RIDI GROUPED HYDRO SOLAR POWER PROJECT IN NEPAL

Document Prepared by EKI Energy Services Limited

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CONTENTS

1 PROJECT DETAILS

1.1 Summary Description of the Project

The main purpose of this Grouped project activity is to generate clean form of electricity through renewable Solar and Hydro energy sources. The project activity involves installation of combined capacity of 15.94 MW Solar power projects and Hydro Power projects in Nepal.

As registry user and as per mutual agreement Ridi Power Company limited will be the Project Proponent of this project activity. Ridi Power Company limited is flagship (parental company) and RIDI group companies are Arun Valley Hydropower Development Company Limited & API Power Company Limited. The project activity installed by Arun Valley Hydropower Development Company Limited & API Power Company Limited which are legal owner of the respective project activities.

The proposed grouped project activity supports development of renewable energy generation plants based on Solar PV and hydro power technology in Nepal and delivering electricity to the NEA grid. Each instance of project activity under this grouped project consists of one or more renewable power generation plant using solar PV technology and Hydro power. The proposed grouped project is a voluntary action being undertaken by NEA.

All the project instances i.e. renewable energy generation plants to be included in this grouped project will be from within Nepal only. Hence the location and geographical boundary of the grouped project can be defined as Nepal. The annual generation in grouped project activity in over crediting period is 67,216.88 MWh/year and the estimated annual emission reductions over a 7-year period from initial four project activity instances are 19,547 tCO_2e/year.

Instance 1 Chandranigahpur Solar 4 MW – The proposed project lies in the Chandranigahapur municipality of Rautahat district, province-2. PP has established solar PV technologies for the proposed site location based on the benefits that any particular technology can offer for the project lifecycle of 25 years. As per this evaluation, polycrystalline technology has been chosen for the 4 MW solar park project. The solar project is commissioned on 22-August-2021. The number of modules is 15240 having each capacity of 325 W.

Instance 2 Dhalkebar Solar 1 MW – The proposed project lies in the Mithila municipality; Integrated Sustainability Services Pvt. Ltd. (hereafter referred as "ISSPL") has been appointed by API Power Company Limited which is owner of that project site (hereafter referred as "APCL") for conducting a technical feasibility study and preparing a detailed project report for setting up a 1 MW solar PV power plant in Dhanusa District in the Janakpur Zone of south-eastern Nepal. The project commissioned on 16-January-2022 APCL has successfully obtained approval from Nepal Electricity Authority (NEA) to install 1 MW Solar PV plant in Dhalkebar at a tariff of NPR 8.95/kWh. The generated electricity from this plant will be evacuated to the NEA grid through 11 kV transmission line and a separate Power Purchase Agreement shall be signed with the NEA for this solar PV project. The number of modules is 3820 having each capacity of 325 W covering an area of 3.09 ha.

Instance 3 Simara Solar 1 MW – The proposed project lies in the Jeetpursirama Sub-metropolitan city, ward-14 of bara district. Integrated Sustainability Services Pvt. Ltd. (hereafter referred as "ISSPL") has been appointed by API Power Company Limited (hereafter referred as "APCL") for conducting a technical feasibility study and preparing a detailed project report for setting up a 1 MW solar PV power plant in Bara District, Province no. 2, Nepal. The number of modules is 3840 having each capacity of 325 W.

APCL has successfully obtained approval from Nepal Electricity Authority (NEA) to install 1 MW Solar PV plant in Simara at a tariff of NPR 9.15/kWh. The generated electricity from this plant will be evacuated to the NEA grid through 11 kV transmission line and a separate Power Purchase Agreement shall be signed with the NEA for this solar PV project.

Instance 4 Kabeli B1 Cascade 9.94 MW - Arun Valley Hydropower Development Company Limited has ownership of Kabeli B1 cascade Hydroelectric Project with an installed capacity of 25MW. Same company is developing Kabeli B1 Cascade Hydroelectric Project as a cascade system with an installed capacity of 9.94 MW and will utilize the water from the tailrace of Kabeli B1 cascade HEP. The project activity is commissioned on 26-March-2022. The proposed project is of 9.94 MW capacity Further, this project does not fall in any places of cultural, historical and archaeological importance/monuments, conservation areas, wild life reserve area, national parks, wetland areas, environmental sensitive and/or fragile area and any other places where the law of the land prohibits any construction activities. Hence, this project falls in Schedule-1 of EPR, 1997.

Arun Valley Hydropower Development Company Ltd. has awarded consulting services to Professional Network for Engineering Services Pvt. Ltd. (PNet) for Detail Project Report of Kabeli B1 Cascade HEP. Design team visited project site and obtained topographic survey of the area. Feasibility study has proposed underground waterway, but possibility of surface waterway system is observed during field visit. Optimized layout with surface waterway system has been prepared by consultant and taken consent from developer. Finalizing details of all components, final report is prepared. This report contains description of project, design data and detailed drawings.

The details of the project, the project activity includes the 4 project locations and their location of installation are mentioned in the table below: -

Name of Instances	Capacity in MW	Technology	Connection with Grid	Country	Location	Destrict
Arun Valley Hydropower Development Company Limited-Kaberi-B1 Cascade	9.94 MW	Hydro	NEA Grid	Nepal	Ambarpur, Nagi	Pachthar
Api Power Company	4.0 MW	Solar	NEA Grid	Nepal	Chandranigahpur	Rautahat

Limited-ISSPL						
Api Power Company Limited – Dhalekbar solar	1.0 MW	Solar	NEA Grid	Nepal	Dhalkebar	Dhanusa
Api Power Company Limited - Simara Solar	1.0 MW	Solar	NEA Grid	Nepal	Simara	Parsa

The project activity start is 22-August-2021 as the earliest date of commissioning date of one project site from project activity, the phase wise commissioning dates of each site of project activity in Section 1.8 of this report.

Pre-Project Scenario

There was no activity at the site of the project participant prior to the implementation of this Project activity. The project participant was not involved in generation of solar PV and Hydro power-based power and supplying it to the grid under the pre-project scenario, therefore, in the absence of the Project activity, the equivalent amount of electricity would have been generated from the Connected / new power plants in the Indian grid, while project activity is a green Field project. Therein, the main emission source in the pre-project scenario is the power plants connected to the Indian grid and main GHG involved is CO_2.

The estimated annual emission reduction of this project activity is 19,547 tCO_2 per year and 136,829 tCO_2e over 07 years crediting period.

Estimated ER for current monitoring period is 24,279 tCO_2 and actual emission reduction for the current monitoring period is 18,234 tCO_2.

Audit Type	Period	Program	VVB Name	Number of years
Validation	(22-August-2021--21-August- 2028)	VCS	TUV SUD South Asia Pvt. Ltd.	07 years 00 month
Verification	(22-August-2021--31-May- 2023)	VCS	TUV SUD South Asia Pvt. Ltd.	01 years 09 months & 09 days
Total	01 validation for Total 7 years of crediting period and 1 verification for 1 year 09 months and 09 days			

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

Project Category : Small Scale project activity

1.3 Project Eligibility

Project involves the generation of electricity through Solar PV and hydro power plants, qualifying as Grid-connected electricity generation activities utilizing renewable sources Located in Nepal. This grouped project meets criteria of small-scale projects (as each instances having capacity less than 15 mw) within Least Developed Countries (LDCs), therefore, it is eligible under the scope of the VCS Program. As per VCS Standard Version 4.4[1], section 2.1.3.

1.4 Project Design

☐ The project includes a single location or installation only

☐ The project includes multiple locations or project activity instances, but is not being developed as a grouped project

☒ The project is a grouped project

Eligibility Criteria

The project is a grouped project and there is no additional information needed to be provided.

