Monitoring Report

CARBON OFFSET UNIT (CoU) PROJECT

Dam Site of 1500 MW Nathpa Jhakri Hydro Power Station, Nathpa (HP)

Title: 1500 MW Large Scale Nathpa Jhakri Hydroelectric Station by SJVN Limited (HCPL CREDUCE JV)

Version 2.0

Date 06/04/2022

First CoU Issuance Period: 08 Years

Monitoring Period: 01/01/2014 to 31/12/2021

Monitoring Report (MR)
CARBON OFFSET UNIT (CoU) PROJECT

Monitoring Report

Title of the project activity	1500 MW Large Scale Nathpa Jhakri Hydroelectric Station by SJVN Limited (HCPL CREDUCE JV)
UCR Project Registration Number	113
Version	2.0
Completion date of the MR	06/04/2022
Monitoring period number and duration of this monitoring period	Monitoring Period Number: 01 Duration of this monitoring Period: 8 Years (first and last days included (01/01/2014 to 31/12/2021)
Project participants	Creduce Technologies Private Limited (Representator) SJVN Limited (Project Proponent)
Host Party	India
Applied methodologies and standardized baselines	Applied Baseline Methodology: ACM0002: "Grid-connected electricity generation from renewable sources", version 20
Sectoral scopes	01 Energy industries (Renewable/Non-Renewable Sources)
Estimated amount of GHG emission reductions for this monitoring period in the registered PCN	2014: 61,04,035 CoUs (61,04,035 tCO2eq)
	2015: 65,08,311 CoUs (65,08,311 tCO2eq)
	2016: 63,08,600 CoUs (63,08,600 tCO2eq)
	2017: 64,24,691 CoUs (64,24,691 tCO2eq)
	2018: 57,78,058 CoUs (57,78,058 tCO2eq)
	2019: 65,98,929 CoUs (65,98,929 tCO2eq)
	2020: 63,73,711 CoUs (63,73,711 tCO2eq)
	2021: 62,16,734 CoUs (62,16,734 tCO2eq)
Total:	5,03,13,069 CoUs (5,03,13,069 tCO2eq)

SECTION A. Description of project activity

A.1. Purpose and general description of project activity >>

The proposed project is registered under UCR, having UCR ID Number: 113 and titled as "1500 MW Large Scale Nathpa Jhakri Hydroelectric Station by SJVN Limited (HCPL CREDUCE JV)". This is a Hydro Power project located in Kinnaur-Shimla district of Himachal Pradesh (India). The project is an operational activity with continuous reduction of GHG, currently being applied under "Universal Carbon Registry" (UCR). This is a run of the river project located on River Satluj (also known as Sutlej) which is a major tributary on the Indus basin. The project receives water from Natha Dam Reservoir having a live capacity of 303 Hectare meter (Ham). The project's power station is in Shimla district of Himachal Pradesh in North India.

a) Purpose of the project activity and the measures taken for GHG emission reductions >>

The project activity aims to harness kinetic energy of water (renewable source) to generate electricity. This project has been promoted by SJVN Limited. The Project will supply 1500 MW of the power to multiple states of India as mentioned in the below table, which are part of the Northern, Eastern, Western and North-Eastern (NEWNE) Electricity Grid of India.

Sl. No.	State	Allocation (In MW)	Percentage to the installed capacity
1.	Haryana	64	4.27
2.	Himachal Pradesh	547	36.47
3.	Jammu & Kashmir	105	7.00
4.	Punjab	114	7.60
5.	Rajasthan	112	7.47
6.	Uttar Pradesh	221	14.73
7.	Uttaranchal	38	2.53
8.	Chandigarh	08	0.53
9.	Delhi	142	9.47
10.	Unallocated quota at the disposal of the Central Govt.	149	9.93
	TOTAL	**1500**	**100**

Note: (Data from SJVN Website https://sjvn.nic.in/businessprojectdetails/28/5/7)

In pre-project scenario these states were importing the required electricity from their respective state utilities connected to Northern Eastern Western and North-Eastern regional grids (NEWNE) to meet their requirement of electrical energy. Currently, NEWNE grid is connected to large numbers of fossil fuel-based power plants. Hence, project activity is displacing the electricity generation i.e., 5,59,03,409 MWh (adjusted measured values) from the NEWNE grid, which is predominantly dependent on power from fossil fuel powered plants. The project activity doesn't involve any GHG emission sources. The annual and the total CO_2e emission reduction by the project activity over the defined monitoring period is as per **Annexure I.**

b) Brief description of the installed technology and equipment>>

The project activity is a renewable power generation activity which incorporates installation and operation of 6 Vertical Axis Francis Turbines having individual capacity of 250 MW with aggregated installed capacity of 1500 MW in the state of Himachal Pradesh in India. The kinetic energy of water flowing from river is converted into mechanical energy using hydraulic turbine, which is then converted into electrical energy using generator. The water used in this process is again diverted to the river stream through proper arrangements.
Below is the description of different components of a hydro power plant.

