main emission source
		CH_4	No	Excluded for simplification- this is conservative
		N_2O	No	Excluded for simplification- this is conservative
Project	Electricity Generation	CO_2	No	The project activity is a run-of-river hydro power and hence no emissions.
		CH_4	No	
		N_2O	No	

3.4 Baseline Scenario

Calculation of baseline emission factor

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

STEP 1: Calculate the Operating Margin emission factor

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

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

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

Where

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

$COEF_{i,j\,y}$: The CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), calculated as described below and

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

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

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i \otimes EF_{CO2,i} \otimes OXID_i$$

Where

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

$EFC_{O2,I}$: The CO_2 emission factor per unit of energy of the fuel i (IPCC default value)

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

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

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

where:

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

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

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

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

STEP 2: Calculate the Build Margin emission factor ($EF_{BM,y}$) as the generation-weighted average emission factor (t CO_2/MWh) of a sample of power plants m of NR grid, as follows:

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

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

Calculation of the Build Margin emission factor $EFBM_{,y}$ ex-ante are based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently (This sample group is larger than group consisting of the five power plants that have been built most recently).

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

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

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

where the weights W_{OM} and W_{BM}, by default, are 50% (i.e., W_{OM} = W_{BM} = 0.5), and $EF_{OM,Simple,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in t CO_2/MWh.

<u>Calculation of Baseline Emissions</u>

$BE_y = EF_y \, x \, EG_Y$

Where

BE_y : Baseline emissions due to displacement of electricity during the year y in tons of CO_2
EG_y : Electricity supplied to the grid by the project activity during the year y in MWh, and
EF_y : CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO_2/MWh.

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

3.5 Additionality

Please refer to section B.3 of the PDD of UNFCCC registered CDM project with Ref No: 0862.The web link for the same is given below:

https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

3.6 Methodology Deviations

Not Applicable, as there are no methodological deviations for this project activity.

4 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

4.1 Baseline Emissions

The baseline emissions are the product of electrical energy baseline $EG_{BL,y}$ expressed in MWh of electricity produced by the renewable generating unit multiplied by the grid emission factor.

Baseline emission factor is calculated as combined margin, consisting of a combination of operating margin (OM) and build margin (BM) factors.

BEy = EGy * EFy

Where:

BEy : Baseline Emissions in year y; t CO_2
EG_y : Energy baseline in year y; kWh
EFy : Emission Factor in year y; t CO_2e/kWh

As per registered CDM PDD, combined margin emission factor is 0.737 tCO_2/MWh. Formula used for the estimation of the net emission reductions due to the project activity a given year y is as under:-

$$ER_y = BE_y - PE_y - L_y$$

Where,

ER_y : Emissions reductions of the project activity during the year y in tons of CO_2
BE_y : Baseline emissions due to displacement of electricity during the year y in tons of CO_2
PE_y : The project emissions associated with the project activity (none for the project activity)
L_y : The emissions sources as leakage (none for the project activity)

Please refer to section D.2 of the PDD of UNFCCC registered CDM project with Ref No: 0862.The web link for the same is given below:

https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

4.2 Project Emissions

DG set on the site is used only as a back up to run the essential auxiliaries when both the units of power project are down and power from HPSEB is not available.

As per the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"[12]

Parameter	UoM	Value	Source
NCV of diesel	TJ/Gg	43.3	IPCC data, from 2006 guidelines, volume 2, Table
Density of diesel	kg/m^3	855	Diesel density @ 150C ,Euro IV / Bharat stage IV emission norms, Annex C foot note 5[13]
Emission factor of diesel	$KgCO_2/TJ$	74,800	IPCC data, from 2006 guidelines, volume 2, Table 1.4 (Upper value of emission factor at 95 % confidence interval)[14]
Oxidation factor of diesel	-	1	IPCC data, from 2006 guidelines chapter 1, Table 1.4[15]

Please refer to section B.4 of the PDD of UNFCCC registered CDM project with Ref No: 0862. The web link for the same is given below:

https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

4.3 Leakage

No leakage emissions have been considered and hence the leakage emission is zero. So the emission reductions is equal to baseline emissions $ER_y = BE_y$.
Please refer to section B.4 of the PDD of UNFCCC registered CDM project with Ref No: 0862. The web link for the same is given below:

https://cdm.unfccc.int/Projects/DB/DNV-CUK1169040011.34/view

[12] http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-03-v2.pdf

[13] http://www.iocl.com/Products/HSD_BS_IV_Specification.pdf

[14] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

[15] http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/2_Volume2/V2_1_Ch1_Introduction.pdf

4.4 Net GHG Emission Reductions and Removals

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	494,668	0	0	494,668
Year 2	494,668	0	0	494,668
Year 3	494,668	0	0	494,668
Year 4	494,668	0	0	494,668
Year 5	494,668	0	0	494,668
Year 6	494,668	0	0	494,668
Year 7	494,668	0	0	494,668
Year 8	494,668	0	0	494,668
Year 9	494,668	0	0	494,668
Year 10	494,668	0	0	494,668
Total	4,946,680	0	0	4,946,680

5 MONITORING

5.1 Data and Parameters Available at Validation

Data / Parameter	EFy
Data unit	tCO_2e/MWh
Description	CO2 emission factor of the grid
Source of data	NREB/NRLDC/CEA
Value applied	0.737
Justification of choice of data or description of measurement methods and procedures applied	Calculated as weighted sum of OM and BM emission factors as per step in ACM0002.
Purpose of Data	Calculation of baseline emissions
Comments	Fixed ex-ante for the entire crediting period.