Following are the eligibility criteria for inclusion of new project activity instances into the grouped project activity as per para 3.6.16 of VCS Project standard v4.4:

No.	Criterion	How the new project activity instances to comply
1	Meet the applicability conditions set out in the methodology applied to the project	All project activity instances meet applicability conditions of methodology (AMS I.D Version 18.0 (project activity instances having capacity less than 15 MW), hence this eligibility criteria is fulfilled. Please refer section 3.2 of this document for methodology applicability criteria.

[1] https://verra.org/wp-content/uploads/2022/12/VCS-Standard-v4.4-FINAL-watermarked.pdf

2	Use the technologies or measures specified in the project description.	The technology used for project activity is renewable energy solar power and hydro power plant.
3	Apply the technologies or measures in the same manner as specified in the project description.	The project activity consists multiple instances of solar and hydro power plants at multiple locations which are supplying electricity to Nepal grid. All instances are greenfield projects. Refer section 1.1 for more details about instances of this report. Hence this condition is fulfilled.
4	Are subject to the baseline scenario determined in the project description for the specified project activity and geographic area.	All initial project activity instances have same baseline as per methodology as detailed in subsequent sections. Hence this eligibility criterion is fulfilled. Please refer section 3.3 of this document for baseline scenario.
5	Have characteristics with respect to additionality that are consistent with the initial instances for the specified project activity and geographic area. For example, the new project activity instances have financial, technical and/or other parameters (such as the size/scale of the instances) consistent with the initial instances, or face the same investment, technological and/or other barriers as the initial instances.	All project activity instances are Solar and hydro power plants. All are green field projects. Located in the same geographical are (Nepal) also only the small-scale projects are considered in the project activity with similar financial and technical parameters. Hence this eligibility criterion is fulfilled.

Along with above points, the Inclusion of New Project Activity Instances follows below criteria Grouped projects provide for the inclusion of new project activity instances as per the section 3.6.17 of VCS standard 4.4[2], subsequent to the initial validation of the project.

No.	Criterion	How the new project activity instances to comply
1	Occur within one of the designated geographic areas specified in the project description	New project activity instances (Renewable energy project) will be occurred in the designated geographic areas specified in the project description.
2	Conform to at least one complete set of eligibility criteria for the inclusion of new project activity instances. Partial conformance with multiple sets of eligibility criteria is insufficient.	New project activity instances will comply with complete set of eligibility criteria as mentioned above for the inclusion of new project activity instances.
3	Be included in the monitoring report with sufficient technical, financial,	New project activity instances information be included in the monitoring report with

[2] https://verra.org/wp-content/uploads/2022/12/VCS-Standard-v4.4-FINAL-watermarked.pdf

No.	Criterion	How the new project activity instances to comply
	geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.	sufficient technical, financial, geographic and other relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.
4	Be included in an updated project description, with updated project location information (as set out in Section 3.11), which shall be validated at the time of verification against the applicable set of eligibility criteria.	New project activity instances information be included with relevant information to demonstrate compliance with the applicable set of eligibility criteria and enable sampling by the validation/verification body.
5	Have evidence of project ownership, in respect of each project activity instance, held by the project proponent from the respective start date of each project activity instance (i.e., the date upon which the project activity instance began reducing or removing GHG emissions).	New project activity instances ownership needs to be evidenced from start date of respective project activity instance.
6	Have a start date that is the same as or later than the grouped project start date.	New project activity instances start date should be after the start date of grouped project activity.
7	Be eligible for crediting from the start date of the project activity instance through to the end of the project crediting period (only).	New project activity instances are eligible to claim credits from the start date of the project activity instance through to the end of the project crediting period.
8	Only eligible for crediting from the start of the verification period in which they were added to the grouped project.	New project activity instances are eligible for crediting from the start date of the verification period.
9	Not be or have been enrolled in another VCS project.	New project activity instances should not be enrolled with the any other mechanism.
10	Adhere to the clustering and capacity limit requirements for multiple project activity instances set out in 3.6.8 – 3.6.9.	All instances of this project activity are not located within 10 kilometers of each other, hence para 3.6.8 is fulfilled. Each instance of this project activity is having capacity less than 15 mw, and in future if any instance will be added will be followed the same criteria. Hence para 3.6.9 is justified.

1.5 Project Proponent

Organization name	RIDI POWER COMPANY LIMITED
Contact person	Kuber Mani
Title	Managing Director
Address	Kathmandu, Nepal
Telephone	01-5111015, +977-9841250864
Email	kmnepal2003@yahoo.com

1.6 Other Entities Involved in the Project

Organization name	EKI Energy Services Limited
Role in the project	Project Consultant
Contact person	Ankit Sethiya
Title	Manager – Operations
Address	Plot No 48, Scheme 78, Vijay Nagar Part- II, Indore 452010, Madhya Pradesh, India
Telephone	0731 428 9086
Email	ankit@enkingint.org, registry@enkingint.org

1.7 Ownership

The renewable energy technologies installed at multiple sites, each of the project instances as part of the project activity are under ownership of legal owner which is RIDI Power company limited. RIDI Power company limited is project proponents and EKI Energy Services Limited having registry rights and all the carbon credits related rights are with EKIESL; and EKIESL will be the concerned authority for all modalities and procedure with respect to VCUs of the project activity.

Legal Ownership of power plants will be with RIDI Power company limited which can be verified with commissioning certificate. Further as per agreement between RIDI Power company limited & EKI Energy Services Limited the VCUs rights are transferred to EKIESL.

The commissioning certificate for each instance of project activity are the supporting documents to demonstrate the project ownership of all instances with their respective SPVs as per shown in below table of this section.

This demonstrates the right of use according to clause 3.7.1 of VCS Standard Version 4.4 – "a project ownership arising by virtue of a statutory, property or contractual right in the plant, equipment or process that generates GHG emission reductions and/or removals".

The details of instances ownership wise is as explained in below table.

Sr. No.	Project proponent Name	SPV name	Instance Name
1	RIDI Power company limited	Arun Valley Hydropower Development Company Limited	Kabeli B1 Cascade 9.94 MW
2		Api Power Company Limited	Dhalkebar Solar 1 MW
3			Chandranigahpur Solar 4 MW
4			Simara Solar 1 MW

1.8 Project Start Date

The start date of the project is 22 August 2021, which is the date of commissioning of the first PV installation at the site. This is the date on which the group project began generating GHG emission reductions.

As per VCS standard version 4.4, project activity or any instances of grouped project activity has to be validated within two years from respective commissioning dates.

In this project activity all instances are requesting for registration within two years of the respective commissioning dates. Site wise commissioning details are in below table.

S.No.	Instances Name	Capacity (MW)	Start Date of instance wise operation (COD Date)
1	Chandranigahpur Solar 4 MW	4.00	22-August-2021
2	Dhalkebar Solar 1 MW	1.00	16-January-2022
3	Simara Solar 1 MW	1.00	24-July-2022
4	Kabeli B1 Cascade 9.94 MW	9.94	26-March-2022
	Total	15.94	

1.9 Project Crediting Period

Grouped Project and 1st Project Activity Instance

Crediting period: Renewable

Total number of years: 7 years 00 months, renewable twice.

Start and end date of first crediting period: 22-August-2021 to 21-August-2028 (total 7 years and 00 months) and both days included.

1.10 Project Scale and Estimated GHG Emission Reductions or Removals

The estimated annual GHG emission reductions/removals of the project are:

☐ <20,000 tCO_2e/year

☒ 20,000 – 100,000 tCO_2e/year

☐ 100,001 – 1,000,000 tCO_2e/year

☐ >1,000,000 tCO_2e/year

Project Scale	
Project	√
Large project	

Year	Estimated GHG emission reductions or removals (tCO_2e)
2021	19,547
2022	19,547
2023	19,547
2024	19,547
2025	19,547
2026	19,547

2027	19,547
Total estimated ERs	**136,829**
Total number of crediting years	**07**
Annual Estimated ERs	19,547

1.11 Description of the Project Activity

ISSPL Solar is responsible for the commissioning of new, small-scale solar PV installations in Nepal. Each project activity instance will comprise one or more solar PV facilities, where the total maximum installed capacity of the facilities is below 6 MW, per project activity instance.