1. **Diversion structure (trench weir):** A diversion structure is required across the river for diverting its water for power generation. The river bed consists of pebbles, gravels and boulders.
2. **Intake/Power Channel:** The water fed from Desilting tank is led to tunnel inlet portal through a Rectangular R.C.C channel also known as Intake or Power Channel.
3. **Desilting Tank:** A Desilting chamber is considered necessary to remove silt particles to minimize the abrasion effects on the turbine runners.
4. **Power Tunnel:** It is a free flow tunnel designed in the same way as that of Power Channel. It is a part of water conducting system.
5. **Penstock:** Water from Forebay is being taken to the Powerhouse to run hydraulic turbine through pressurized penstock pipe running from Forebay tank.
6. **Power House Building:** Power house building is a simple structure housing the generating units, auxiliary equipment, control panels and suitable outlet for tail water discharge.
7. **Tail Race Tunnel:** Turbine discharge shall be disposed to river through the separate tailrace channel.
8. **Surge shaft** is a structure provided at the end of headrace tunnel or pipe to account for water hammering effect in the pipe at its downstream.

c) Relevant dates for the project activity (e.g., construction, commissioning, continued operation periods, etc.)>>

The project consists of 6 Turbines, commissioning dates and crediting period corresponding to monitoring period of each turbine is mentioned in the table below.
UCR Project ID : 113

Turbine	Commissioning Date
UNIT-1	May 18, 2004
UNIT-2	May 06, 2004
UNIT-3	March 31, 2004
UNIT-4	March 30, 2004
UNIT-5	October 06, 2003
UNIT-6	January 02, 2004

Monitoring Period : 01/01/2014 to 31/01/2021 (both dates are included)
Crediting Period : 01/01/2014 to 31/01/2021 (both dates are included)

d) Total GHG emission reductions achieved or net anthropogenic GHG removals by sinks achieved in this monitoring period>>

The total GHG emission reductions achieved in this monitoring period is as follows:

Summary of the Project Activity and ERs Generated for the Monitoring Period	
Start date of this Monitoring Period	01/01/2014
Carbon credits claimed up to	31/12/2021
Total ERs generated (tCO_{2eq})	5,03,13,069 tCO2eq
Leakage	0

e) Baseline Scenario>>

As per the approved consolidated methodology ACM0002 Version 20, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following: **"If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources to the grid".**

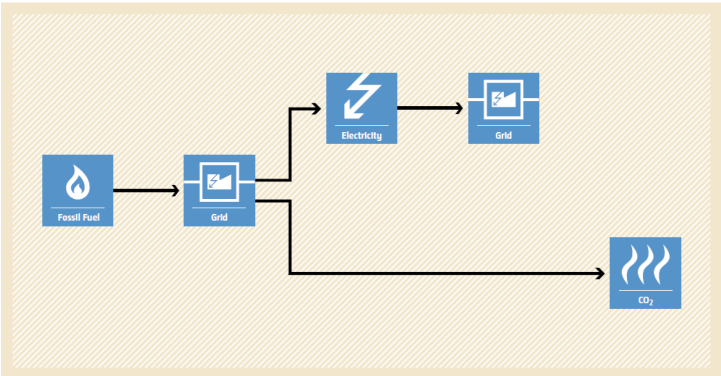
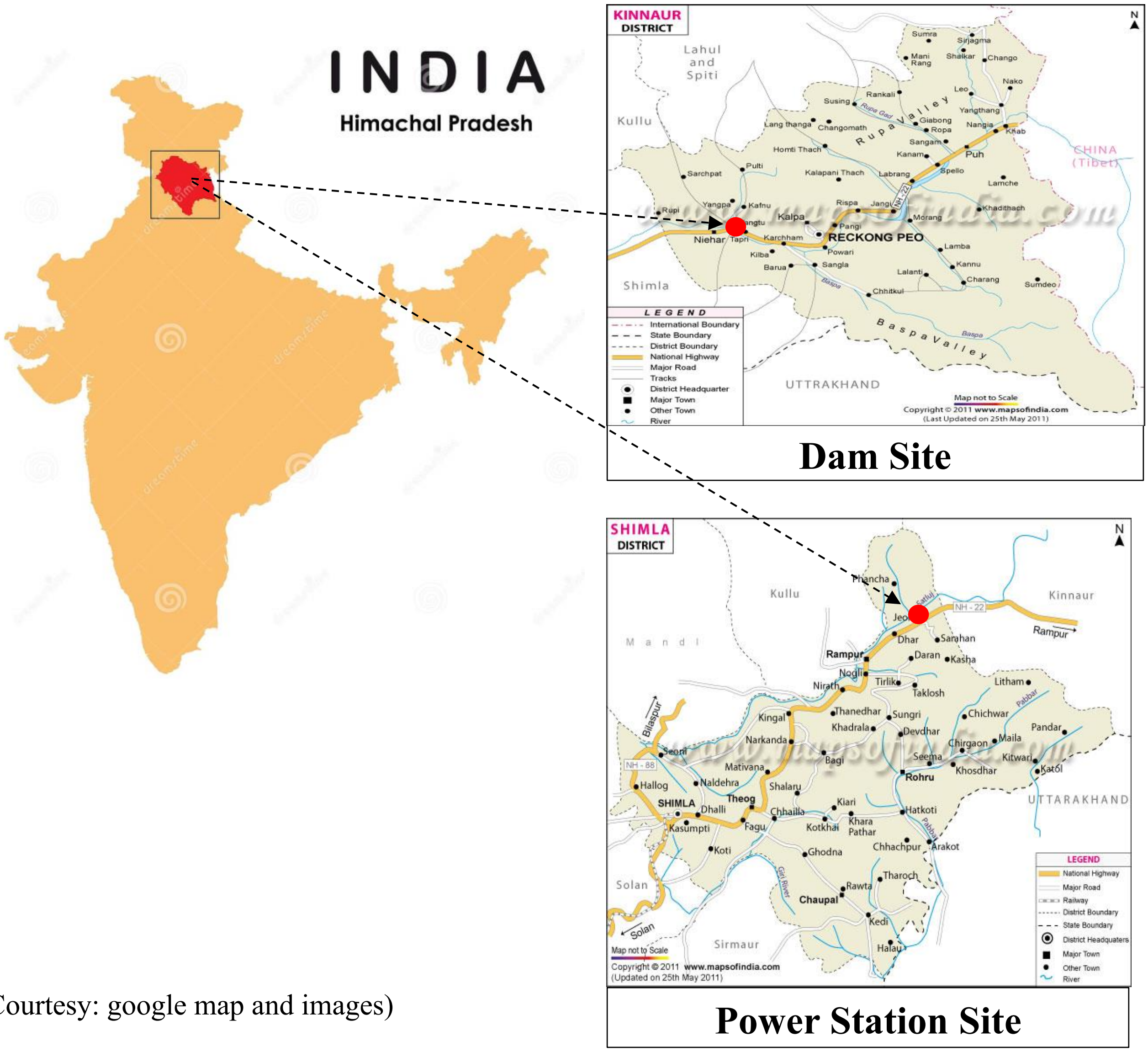