5.2 Data and Parameters Monitored

Data / Parameter	EG_y
Data unit	MWh
Description	Electricity supplied to the grid by the project activity
Source of data	ADHP records (switch yard logbooks) at site
Description of measurement methods and procedures to be applied	For measuring the energy delivered by the project activity at the interconnection point, one set of Main meter (part of interconnection facility) and check meter has provided by the company and the HPSEB at the interconnection point. Monthly joint meter readings of the main meter and check meter at the interconnection point has been taken by the designated officials of the company and HPSEB. The joint meter readings has been recorded and signed by the authorized representative of both the parties on each of the above instances.
Frequency of monitoring/recording	Continuous Metering, and monthly recording has been done
Value applied	494,668
Monitoring equipment	Energy meters
QA/QC procedures to be applied	Meters installed at the switchyard accurately monitor electricity supplied to the grid.
Purpose of data	Calculation of baseline emissions
Calculation method	Calculation of baseline emissions.
Comments	-

Data / Parameter	$FC_{diesel, y}$
Data unit	Tons
Description	Quantity of Diesel consumed by the standby DG set in year y
Source of data	Records of levels in the diesel storage tanks as per the plant log book.

Description of measurement methods and procedures to be applied	Measurement Procedure: The diesel quantity available in the diesel storage tanks is recorded daily by PP in the plant log book. The diesel consumption has been recorded in the logbook in litres. Accuracy of the Measurement Method: To confirm the accuracy on measurement of quantity of diesel consumed in the project activity can be cross checked against the fuel purchase receipts. Responsibility: Log book has been maintained by the shift in charge and same has been cross checked by the General Manager of the project activity.
Frequency of monitoring/recording	Frequency: Continuously monitored. Recording frequency: monthly and aggregated annually Archiving Policy: Paper & Electronic
Value applied	-
Monitoring equipment	Manually Monitoring
QA/QC procedures to be applied	The data recorded can be cross checked against the fuel purchase receipts
Purpose of data	Calculation of baseline emissions
Calculation method	It has been directly monitored. Thus, calculation is not necessary for this project.
Comments	-

5.3 Monitoring Plan

Data recording:

The methodology requires monitoring of electricity generation from the project activity.

Completeness:

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 collection is happening using these control systems. An hourly log of data is also prepared by the shift in-charge. A daily report of aggregation of these data is also prepared. Parameters monitored are

the total power generated, power exported to the grid and auxiliary power consumed[16] (other parameters like head availability, grid issues; frequency etc has also been maintained hourly in the log).

Reliability:

For electricity generation data, automatic control meters for power generation and export is regularly maintained. The plant operating & maintenance procedures also include regular meter calibration. Actual net power generation data is metered using switch yard energy meters. The billing invoices for the power sold and meters' readings at substation(s) are used to cross check the data.

Calculation:

$BE_y = EF_y * EG_y$

Where,

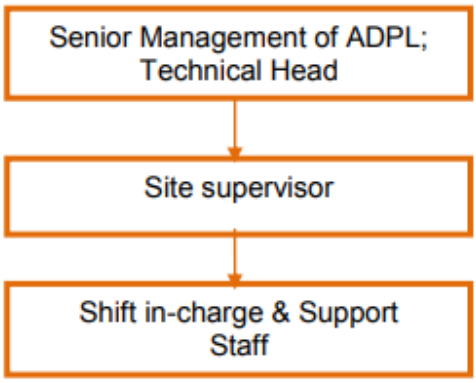
BE_y: Baseline emissions due to displacement of electricity during the year y in tons of CO_2
EG_y: Electricity supplied to the grid by the project activity during the year y in MWh, and
EF_y: CO_2 baseline emission factor for the electricity displaced due to the project activity in during the year y in tons CO_2/MWh.

Reporting: After verification of the data and due diligence on correctness, an annual report on monitoring and estimations is maintained by the CDM team and record to this effect is maintained for verification.

The electricity supplied to the grid by the project activity (EG_y) is being monitored at the switchyard as per the monitoring plan mentioned in the registered PDD. The value of the electricity supplied to the grid is directly arrived using the measured import and export readings from the respective energy meters. The data was measured by energy meters and log sheets were maintained by shift in charge on hourly basis. Further daily report of aggregation of generation data was prepared. Besides a manual log, data was captured directly from the meters through a digital data capture device on a weekly basis. The weekly reports were aggregated on a monthly basis and submitted to the management for review.The sales invoices were raised at different intervals depending on different contracts and copies are being archived for a cross checking during verification. The above mentioned reporting procedure is well in line with the monitoring plan mentioned in the registered PDD.

[16] The auxiliary power includes the power imported through 11 kV line from HPSEB (refer annex-3) when both the units of the project activity are not generating.

Organizational structure, roles and responsibilities



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

Senior Management of ADPL/Technical Head: Overall responsibility of compliance with the CDM monitoring plan.

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

Shift In-charge: Responsibility of daily report generation.

Internal audits of CDM project compliance-

Internal Audit was conducted on 31/12/2016 by the owners' representatives to check the training of CDM team, correctness of monitoring procedures, reporting and archiving of data monitored. Report on internal audits done, deviation found and corrective action taken are maintained and kept for external auditing.

Emergency procedures-

In case of failure of main meter, the check meter readings shall be referred for emission reduction calculation. If both the main meter and check meter are failed simultaneously, the affected period shall not be considered for the emission reduction calculation.