The Project has been configured into a single modular plot having a DC capacity of 1.2 MWp with one inverter of 1000 kW, with a maximum AC output of 1 MW. In order to minimize DC ohmic losses, inverters, MV transformers and switchgear shall be suitably located within the modular plot. The PV modules are electrically connected with cables sized to minimize DC ohmic losses. The DC electrical output from the PV modules is fed through DC cables of suitable grade to junction boxes, which are then connected to inverters. These inverters convert the DC electrical input to AC output and the same is then stepped up using a single 1 MVa 300 V/11kV Transformer. The 11kV AC electrical supply is then evacuated into the NEA owned grid through 11kV transmission lines that connect the project step-up transformer to the NEA owned grid substation.

The general arrangement of the project comprises a connection structure on the left bank of the Kabeli River, located at about 400 m upstream from the confluence of Kali Khola with Kabeli River. The main features of the Project are as follows:

• Interconnection structure comprising RCC Box canal and pipe canal, side channel spillway of 75 m length, and forebay, the total length of interconnection conduit up to forebay is 1160 m.

• Headrace pipe consisting of 1165 m long Steel pipe of 3.75 m internal diameter (ID) with thickness of 12mm.

• Surge tank of diameter 18 m to manage effect of water hammer during closure and start-up

• Two parallel steel penstock pipe of 2.3 m diameter

• A surface powerhouse (25*14 m) with two generating units.

• Tailrace canal of 160 m; and

• A 33 kV single circuit, 3.0 km long transmission line from the powerhouse to switchyard at Kabeli pooling station.

Simara Solar 1 MW

Summary of 1 MW Solar PV Power Plant

1	Project Authority	API Power Company Limited
2	Project Capacity (AC side)	1 MW
3	Selected Location	Jitpursamara, Bara District, Province 2
4	Nearest Major Town	Simara
5	Accessibility	By Tribhuwan highway
6	Nearest Airport	Simara, Nepal
7	Solar module type	Trina TSM-315PD14 (Si-Poly)
8	Capacity of each module (W)	325
9	No. of modules	3840
10	PV System Mounting Structure type	MS Galvanized
11	Power conditioning unit (Invertors) capacity	1000 kW X1 Nos
12	Area and dimension of each module	1.9403 m^2 and 1956*992*40 mm
13	Total area covered by panel	0.7451 ha
14	Power conditioning unit specifications	Input voltage range600-850V
15	No. of invertors	1
16	Invertors make	ABB
17	Cables and earthing systems	1 Set
18	Plant Load Factor	As per Contract Energy Table with NEA: 18.71%P50 PVSyst19.52%

Dhalkebar Solar 1 MW

Efficiency of Commercially Available PV Technologies

1	Project Authority	API Power Company Limited
2	Project Capacity (AC side)	1 MW
3	Selected Location	Maithila Municipality
4	Nearest Major Town	Dhalkeber
5	Accessibility	By East-West National highway
6	Nearest Airport	Janakpur, Nepal
7	Solar module type	Poly-crystalline
8	Capacity of each module (W)	325
9	No. of modules Modules of String No. of String	3820 20 191
10	Dimension of each Module	1956*992*40mm
11	Front glass	3.2 mm, Anti-refection coating.
12	PV System Mounting Structure type	MS Galvanized/POSMAC
13	Power conditioning unit (Invertors) capacity	1000 kW
14	Power conditioning unit specifications	Input voltage range650-850V
15	No. of invertors	1
16	Invertors make	ABB/TMEIC or equivalent
17	Cables and earthing systems	1 Set
18	Plant Load Factor	As per PPA with NEA: 19.77%P50 PVSyst:20.55%

Chandranigahpur Solar 4 MW

Project Summary of proposed 4 MW Solar PV Plant

1	Project Authority	API Power Company Limited
2	Project Capacity (AC side)	4 MW
3	Selected Location	Chandranigahapur, Rautahat, province 2
4	Nearest Major Town	Chandranigahapur
5	Accessibility	By East-West National highway
6	Nearest Airport	Simara, Nepal
7	Solar module type	Trina, Su ntech, Jinko, Hanwa (Si-Poly)
8	Capacity of each module (W)	325
9	No. of modules	15240
10	PV System Mounting Structure type	MS Galvanized
11	Power conditioning unit (Invertors) capacity	2000 kW *2 Nos
12	Power conditioning unit specifications	Input voltage range650-850V
13	No. of invertors	2
14	Invertors make	ABB/TMEIC
15	Cables and earthing systems	1 Set
16	Plant Load Factor	19.77%

Kabeli B1 Cascade 9.94 MW

Parameters	Value
Number of units	2
Rating	6.23 MVA
Power factor	0.85 over-excited
Cooling	TEWAC (Totally Enclosed Water Air Cooling)
Synchronous speed	375 rpm
Runaway speed	784 rpm
Number of Poles	16
Rated Frequency	50 Hz
Rated voltage	11 kV
Rated range of voltage variation	±5%
Range of frequency variation	±2%
Stator winding connection	Y (Star)
Rotor and Stator insulation	Class F
Installed Capacity	9.94 MW
Gross Head	37.1 m
Rated Design Head	32.5 m
Design Plant Discharge	35.14 m3/sec
Catchment Area	710 sq. km
Average Precipitation	2509 mm/year
100 years Design Flood (HW)	1065 m3/sec
Minimum Monthly Flow	9.17 m3/sec

Design Discharge	35.14 m3/sec

1.12 Project Location

Instance	Technology	Capacity	Latitude	Longitude
Chandranigahapur	Solar	4 MW	27°06'27.0"N, 27.1075	85°22'05.6"E, 85.3682
Dhalkeber	Solar	1 MW	26°55'21.2"N, 26.9225	85°56'42.8"E, 85.9452
Simara	Solar	1 MW	27°09'04.0"N, 27.1510	85°00'44.7"E, 85.0124
Kabeli B1Cascade	Hydro	9.94 MW	27°16'22.7"N, 27.2729	87°46'58.8"E, 87.7829

Below is the picture for Chandranigahapur 4 mw solar PV instance –

Below is the picture for Dhalkeber 1 mw solar PV instance –

Below is the picture for Simara 1 mw solar PV instance –

Below is the picture for Kabeli B1 cascade 9.94 mw Hydro power plant instance –

1.13 Conditions Prior to Project Initiation

There was no project at the site of the project participant prior to the implementation of this project activity. The project participant was not involved in generation of Hydro power & solar PV based power and supplying it to the grid under the pre-project scenario, therefore, in the absence of the proposed project activity, the equivalent amount of electricity would have been generated from the connected / new power plants in the Nepal electricity grid, while proposed project activity is a green field project. Therein, the main emission source in the pre-project scenario is the power plants connected to the Nepal electricity grid and the primary GHG involved is CO_2.

The project activities were newly implemented and these activities were not constructed to

- Increase in the reservoir capacities and the power density of the project activity,
- New reservoir for power generation.
- modify/retrofit of any existing grid-connected renewable power plant/unit,

The conditions prior to initiation of the project are

Electricity has a universal role in the economic development. It has a dual function as a “factor of production” and as a “consumer good” that increases the quality of life. Energy needs of the country are growing in tune with the needs of the liberalized economy.

1.14 Compliance with Laws, Statutes and Other Regulatory Frameworks

The project is in compliance with relevant laws, statues and other regulatory frameworks. The project does not violate any laws, statutes and or other regulatory frameworks in Nepal. Also, The Project has received necessary approvals for development and commissioning for Hydro power project and solar power project from the state Nodal agencies and is in compliance to the local laws and regulations provided in the below table for both Hydro and solar projects.