Figure 1 Baseline Scenario

A.2. Location of project activity>>

Country	:	India
State	:	Himachal Pradesh
District	:	Kinnaur and Shimla
Dam Village Site	:	Nathpa Village
Power House Location	:	Jhakri Village

The representative location map of Naptha Dam and Jhakri Power Station is shown below:



Dam Site

Power Station Site

(Courtesy: google map and images)

The Nathpa Dam is located Near Nathpa Village of District Kinnaur in the state of Himachal Pradesh. The dam is constructed on the river of Satluj. It is 80 kilometres from Kinnaur city and 176 kilometres from the Shimla city. Project Coordinates of the dam is 31°33'51.8"N 77°58'48.1"E.

Dam Site of 1500 MW Nathpa Jhakri Hydro Power Station, Nathpa (HP)

The Nathpa Jhakri Power House is located in the Village of Jhakri, District Shimla in the state of Himachal Pradesh. It is 47 kilometres from the Nathpa Dam and 135 kilometres from Shimla city. Location coordinates of the power house is 31°29'58.5"N, 77°42'22.2"E.

Power House of 1500 MW Nathpa Jhakri Hydro Power Station, Jhakri (HP)

Nathpa Jhakri Hydro Power Station has 301 meter deep and 21.6 m wide surge shaft with an opening to the sky.

301 Meter Deep Surgeshaft of Nathpa Jhakri Hydro Power Station, Jhakri (HP)

A.3. Parties and project participants >>

Party (Host)	Participants
India	**Creduce Technologies Private Limited (Representator)** Contact person: Shailendra Singh Rao Mobile: +91 9016850742, +91 9601378723 Address: 2-O-13,14 Housing Board Colony, Banswara, Rajasthan - 327001, India. **SJVN Limited (Developer)** Address: Shakti Sadan, Corporate Office Complex Shanan, Shimla-171006, Himachal Pradesh, India.

A.4. References to methodologies and standardized baselines >>

SECTORAL SCOPE - 01 Energy industries (Renewable/Non-Renewable Sources)

TYPE - Renewable Energy Projects

CATEGORY - ACM0002: "Grid-connected electricity generation from renewable sources", version 20

A.5. Crediting period of project activity >>

Turbine	Crediting period
UNIT-1	01/01/2014 to 31/12/2021
UNIT-2	01/01/2014 to 31/12/2021
UNIT-3	01/01/2014 to 31/12/2021
UNIT-4	01/01/2014 to 31/12/2021
UNIT-5	01/01/2014 to 31/12/2021
UNIT-6	01/01/2014 to 31/12/2021

Length of the crediting period corresponding to this monitoring period : 08 Years
01/01/2014 to 31/12/2021 (Both the dates are included)

A.6. Contact information of responsible persons/entities >>

Name : Shailendra Singh Rao
Contact No : +91 9016850742, +91 9601378723
E-Mail : shailendra@creduce.tech

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity >>

a) Provide information on the implementation status of the project activity during this monitoring period in accordance with UCR PCN>>

The project consists of Six Units with an aggregated installed capacity of 1500 MW which was implemented and commissioned by Satluj Jal Vidyut Nigam Ltd. (SJVN Ltd.). SJVN Limited is a Mini Ratna Category-I and Schedule 'A' CPSE under administrative control of Ministry of Power, Government of India, was incorporated on May 24, 1988 as a joint venture of the Government of India (GOI) and the Government of Himachal Pradesh (GOHP). SJVN Limited is the promoter of this project. The project generates clean energy by utilizing the kinetic energy of flowing water from flow of Satluj River. The run of the river project is located on River Satluj a major tributary on the Indus basin, in Shimla district of Himachal Pradesh in North India.
A Memorandum of Understanding for execution of the Nathpa Jhakri project was signed between Government of India and Government of Himachal Pradesh in July, 1991. Project has been financed on a 50:50 debt equity ratio basis. The Project had the backing of World Bank and it was completed at a cost of INR 8187 Crores.

b) For the description of the installed technology, technical process and equipment, include diagrams, where appropriate>>

The project activity involves six Hydro Turbine Generators of Francis Horizontal type (250 MW each). The other salient features of the technology are:

(1)	**<u>Location:</u>**	
	State	Himachal Pradesh
	District	Kinnaur / Shimla
	Vicinity	Dam down Stream of Wangtoo Bridge at Nathpa and Power House near Jhakri Village on left bank of River Satluj.
(2)	**<u>Hydrology:</u>**	
	Catchment area of Satluj at Dam site.	49,820 Sq.Km
	Dependable Year run-off	7689 million cubic meters
	Mean year run-of (Satluj)	9596 million cubic meters.
	Design discharge	405 cumecs
	Design flood	5660 cumecs
(3)	**<u>Diversion Dam:</u>**	
	Type of Dam	Concrete, Gravity.
	Maximum height above Foundation level	62.5 meters
	Length of dam at Road level	185.45 m
	Top of dam	EL.1498.50m
	Full Reservoir level	EL.1495.50m

	Minimum Draw Down level	EI.1474.00m
	Poundage Available (Gross)	343 Hect. Meters
(4)	**Under Sluices:**	
	Crest level	EI. 1458.00 M.
	Number	Five
	Gates	5 Radial Gates, each of size 7.5 M x 8.50m.
	Energy dissipation arrangement	Ski-jump.
(5)	**Spillway:**	
	Crest Level	EI. 1488.00m
	Gates	1 Counter weight Balanced Gate of size 2.5m x 7.5m.
	Energy Dissipation	Ski jump.
(6)	**Diversion Tunnel:**	
	Length	738m
	Diameter	8m D-shaped (on right bank)
(7)	**Intake Arrangement:**	
	No. of Intake tunnels	4
	Total discharge through Intake	486 cumecs
	Size and Shape of Intake tunnels	Rectangular opening of 6.0m x 5.25m suitably transitioned to 6.0m Horse shoe tunnel.
(8)	**Desilting Arrangements:**	
	Type.	Underground.
	Number and Size	Four parallel chambers, egg-shaped, each 525m (length) x 16.31m (max. width at center) x 27.5m(height)
	Flow through velocity	31.0cm/Sec.
	Particle size to be removed	Particles greater than 0.2 mm.
(9)	**Head Race Tunnel:**	
	Shape & type	Circular, Concrete lined
	Length	27.4 Km
	Diameter,	10.15 M
	Design discharge	405 cumecs
	Velocity.	5.0 m/sec.
(10)	**Sholding Works:**	
(a)	**Weir**	
	Location	Across Sholding Khad at EL. 1542.40 M.
	Type	Trench weir.
	Design discharge	8.0 cumecs (including 2.0 cumecs for flushing)
	Length	16.0 M
	Width.	3.0 m.
	Depth.	1.63 m to 3.38 m.
(b)	**Inlet Tunnel**	
	Size & Shape.	2m, D-Shaped.
	Length	51.36 m
(c)	**Outlet Tunnel**	