Table 10-1: List of Project Related Policies, Acts and Regulations

Legislations	Functions	Justification
Company Act 2063 in BS (bikram Sanwat) (2006)[4] for both Hydro and solar project	Registration and operation	The company is registered and complies with this law
Hydropower Development Policy 2058 in BS (bikram Sanwat) (2001)[5] for Hydro project	Guidelines for hydropower development	The Hydro project complies with this policy
National Biodiversity Strategy and Action Plan 2071 in BS (bikram Sanwat) (2014)[6] for Hydro project	Management of Diversity	The Hydro project complies with this policy
Income Tax Acts and Budgets[7] for both Hydro and solar projects	Taxation and other provisions	The company pay taxes as per the regulation, so it's complying with the law.
Electricity Act 2049 (1992)[8] for both Hydro and solar projects	Regulations for survey, generation, transmission and distribution of Small Hydropower power	The Hydro and solar projects are complying with this law.
Water Resources Act 2049 in BS (bikram Sanwat) (1992)[9] for Hydro project	Regulations for rational utilization, conservation,	The Hydro project complies with this law
NEA's policy regarding small hydropower 2055 in BS (bikram Sanwat) (1998)[10] for Hydro project	Regulation regarding buy back rates and Power purchase agreement of small hydropower projects by private sectors	The Hydro project complies with this policy

[4] https://admin.theiguides.org/Media/Documents/CompanyAct2006.pdf

[5] http://sar-climate.adpc.net/index.php/2022/06/02/hydro-power-development-policy-2058-2001/

[6] https://www.cbd.int/doc/world/np/np-nbsap-v2-en.pdf

[7] https://www.lawcommission.gov.np/en/wp-content/uploads/2018/10/income-tax-act-alongwith-each-year-financial-acts-amendment-2058-2002.pdf

[8] https://lawcommission.gov.np/en/?p=12917

[9] https://www.fao.org/faolex/results/details/en/c/LEX-FAOC001367/

[10] https://powermin.gov.in/en/content/policy-hydro-power-development

Environment Protection Act 2076 in BS (bikram Sanwat) 2019[11] for both Hydro and solar projects.	Regulations regarding environment protection and hydropower development	The Hydro and solar projects are complying with this law.
VAT and TAX Provision for both Hydro and solar projects	Recent Developments, Budget declarations	The Hydro and solar projects are complying with this law.

Note – Dates are mentioned in above table are both in BS Nepal & international calendar

Project instances have been awarded Consent to operate for each site from Nepal NEA, hence the following laws are compiled by the solar and hydro project instances of this project activity.

1. Renewable Energy Subsidy Policy of Nepal[12] for both Hydro and solar projects, and both projects are complying with the policy.
2. Electricity Act, 1992 & Electricity Rules, 1993: This legal framework lays the groundwork for licensing electricity projects in the country.[13] for both Hydro and solar projects.
3. Electricity Regulatory Commission Act, 2017: This legislation was formed to oversee the production, distribution, and trade of electricity. And project activity is in compliance of this law. for both Hydro and solar projects.
4. Nepal Electricity Authority Act, 1984: This law governs the Nepal Electricity Authority, which primarily manages the power supply in the nation. And project activity is supplying the power to national grid of Nepal hence compliance of this law. for both Hydro and solar projects.

1.15 Participation under Other GHG Programs

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

Project has not been registered and it is not seeking registration under any other GHG programs.

1.15.2 Projects Rejected by Other GHG Programs

Project has not been rejected by any other GHG programs.

1.16 Other Forms of Credit

The project activity neither has nor intends to generate any other form of GHG related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

1.16.1 Emissions Trading Programs and Other Binding Limits

[11] https://lawcommission.gov.np/en/wp-content/uploads/2021/03/The-Environment-Protection-Act-2019-2076.pdf

[12] https://policy.asiapacificenergy.org/sites/default/files/Subsidy%20Policy%20for%20Renewable%20Energy%202069%20BS%20%282013%29%20%28EN%29.pdf

[13] https://meroadalat.com/hydropower-law-in-nepal/

Does the project reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading?

☐ Yes ☒ No

1.16.2 Other Forms of Environmental Credit

The project activity neither has nor intends to generate any other form of GHG related environmental credit for GHG emission reductions or removals claimed under the VCS Program.

1.16.3 Supply Chain (Scope 3) Emissions

The project activity is generation of electricity from solar power and Electricity is supplied to Nepal Grid. The PP is the only owner of VCUs in entire supply chain. Project's GHG emission reductions or removals are in a supply chain, In the upstream side of this project the Solar PV producers and retailers only supplying PV as per the Purchase order and there is no such agreement between PP and PV producers/retailers of sharing VCUs.

Project proponent downstream product is electricity generated by solar power project which directly sales to Nepal Electricity authority (NEA) via National Grid through power purchase agreement which says NEA will not be having rights to sell any emission reduction (VCUs) generated by this project activity hence PP is the only owner of VCUs for entire project crediting period. Hence project proponent will be having rights to claim emission reductions and there is no double accounting of VCUs in supply chain in scope 3.

1.17 Sustainable Development Contributions

1.17.1 Sustainable Development Contributions Activity Description

Contribution to Sustainable Development

Implementation of project activity will support in the sustainable development primarily in the local area surrounding the project site and also at the national level. Expected contribution of proposed project activity towards sustainable development can be categorized under four indicators as explained below:

Social well-being:

Proposed project activity is Greenfield power plant based on solar PV technology and hydro power plant. Installation of this power plant will generate direct and indirect employment in the local area around the project site. This generation of direct and indirect employment will help in poverty alleviation and hence contributing towards social well-being.

Being a Greenfield project, there will be improvement in the infrastructure in the local area around the project site. The infrastructure related to connectivity in terms of road networks etc. is expected to improve. This will lead to improvement in standard of living of population surrounding project site and hence leading to social wellbeing.

Environmental well-being:

The project activity is installation of solar PV and Hydro power-based power generation system. This system will generate power without any kind of emissions into atmosphere. Also, in the absence of project activity, the equivalent amount of power would have been generated through grid connected fossil fuel powered power plants thereby leading to emissions. This clarifies that the proposed project activity does not cause any negative impact on environment; hence leading to environmental well-being.

Economic well-being:

Being a Greenfield power plant, the project activity generates direct and indirect employment opportunities in terms of skilled and semi-skilled manpower during construction and operation phase of the project. Apart from this business opportunities would be generated in terms of supply of equipment's and services at the project site, import and transport of equipment's etc. This will help towards the economic well-being of local area surrounding project activity as well as nation as whole.

Technological well-being:

Power generation through solar PV and hydro power technology is environmentally safe and sound technology. Also, there are no harmful emissions while operation of the plant. Hence this technology is amongst the cleanest sources of power generation among the other power generation technologies available in the country. In this scenario, the share of power generation through renewable sources i.e., solar and hydro is very small in Nepal. Thus, project activity would help in diffusion of the cleaner technology in the country for power generation. This will lead to technological well-being in power generation sector in Nepal.

1.17.2 Sustainable Development Contributions Activity Monitoring

Contribution to sustainable development:

The project activity has beneficial effect on the local environment and employment in the nearby region. Clean Electricity generation through Hydro Project and solar PV result in avoidance of consumption of fossil fuels which results in contribution to SDG 7. The emission avoidance through these activities results in contribution to SDG 13. All the workers at site are trained which results in increase of skills, which contributes to SDG 8.6 Detailed indicators are mentioned in table 1. This is a voluntary project activity doesn't contribute to achieving any nationally stated sustainable development priorities. Project officials has taken decision to keep all the employees on permanent basis working at the project activity.

• SDG 7.0: According to SDG target 7.0, indicator 7.2.1, the project activity generates electricity from hydro energy sources that ensures supply of electricity sources from clean energy sources at affordable rate. In the 1st monitoring period, this project activity has supplied 83,408 MWh clean electricity.

- SDG 8.0: According to SDG target 8.5, indicator 8.5.1, As per Average hourly earnings of employees, by sex, age, occupation and persons with disabilities, the project activity will create opportunity to earn as per minimum wages and as per the standard hourly income.

- SDG 13.0: According to SDG target 13.0, indicator 13.2.2, it states "Total greenhouse gas emissions per year". By mitigating 24,279 tCO_2e which is greenhouse gas, the project activity has contributed towards SDG target 13.0. for present monitoring period.

Table 1: Sustainable Development Contributions

Row number	SDG Target	SDG Indicator	Net Impact on SDG Indicator	Current Project Contributions	Contributions Over Project Lifetime
1)	7.2	7.2.1: Renewable energy share in the total final energy consumption	Implemented activities to increase	About 83,408 MWh has been displaced in the current monitoring that helps to increase the renewable energy share in the energy mix.	The annual estimated clean energy generation from the project activity over its entire crediting period is 874,984.891 MWh.
2)	8.5	8.5.1 Average hourly earnings of employees, by sex, age, occupation and persons with disabilities[14]	Implemented activities to increase	The project activity will create opportunity to earn as per minimum wages and as per the standard hourly income, as per law NPR 17,300 is the per month minimum wages and NPR 72 is wages/hour.	The minimum wages which 17,300 NPR[15] and NPR 72 per hour. However more than minimum wages being paid by the employer for male and female employees in this project activity which is in the range of NPR 20,000 to 50,000.

[14] There is no disable employee at any project site.

[15] https://wageindicator.org/salary/minimum-wage/nepal

3)	13.2	13.2.2 Total greenhouse gas emissions per year[16]	Implemented activities to avoid	By supplying 62,606 MWh clean electricity (generated through Solar and Hydro project) to Nepal grid, the project avoided releases of 18,234 tCO_2e in to the atmosphere during the current monitoring period.	Prevented the release of 18,234 of carbon into the atmosphere for current monitoring period, The cumulative quantifiable impact of the project's activities is 136,829 tCO_2e related to SDG 13 (Climate Action) over its entire crediting period a measurable contribution towards combating climate change.

[16] https://unstats.un.org/sdgs/metadata/?Text=&Goal=13&Target=

1.18 Additional Information Relevant to the Project

Leakage Management

Since the project activity instances to be included into the grouped project activity are renewable energy projects based on hydropower, no leakage emissions are considered - in line with paragraph 27 of the small-scale methodology AMS.I.D (version 18.0).

Thus, leakage management plan and implementation of leakage and risk mitigation measures are not applicable for this grouped project activity.

Commercially Sensitive Information

Not Applicable, not any commercially sensitive information has been excluded from the public version of the project description. There is no commercially sensitive information.

Further Information

Not Applicable

2 SAFEGUARDS

2.1 No Net Harm

The project activity promotes environmental and socio-economic well-being as it results in zero GHG emissions due to installation and operation of clean, renewable energy technology for electricity generation. Thus, there are no any significant impacts due to implementation of project activity on air, water, soil quality and ambience are envisaged due to the project activity.

For hydropower projects in Nepal the EIA study has to comply with a range legal requirements of government of Nepal like Constitution of Nepal, 2072, Policy, Guidelines, Acts, Regulations and International Treaties and Conventions such as: Three Years man 2070 (2013), Hydropower Development Policy, 2001, Forest Policy, 2000, Nepal Biodiversity strategy, 2002, Nepal Biodiversity Strategy Implementation man, 2006, National Water strategy (2002) and Nepal Water man 2005, National Environmental Impact Assessment Guidelines, 1993, Department of Electricity Development Manuals, Forestry Sector ETA Guidelines 1995. Forest Produce, Collection, Sale and Distribution Guideline, 2000, Community Forest Guidelines, 2008, Community Forest Inventory Guidelines, 2005, Environmental Management Guidelines (Road), 1997, Guidelines for the physical Infrastructure Development and Operation in the Protected Areas 2065 (2008), soil and Watershed Conservation Act. 1982, Forest Act, etc. a detailed Environmental Management Plan, which includes relevant mitigation measures, monitoring procedures and responsibilities, is provided in the Environmental Assessment Report.

- The project won't encroach into any of the declared protected areas of Nepal, nor will it undermine the rich cultural heritage sites of Nepal.

- There might be some localized impacts due to construction, but they are included in the Environmental Management Plan (EMP).

2.2 Local Stakeholder Consultation

The details of the Stakeholder Meetings are as follows:

		Date of Invitation	Date of Meeting	
Instance Name	Capacity in MW	In AD	In AD	Location of Meeting
Kabeli B1 Cascade	9.94	28- May-2017	02-June-2017	Hilihang VDC & Amarpur VDC, Panchthar District. Yangwarak VDC Taplejung District
Dahlkebar Solar	1.00	22-August-2018	27-August-2018	Dhalkebar, Mithila Municipality, Dhanusa district
Chandranighapur Solar	4.00	10-August-2018	22-August-2018	Chandranigahapur Municipality Ward No. 5 Rautahat
Simara Solar	1.00	22-August-2018	27-August-2018	Simara district

In the introductory speech, the representative of RIDI Power Limited (Project Investor), welcomed the gathering and given a brief about the climate mitigation project activity. Subsequent to the introductory speech, stakeholders were explained about the electricity generation from Hydro & Solar projects is an environmentally friendly power generation technology contributing to reduction in GHG emissions. They were also explained about the benefits of the Hydro & Solar power projects like, increasing energy availability and improving quality of power and its assistance to the local population by providing employment opportunities to both skilled & unskilled labours.

The Minutes of meeting with commenting sheet from LSH, invitation letter receipt copy is to be submitted to the DOE during validation. For more details refer appendix 2.

Meeting started with opening speech by representative of project participant. He introduced all guests on dais. The representative of project participant explained technical aspects of project to stakeholders. He also explained about social, environmental & economic benefits of the project. He also elaborated about carbon mechanism & its requirement for the current project. After the detailed discussions, the session was open for questions from stakeholders.

For monitoring the ongoing communication with local stakeholders PP has kept the grievance register on the respective monitoring office of each instance,

Refer Section Appendix 2 for details for local stakeholder consultation for site wise details.

Feedback received from stakeholders

1. During the implementation of the project, employment opportunities should be provided to skilled and unskilled workers at the local level.
2. Special attention should be paid to the use of local agriculture products during project implementation.
3. Proper attention should be paid to the protection of forest and wildlife habitats damaged by the project.
4. The project should take special initiatives for the protection of religious places.
5. The project should be completed within the time limit as much as possible.
6. The project should provide shares to locals.

2.3 Environmental Impact

For Solar and hydropower projects in Nepal the EIA study has to comply with a range legal requirements of government of Nepal like Constitution of Nepal, 2072, Policy, Guidelines, Acts, Regulations and International Treaties and Conventions such as: Three Years man 2070 (2013), Hydropower Development Policy, 2001, Forest Policy, 2000, Nepal Biodiversity strategy, 2002, Nepal Biodiversity Strategy Implementation man, 2006, National Water strategy (2002) and Nepal Water man 2005, National Environmental Impact Assessment Guidelines, 1993, Department of Electricity Development Manuals, Forestry Sector ETA Guidelines 1995. Forest Produce, Collection, Sale and Distribution Guideline, 2000, Community Forest Guidelines, 2008, Community Forest Inventory Guidelines, 2005, Environmental Management Guidelines (Road), 1997, Guidelines for the physical Infrastructure Development and Operation in the Protected Areas 2065 (2008), soil and Watershed Conservation Act. 1982, Forest Act, Convention on Bidogical Diversity, 1992 etc.