	Size & Shape.	2m, D-Shaped.
	Length	126.73 m
(d)	**Silting Flushing Tunnel**	
	Shape	D-Shaped.
	Size	1.8m x 2.2 m
	Length	276.44m
(e)	**Desilting Arrangement**	
	Type	Underground
	Size	53m x 10.15m x 10.81m (H)
	Water depth, Flow throw Velocity	5.57m, 16cm/Sec.
(f)	**Drop Shaft**	
	Diameter.	2.5 m.
	Depth	102.63m, meeting HRT at RD 6407.04m
	Discharge	6.0 cumecs
(g)	**Permanent Access Tunnel**	
	Size & Shape	4.0m, D-Shaped
	Length	471.39 m
(11)	**Crossing under Manglad-Khad:**	
	No. of Steel lined Tunnels	1 No.
	Diameter & length	8.5m, 710m
	Thickness of High Tensile ASTM-A 517 Grade-F Steel Plates	30, 36 and 40mm
(12)	**Daj Steel Liner:**	
	No. of Steel lined Tunnels	1 No.
	Diameter & Length	8.5m, 376m
	Thickness of High Tensile ASTM-A 517 Grade-F Steel Plates	30 and 36mm
(13)	**Surge Shaft:**	
	Type	Restricted Orifice
	Diameter	21.6 m circular for height of about 211m, connecting Shaft of 102 m dia., and about 85.0 m high and top pond with about 5 m water depth during maximum upsurge.
	Total Height.	301 m.
	Tunnel invert at Surge Shaft	EL 1272.61m
	Max. Upsurge	EL 1583.95m
	Min. Down Surge	EL 1373.19m
	Lower Expansion Gallery	10.15 m diameter, 180m long
(14)	**Pressure Shaft:**	
	Type	Circular steel lined with high tensile steel corresponding to ASTM – A517 Grade – F of thickness varying from 26mm to 38mm.
	Number	3, each bifurcating to feed 2 units
	Dia. & length:	4.9m and approx. 571m to 622m length
	Branch Tunnels	3.45m dia. and 64.0m length
(15)	**Power House:**	
	Type	Underground
	Size	220mx20mx49m (height)

	Type of Turbine	Vertical Axis Francis Turbine
	Gross Head	486 m
	Design Head	428 m
	Number and capacity of generating units.	6 x 250 MW
(16)	**<u>Tail Race Tunnel:</u>**	
	Size	10.15m Dia. Circular
	Length.	982 m
(17)	**<u>Power Potential:</u>**	
	Installed Capacity	1500MW
	Annual Energy generation In a 50% mean year	7447 GWH
	Annual Energy generation In a 90% dependable year	6612 GWH

B.2 Do no harm or Impact test of the project activity>>

Indian economy is highly dependent on "Coal" as fuel to generate energy and for production processes. Thermal power plants are the major consumers of coal in India and yet the basic electricity needs of a large section of population are not being met. This results in excessive demands for electricity and places immense stress on the environment. Changing coal consumption patterns will require a multi-pronged strategy focusing on demand, reducing wastage of energy and the optimum use of renewable energy (RE) sources. This project is a greenfield activity where grid power is the baseline. The renewable power generation is gradually contributing to the share of clean & green power in the grid; however, grid emission factor is still on higher side which defines grid as distinct baseline.
The Government of India has stipulated following indicators for sustainable development in the interim approval guide lines for such projects which are contributing to GHG mitigations. The Ministry of Environment, Forests & Climate Change, has stipulated economic, social, environment and technological well-being as the four indicators of sustainable development. It has been envisaged that the project shall contribute to sustainable development using the following ways:

Social well-being: The project would help in generating direct and indirect employment benefits accruing out of ancillary units for manufacturing power plant and dam site. It will lead to development of infrastructure around the project area in terms of improved road network etc. and will also directly contribute to the development of renewable infrastructure in the region.

Environmental well-being: The project utilizes Hydro energy for generating electricity which is a clean source of energy. The project activity will not generate any air pollution, water pollution or solid waste to the environment which otherwise would have been generated through fossil fuels. Also, it will contribute to reduction GHG emissions. Thus, the project causes no negative impact on the surrounding environment contributing to environmental well-being.

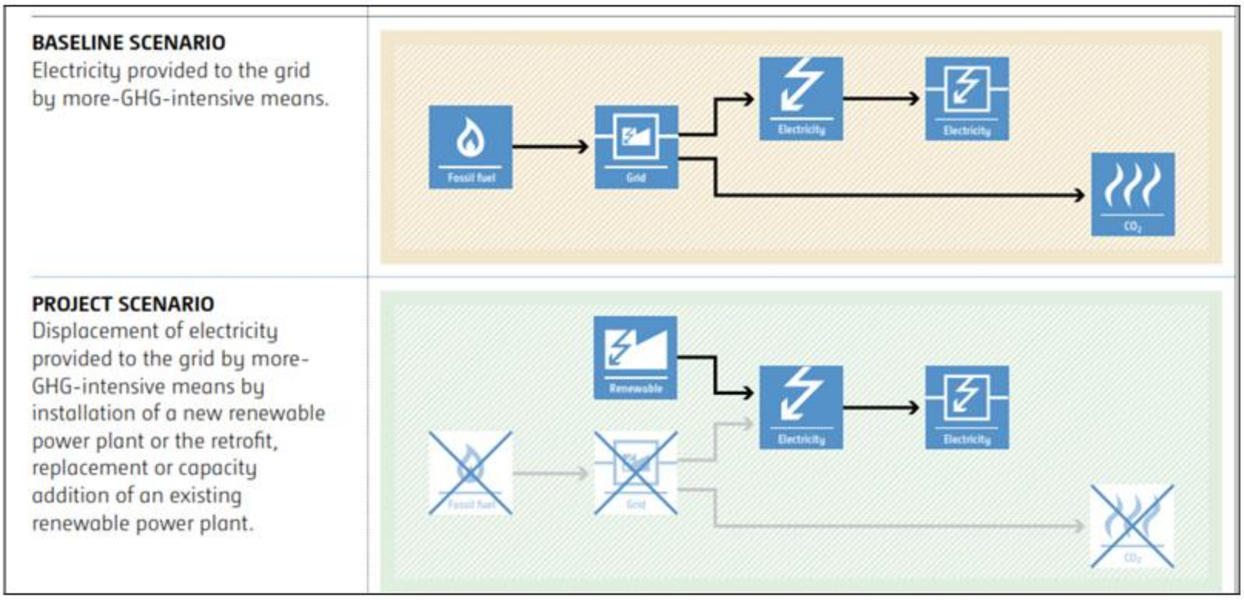
Economic well-being: Being a renewable resource, using Hydro energy to generate electricity contributes to conservation precious natural resources. The project contributes to the economic sustainability through promotion of decentralization of economic power, leading to diversification of the national energy supply, which is dominated by conventional fuel based generating units. Locally, improvement in infrastructure will provide new opportunities for industries and economic activities to be setup in the area. Apart from getting better employment opportunities, the local people will get better prices for their land, thereby resulting in overall economic development.