The environmental impacts of this project are not considered to be significant. Nevertheless, a detailed Environmental Management Plan, which includes relevant mitigation measures, monitoring procedures and responsibilities, is provided in the Environmental Assessment Report. Topography, hydrological, geological and power optimization studies have shown that the proposed dam site and tailrace of this Hydropower Project are the most suitable ones. Hence, the project seems feasible from all perspectives.

• The project won't encroach into any the declared protected areas of Nepal, nor will it undermine the rich cultural heritage sites of Nepal.

• There might be some localized impacts due to construction, but they are included in the Environmental Management Plan (EMP).

2.4 Public Comments

The project activity was published for public comment and no any relevant comments were received during the one month commenting period.

2.5 AFOLU-Specific Safeguards

Not Applicable

3 APPLICATION OF METHODOLOGY

3.1 Title and Reference of Methodology

The approved baseline and monitoring methodology is used for the project. The details of the methodology are as follows:

Methodology: AMS.I.D

Project Type: Type-I: Renewable Energy Projects

Title: Grid connected renewable electricity generation

Version No.: Version 18; EB 8[17]

Reference: Appendix B of the simplified modalities and procedures for small-scale CDM project activities i.e. "Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories"

The methodology refers to following CDM Tools:

• Tool: 7 - Tool to calculate emission factor for an electricity system (Version 07.0.0)[18]

• Tool: 3 - Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion (Version no. 03.0)

Tool: 21 – Demonstration of additionality of small-scale project activities (Version 13.1)[19]

Tool: 01 – Tool for the demonstration and assessment of additionality[20]

Tool: 19 – Demonstration of additionality of microscale project activities[21]

[17] https://cdm.unfccc.int/UserManagement/FileStorage/2P7FS6ZQAR84LG3NMKYUH50WI9ODBC

[18] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

[19] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v13.1.pdf

[20] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

[21] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v10.0.pdf

3.2 Applicability of Methodology

Applicability conditions as per the applied Methodology: AMS-I.D Version 18.0 for Solar Projects:

Methodology Criteria	Project Activity Parameters
4. This methodology is applicable to project activitiesthat (a) install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s).	The proposed project activity is the installation of a new solar photovoltaic (PV)power plant at project site where there was no renewable energy power plant operatingprior to the implementation of this project activity. Thus, the project activity under consideration is a Greenfield plant. Hence this condition is fulfilled by theproject activity.
5. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: • The project activity is implemented in an existing reservoir with no change in the volume of reservoir; • The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m^2; • The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the Project Emissions section, is greater than 4 W/m^2.	The proposed project activity is solar PV power plant project activity. Hence this condition is not applicable.
6. If the new unit has both renewable and non- renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	All instances of this project activity is below capacity of 15 mw and in future any instances will be added to this grouped project activity will not be having capacity more than 15 mw.

7. Combined heat and power (co-generation) systems are not eligible under this category.	Combined heat and power (co-generation) systems are not existing within proposed project activity. So, this condition is not fulfilled by the project activity. Hence not applicable.
8. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The proposed project activity is a greenfield plant that does not involve any addition of renewable energy generation unit.
9. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The proposed project activity is not a retrofit or replacement unit of an existing facility.
10. In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid, then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	There is no landfill gas, waste gas, wastewater treatment and agro- industries projects recovered methane emissions in this proposed project activity. Hence not applicable
11. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	There is no biomass is sourced from dedicated plantations in this proposed project activity. Hence not Applicable.

Applicability conditions as per the applied Methodology: AMS-I.D Version 18.0 for Hydro Power Projects:

Methodology Criteria	Project Activity Parameters
4. This methodology is applicable to project activities that: (a) Install a Greenfield plant;	The proposed project activity is the installation of a new hydro power plant at project site where there was no renewable energy power plant operating prior to the implementation of this project activity. Thus, the project activity under

(b) Involve a capacity addition in (an) existing plant(s); (c) Involve a retrofit of (an) existing plant(s); (d) Involve a rehabilitation of (an) existing plant(s)/unit(s); or (e) Involve a replacement of (an) existing plant(s).	consideration is a Greenfield plant. Hence this condition is fulfilled by the project activity.
5. Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology: (a) The project activity is implemented in an existing reservoir with no change in the volume of reservoir; (b) The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m^2; (c) The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m^2	The proposed project activity is a run of river hydro power plant project activity. Hence this condition is not applicable.
6. If the new unit has both renewable and non- renewable components (e.g., a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW.	All instances of this project activity is below capacity of 15 mw and in future any instances will be added to this grouped project activity will not be having capacity more than 15 mw.
7. Combined heat and power (co-generation) systems are not eligible under this category.	Combined heat and power (co-generation) systems are not existing within proposed project activity. So, this condition is not fulfilled by the project activity. Hence not applicable.

8. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units.	The proposed project activity is a greenfield plant that does not involve any addition of renewable energy generation unit.
9. In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15 MW.	The proposed project activity is not a retrofit or replacement unit of an existing facility.
10. In the case of landfill gas, waste gas, wastewater treatment and agro-industries projects, recovered methane emissions are eligible under a relevant Type III category. If the recovered methane is used for electricity generation for supply to a grid, then the baseline for the electricity component shall be in accordance with procedure prescribed under this methodology. If the recovered methane is used for heat generation or cogeneration other applicable Type-I methodologies such as "AMS-I.C.: Thermal energy production with or without electricity" shall be explored.	There is no landfill gas, waste gas, wastewater treatment and agro- industries projects recovered methane emissions in this proposed project activity. Hence not applicable.
11. In case biomass is sourced from dedicated plantations, the applicability criteria in the tool "Project emissions from cultivation of biomass" shall apply.	There is no biomass is sourced from dedicated plantations in this proposed project activity. Hence not Applicable.

The applicability conditions of tools applicable under the methodology AMS.I. D; are explained as follows:

Applicability conditions of Tool – 7 "Tool to calculate the emission factor for an electricity system" (Ver- 07.0) for Solar project activity:	
1. 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 under section 5.1 for calculating baseline emissions.
2. 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 the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
3. 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 Nepal, a non-Annex I country[22]. Therefore, this criterion is not applicable.
4. Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	The project activity is a grid connected Solar power project. Therefore, this criterion is not applicable.

- "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion"- In accordance with applicable approved methodology AMS-I.D version 18, the proposed project activity does

[22] https://unfccc.int/process/parties-non-party-stakeholders/parties-convention-and-observer-states?field_national_communications_target_id%5B514%5D=514&field_parties_date_of_ratifi_value=All&field_parties_date_of_signature_value=All&field_parties_date_of_ratifi_value_1=All&field_parties_date_of_signature_value_1=All&combine=

not involve the project emissions, thus the said tool has not been used for the project activity under consideration.

Applicability conditions of Tool – 7 "Tool to calculate the emission factor for an electricity system" (Ver- 07.0) for Hydro Power project activity:	
5. 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 under section 5.1 for calculating baseline emissions.
6. 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 the project activity is grid connected, this condition is applicable and the emission factor has been calculated accordingly.
7. 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 Nepal, a non-Annex I country[23]. Therefore, this criterion is not applicable.
8. Under this tool, the value applied to the CO_2 emission factor of biofuels is zero.	The project activity is a grid connected hydro power project. Therefore, this criterion is not applicable.

[23] https://unfccc.int/process/parties-non-party-stakeholders/parties-convention-and-observer-states?field_national_communications_target_id%5B514%5D=514&field_parties_date_of_ratifi_value=All&field_parties_date_of_signature_value=All&field_parties_date_of_ratifi_value_1=All&field_parties_date_of_signature_value_1=All&combine=

Applicability conditions of Demonstration of additionality of small-scale project activities, TOOL21, version 13.1. for both Solar and Hydro power projects	
1. Para 4- The use of the methodological tool "Demonstration of additionality of small-scale project activities" is not mandatory for project participants when proposing new methodologies. Project participants and coordinating/managing entities may propose alternative methods to demonstrate additionality for consideration by the Executive Board.	This condition is applicable. The project participants not proposing new methodology.
2. Para 5- Project participants and coordinating/managing entities may also apply "TOOL19: Demonstration of additionality of microscale project activities" as applicable.	This condition is applicable as instance 1, 2 and 3 of project is a microscale project activity.