Technological well-being: The project activity leads to the promotion of Hydro Turbine Generators into the region and will promote practice for small scale and large-scale industries to reduce the dependence on carbon intensive grid supply to meet the captive requirement of electrical energy and also increasing energy availability and improving quality of power under the service area. Hence, the project leads to technological well-being.

B.3. Baseline Emissions>>

In the absence of the project activity, the equivalent amount of electricity would have been imported from the regional grid (which is connected to the unified Indian Grid system (NEWNE Grid)), which is carbon intensive due to predominantly sourced from fossil fuel-based power plants.

Baseline Scenario:



B.4. Debundling>>

This project activity is not a de-bundled component of a larger project activity.

SECTION-C: Application of methodologies and standardized baselines

C.1. References to methodologies and standardized baselines >>

Sectoral Scope: 01 Energy industries (Renewable/Non-Renewable Sources)
TYPE I – Renewable Energy Projects
Applied Baseline Methodology: ACM0002: “Grid-connected electricity generation from renewable sources”, version 20

C.2. Applicability of methodologies and standardized baselines >>

The project activity involves generation of grid connected electricity from the construction and operation of a new Hydro power project. The project activity has installed capacity of 1500 MW which will qualify for a large-scale project activity of the Large-Scale methodology. The project status is corresponding to the methodology ACM0002, version 20 and applicability of methodology is discussed below:

Applicability Criterion	Project Case
1. This methodology is applicable to grid-connected renewable energy power generation project activities that: (a) Install a Greenfield power plant; (b) Involve a capacity addition to (an) existing plant(s); (c) Involve a retrofit of (an) existing operating plants/units; (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s)/unit(s).	The project activity consists of installation of Greenfield power plant at a site where no renewable power plant was in operation prior to the implementation of the project activity. Thus, it fulfills the point (a) of criteria 1.
2. The project activity may include renewable energy power plant/unit of one of the following types: hydro power plant/unit with or without reservoir, Hydro 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 six Hydro turbine generators. Hence, meets this criterion.
3. In the case of capacity additions, retrofits, rehabilitations or replacements (except for Hydro, 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 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.	The project activity does not involve capacity additions, retrofits, rehabilitations or replacements. Hence this criterion is not applicable to the project activity.

4. In case of hydro power plants, one of the following conditions shall apply: (a) The project activity is implemented in existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or (b) 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 (7), is greater than 4 W/m2; or (c) The project activity results in new single or multiple reservoirs and the power density, calculated using equation (7), is greater than 4 W/m2; or (d) The project activity is an integrated hydro power project involving multiple reservoirs, where the power density for any of the reservoirs, calculated using equation (7), is lower than or equal to 4 W/m2, all of the following conditions shall apply: (i) The power density calculated using the total installed capacity of the integrated project, as per equation (8), is greater than 4 W/m2; (ii) Water flow between reservoirs is not used by any other hydropower unit which is not a part of the project activity; (iii) Installed capacity of the power plant(s) with power density lower than or equal to 4 W/m2 shall be: (a) Lower than or equal to 15 MW; and (b) Less than 6 per cent of the total installed capacity of integrated hydro power project.	The project activity is a run of river project which results in new single reservoir named Nathpa Dam and the Power density is calculated using equation (7), is 6,290 W/m^2. Hence the condition (c) is applicable.
5. In the case of integrated hydro power projects, project proponent shall: (a) 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 (b) Provide an analysis of the water balance covering the water fed to power units, with all possible combinations of reservoirs and without	This condition is not applicable since the project activity is not an integrated hydro project.

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 of five years prior to the implementation of the CDM project activity.	
6. The methodology is not applicable to: (a) 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; (b) Biomass fired power plants/units.	Project activity does not involve: (a) Switching from fossil fuels to renewable energy sources at the site of the project activity. (b) Biomass fired plants. Hence this criterion is not applicable.
7. 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".	The project is not a retrofit, rehabilitations, replacements or capacity addition; hence this applicability criterion is not relevant.
8. In addition, the applicability conditions included in the tools referred to above apply.	Applicability conditions of the applied tool is justified.

C.3 Applicability of double counting emission reductions >>

The project activity is a large-scale hydro project and was not applied under any other GHG mechanism prior to this registration with UCR. Also, project has not been applied for any other environmental crediting or certification mechanism. Hence project will not cause double accounting of carbon credits (i.e., COUs).

C.4. Project boundary, sources and greenhouse gases (GHGs)>>

As per applicable methodology ACM0002 Version 20, "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system."

Thus, the project boundary includes the Hydro Turbine Generators and the Indian grid system.

Source		Gas	Included?	Justification/Explanation
Baseline	Grid connected electricity generation	**CO_2**	**Yes**	**CO2 emissions from electricity generation in fossil fuel fired power plants**
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
		Other	No	No other GHG emissions were emitted from the project
Project	Greenfield Hydro Power Project Activity	CO_2	No	No CO_2 emissions are emitted from the project
		CH_4	No	Project activity does not emit CH_4
		N_2O	No	Project activity does not emit N_2O
		Other	No	No other emissions are emitted from the project

C.5. Establishment and description of baseline scenario (UCR Protocol) >>

As per para 22 of the approved consolidated methodology ACM0002 Version 20, if the project activity is the installation of a new grid-connected renewable power plant/unit, the baseline scenario is the following:

"If the project activity is the installation of a Greenfield power plant, the baseline scenario is electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources to the grid".

The project activity involves setting up of a new hydro power plant to harness the green power from hydro energy and to use for sale to national grid i.e., Indian grid system through PPA arrangement. In the absence of the project activity, the equivalent amount of power would have been generated by the operation of grid-connected fossil fuel-based power plants and by the addition of new fossil fuel-based generation sources into the grid. The power produced at grid from the other conventional sources which are predominantly fossil fuel based. Hence, the baseline for the project activity is the equivalent amount of power produced at the Indian grid.

A "grid emission factor" refers to a CO_2 emission factor (tCO_2/MWh) which will be associated with each unit of electricity provided by an electricity system. The UCR recommends an emission factor of 0.9 tCO_2/MWh for the 2014-2020 years as a fairly conservative estimate for Indian projects not previously verified under any GHG program. Also, for the vintage 2021, the combined margin emission factor calculated from CEA database in India results into same emission factors as that of the default value. Hence, the same emission factor has been considered to calculate the emission reduction.

Net GHG Emission Reductions and Removals

$$ER_y = BE_y – PE_y – LE_y$$

Where:

ER_y = Emission reductions in year y (tCO_2/y)
BE_y = Baseline Emissions in year y ($t\ CO_2/y$)
PE_y = Project emissions in year y (tCO_2/y)
LE_y = Leakage emissions in year y (tCO_2/y)

Baseline Emissions

Baseline emissions include only CO_2 emissions from electricity generation in power plants that are displaced due to the project activity. The methodology assumes that all project electricity generation above baseline levels would have been generated by existing grid-connected power plants and the addition of new grid-connected power plants.

The baseline emissions are to be calculated as follows:

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

Where:

BE_y = Baseline emissions in year y ($t\ CO_2$)

$EG_{,y}$ = Quantity of net electricity generation (adjusted measured values) that is produced and fed into the grid as a result of the implementation of this project activity in year y (MWh).

$EF_{grid,y}$ = UCR recommended emission factor of 0.9 tCO_2/MWh has been considered, this is conservative as compared to the combined margin grid emission factor which can be derived from Database of Central Electricity Authority (CEA), India.

Hence,

BEy = 5,59,03,409 x 0.9 = 5,03,13,069 tCO2eq

Project Emissions

Considering ACM0002 methodology paragraph 38 (c) equation 10. The project power density is higher than 10 W/m^2.

Hence,

PEy = 0

Leakage Emissions

As per paragraph 53 of ACM0002 version-20, all projects other than Biomass projects have zero leakage.

Hence,

LEy = 0

Total Emission reduction by the project for the current monitoring period is calculated as below:

Hence,

ERy = 5,03,13,069 – 0 – 0

ERy = 5,03,13,069 CoUs

C.6. Prior History>>

The project activity is a Large-scale hydro project and was not applied under any other GHG mechanism prior to this registration with UCR. Also, project has not been applied for any other environmental crediting or certification mechanism.

C.7. Monitoring period number and duration>>

First Monitoring Period : 08 Years
01/01/2014 to 31/12/2021 (included of both dates)

C.8. Changes to start date of crediting period >>

Crediting period start date is 01/01/2014.

C.9. Permanent changes from PCN monitoring plan, applied methodology or applied standardized baseline >>

PCN version 2.0 should be considered for the latest information about the project activity.

C.10. Monitoring plan>>

The project activity essentially involves generation of electricity from water, the employed Hydro Power Plant can only convert Hydro energy into electrical energy and cannot use any other input fuel for electricity generation, thus no special ways and means are required to monitor leakage from the project activity. The maintenance of the meters is done by Power Grid Corporation of India Limited (PGCIL) and weekly generation reports are submitted by Northern Regional Power Committee (NRPC).