Applicability conditions of Tool for Investment analysis, TOOL27, version 12.0 for Hydro Power Projects:	
1. Para 2- This methodological tool is applicable to project activities that apply the methodological tool "Tool for the demonstration and assessment of additionality", the methodological tool "Combined tool to identify the baseline scenario and demonstrate additionality", the guidelines "Non-binding best practice examples to demonstrate additionality for SSC project activities", or baseline and monitoring methodologies that use the investment analysis for the demonstration of additionality and/or the identification of the baseline scenario.	This condition is applicable. The tool in accordance with the guidance under "Tool for the demonstration and assessment of additionality".
2. Para 3- In case the applied approved baseline and monitoring methodology contains requirements for the investment analysis that are different from those described in this methodological tool, the requirements contained in the methodology shall prevail.	This condition is applicable as the tool in accordance with the applied methodology.

Tool for the demonstration and assessment of additionality, TOOL01, version 07.0.0 for solar and hydro power projects	
1. The use of the "Tool for the demonstration and assessment of additionality" is not mandatory for project participants when proposing new methodologies. Project participants may propose	This condition is not applicable. The project participants not proposing new methodology.

	alternative methods to demonstrate additionality for consideration by the Executive Board. They may also submit revisions to approved methodologies using the additionality tool.	
2.	Once the additionally tool is included in an approved methodology, its application by project participants using this methodology is mandatory.	This condition is not applicable as project is not proposing new methodology.

Demonstration of additionality of microscale project activities, TOOL19, version 10.0 for solar power projects	
1. This tool covers all technologies/measures that meet the conditions in paragraphs 11-13 below irrespective of the scale of the approved CDM methodology applied to the project activity.	This condition is applicable. As instance 1, 2 and 3 is installation of photovoltaic electricity generation which is in line with para 11 (c) (i).
2. A project activity with more than one component, where each component meets the microscale threshold, is eligible as microscale CDM project activity. The sum of the size of components of a project activity belonging to the same type (i.e. installed capacity for Type I, energy savings for Type II and emission reductions for Type III) shall not exceed the microscale thresholds for the respective type.	This condition is not applicable as project is not proposing new methodology.
3. The tool is not applicable to technologies/measures included in approved methodologies "AMS-III.V: Decrease of coke consumption in blast furnace by installing dust/sludge recycling system in steel works", "AMS-III.P: Recovery and utilization of waste gas in refinery facilities", "AMS-III.Q: Waste Energy Recovery (gas/heat/pressure) Projects" and "AMS-III.W: Methane capture and destruction in non-hydrocarbon mining activities".	This condition is not applicable as project is not applying mentioned methodologies.
4. Microscale CDM project activities shall demonstrate that they are not a debundled component of a small-scale (SSC) CDM project activity by applying the criteria in the methodological tool "TOOL20: Assessment of debundling for SSC project activities", for example by suitably considering microscale thresholds in the place of SSC thresholds (EB 62, para 48). In the case of bundled projects, microscale CDM project activity refers to individual projects within the bundle and requirement under paragraph 10 of the TOOL20 is not applicable.	This condition is not applicable as project is not debundled component.

3.3 Project Boundary

As per paragraph 18 of applicable approved methodology AMS- I.D, Version 18.0, "the spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the project power plant is connected to". Thus, the project boundary for the proposed VCS project activity consists of Hydro power and PV installation, connected substations, metering equipment's and NEA.

The project boundary for the proposed project activity can be diagrammatically represented as follows:

As per AMS-I.D, version 18.0 - "The spatial extent of the project boundary includes the project power plant and all power plants connected physically to the electricity system that the project power plant is connected to Nepal grid.

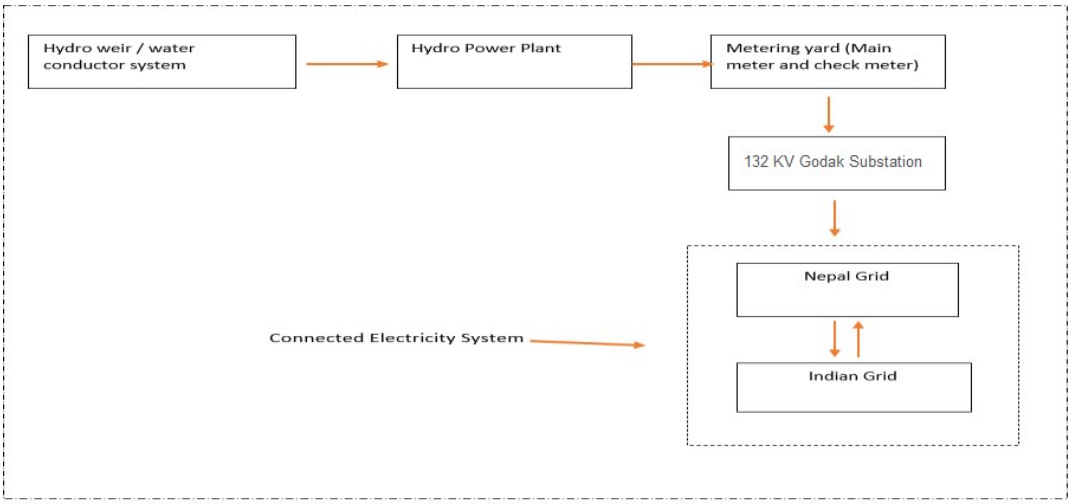
Nepal is interconnected with India at various places through 11kV, 33kV, 132kV and 220kV lines. For transfer of bulk power, interconnection between India and Nepal through Dhalkebar (Nepal) - Muzaffarpur (India) 400kV D/C transmission line has been constructed. A total of about 700 MW[24] of power is being supplied to Nepal through these interconnections

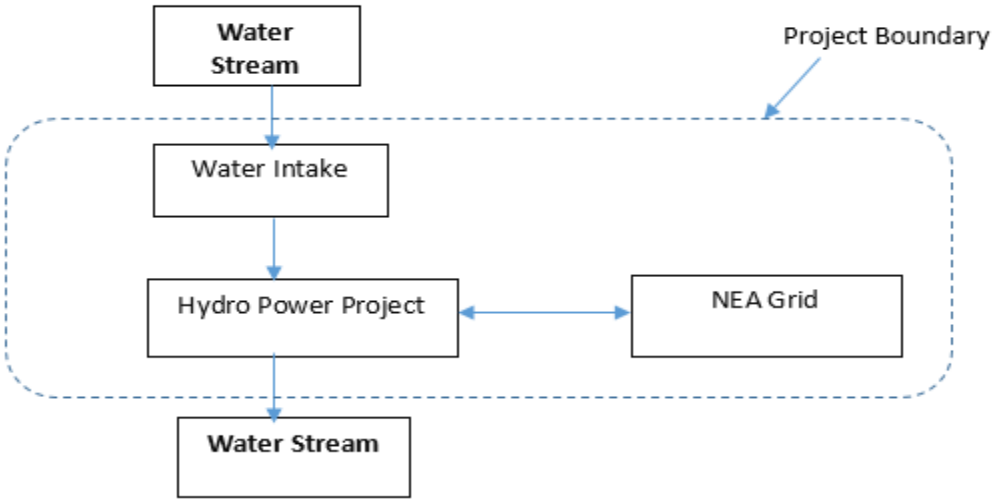
As per AMS-I.D, version 18.0, Section 2.2 para 6 - If the new unit has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale project activity applies only to the renewable component. If the new unit co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW. This project activity's each instance does not exceed the capacity of 15 mw.