Data and Parameters available at validation (ex-post values):

Data / Parameter	$EF_{grid,y}$
Data unit	tCO_2 /MWh
Description	A "grid emission factor" refers to a CO_2 emission factor (tCO_2/MWh) which will be associated with each unit of electricity provided by an electricity system. The UCR recommends an emission factor of 0.9 tCO_2/MWh for the 2014- 2020 years as a fairly conservative estimate for Indian projects not previously verified under any GHG program. Hence, the same emission factor has been considered to calculate the emission reduction under conservative approach.
Source of data	https://a23e347601d72166dcd6-16da518ed3035d35cf0439f1cdf449c9.ssl.cf2.rackcdn.com//Documents/UCRStandardJan2022updatedVer3_180222035328721166.pdf
Value applied	0.9
Measurement methods and procedures	-

Monitoring frequency	Ex-ante fixed parameter
Purpose of Data	For the calculation of Emission Factor of the grid
Additional Comment	The combined margin emission factor as per CEA database (current version 16, Year 2021) results into higher emission factor. Hence for 2021 vintage UCR default emission factor remains same.

Data and Parameters to be monitored (ex-post monitoring values):

Data / Parameter	EG_y
Data unit	MWh
Description	Net electricity supplied (adjusted measured values) to the NEWNE grid facility by the project activity.
Source of data	Daily Generation Reports (DGR) Deviation settlement account (DSA) The Deviation Settlement Account are issued as per Central Electricity Regulatory Commission (Deviation Settlement Mechanism and related matters) Regulations, 2014 and amendments.
Measurement procedures (if any):	Data Type : Measured Monitoring equipment : Energy Meters are used for monitoring Archiving Policy : Electronic Calibration frequency : Once in 5 years (considered as per provision of CEA India).
Measurement Frequency:	Weekly
Value applied:	As per Deviation settlement account (DSA).
Purpose of data:	The Data/Parameter is required to calculate the baseline emission.

Data used for the calculation of the Project Emission

Data / Parameter	Cap
Data unit	W
Description	Installed capacity of the hydro power plant after the implementation of the project activity.
Source of data	Project Site
Measurement procedures (if any):	Determine the installed capacity based on manufacturer's specifications or commissioning data or recognized standards.
Monitoring Frequency:	Once at the beginning of each crediting period.
Value applied:	1,500,000,000 Watts (1500 MW)
Purpose of data:	The Data/Parameter is required to calculate the Power Density of the project activity used to determine the Project Emissions.

Data / Parameter	Ap
Data unit	m^2
Description	Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Project Site

Measurement procedures (if any):	Measured from topographical surveys, maps, satellite pictures, etc.
Monitoring Frequency:	Once at the beginning of each crediting period.
Value applied:	2,38,450 m^2 (23.845 ha.)
Purpose of data:	The Data/Parameter is required to calculate the Power Density of the project activity used to determine the Project Emissions.

ANNEXURE I (Emission Reduction Calculation)

1500 MW Large Scale Nathpa Jhakri Hydroelectric Station by SJVN Limited (HCPL & Creduce JV)

Month - Wise Energy Delivered to Grid (in Million kWh)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2014	215.268	183.753	224.098	314.618	751.324	1076.635	1181.277	1138.233	793.482	428.733	269.608	223.595
2015	191.989	170.302	241.698	429.867	1083.096	1105.826	1099.388	1075.992	861.148	442.505	307.277	241.947
2016	206.918	187.402	214.032	307.053	946.248	1151.615	1126.196	1024.534	917.195	463.348	266.679	217.311
2017	190.289	177.369	207.126	617.303	1002.204	1077.698	1057.955	1040.262	797.541	456.138	294.677	239.309
2018	199.856	168.324	198.801	278.595	510.445	1056.659	1145.650	942.285	929.947	462.336	306.999	237.549
2019	203.631	172.910	212.293	537.605	769.411	1141.854	1173.947	1105.899	1015.542	469.262	308.539	241.100
2020	209.884	188.523	232.858	323.753	720.827	1080.394	1204.520	1165.703	1006.371	461.077	279.500	227.665
2021	199.304	169.718	207.673	247.522	540.307	1064.003	1206.824	1174.917	992.956	555.209	318.430	249.321

Year-Wise Emission reduction calculation for the project activity

Year	Total Electricity delivered to grid in MWh	Verified Electricity delivered in MWh	Recommended emission factor tCO_2/MWh	Total CoUs generated
2014	68,00,623	67,82,261	0.9	61,04,035
2015	72,51,035	72,31,457	0.9	65,08,311
2016	70,28,532	70,09,555	0.9	63,08,600
2017	71,57,872	71,38,546	0.9	64,24,691
2018	64,37,445	64,20,064	0.9	57,78,058
2019	73,51,993	73,32,143	0.9	65,98,929
2020	71,01,074	70,81,901	0.9	63,73,711
2021	69,26,183	69,07,482	0.9	62,16,734
Total CoUs to be issued for the first monitoring period (Year: 2014 to 2021)				5,03,13,069