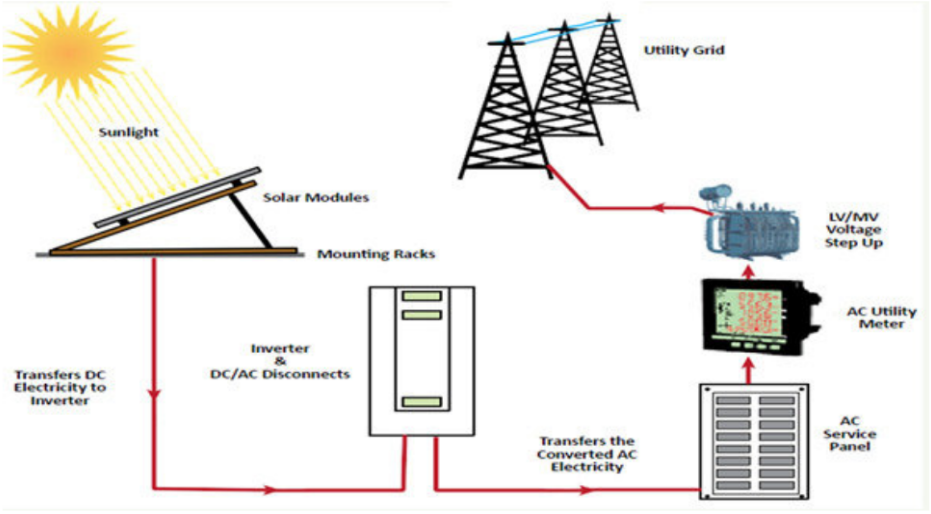
Power exchange happens through cross boarder exchange trade of power.[25]

[24] https://powermin.gov.in/en/content/interconnection-neighbouring-countries

[25] https://powermin.gov.in/en/content/interconnection-neighbouring-countries





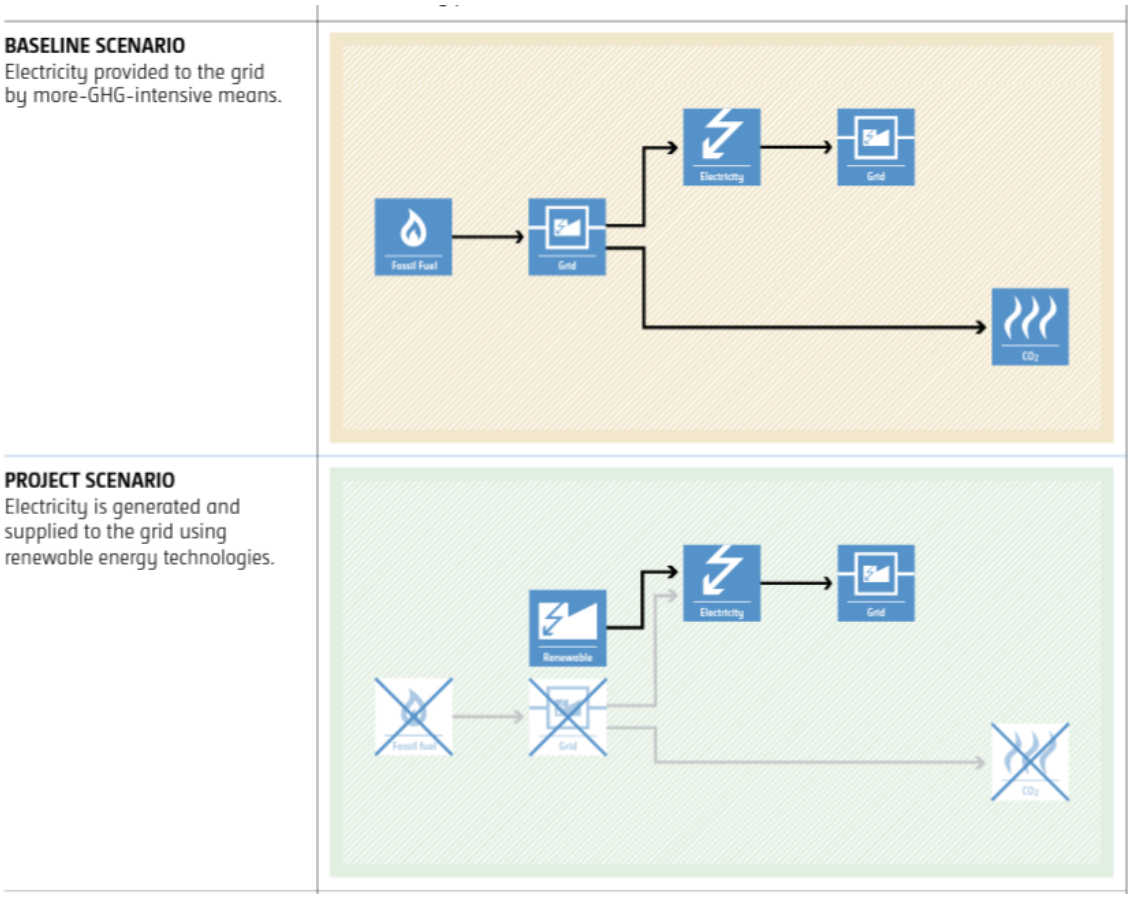


Schematic diagram of a grid connected PV power plant

The project boundary is therefore the physical boundary, which includes the project site and all power plants physically connected through transmission and distribution lines to the project activity and that can be dispatched without significant transmission constraints. The below figure illustrates the boundary of project activity. Therefore, the entire national grid and all connected power plants have been considered in the project boundary for the proposed project activity.

A total power is being supplied to Nepal through these interconnections. In the regional grid consisting of Nepal and the Indian grid, electricity delivered to the grid by the project would have otherwise been generated by the operation of grid-connected power plants operational by the addition of new generation sources into regional grid.

The project boundary includes the Solar PV Plant and Hydro plants, sub-stations, grid and all power plants connected to grid. The proposed project activity will evacuate power to the Nepal grid. Therefore, the national grid and all connected power plants have been considered in the project boundary for the proposed project activity. Comparison between baseline scenario and post project installation flow diagram as follows.



Source		Gas	Included?	Justification/Explanation
Baseline	Fossil fuel fired power plants connected	CO_2	Yes	Main Emission Source
		CH_4	No	Excluded for simplification. This isconservative
		N_2O	No	Excluded for simplification. This isconservative

Source		Gas	Included?	Justification/Explanation
	to integrated NEA grid	Other	Not Applicable	Not Applicable
Project	Not Applicable	CO_2	No	In line with paragraph 20 of applicable approved methodology AMS-I.D Version 18, there will be no project emissions due to project activity.
		CH_4	No	
		N_2O	No	
		Other	No	

3.4 Baseline Scenario

Project activity under consideration involves the installation of new solar PV power project of capacity 6 MW and new Hydro power plant 9.94 MW in Nepal. As per the paragraph 19 of applicable approved methodology AMS-I.D Version 18.0. "The Baseline scenario is that the electricity delivered to the grid by the project activity that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid". The project activity is located in Nepal and connected to grid. The baseline to the proposed project activity is the electricity that would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources into the grid.

The baseline scenario for the solar project involves assessing the typical energy mix and consumption patterns in the project area before project implementation. This includes:

- Reliance on grid-connected electricity, often sourced from fossil fuels.

The baseline scenario for the hydropower project involves assessing the existing energy infrastructure and potential for hydropower development in the project area. This includes:

- Reliance on grid-connected electricity, primarily sourced from thermal power plants located in other regions.

Before project activity, no such operational activities are happening prior to the project. The proposed project activity is not a part of expansion or retrofitting of any existing facilities. Hence, all instances in this project activity are Greenfield projects.

3.5 Additionality

To demonstrate the additionality of project activity applicable tool's applicability are demonstrated in section 3.2 of this report. Refer Section 3.2 of report for more details and applicability of following tools as per the applied methodology AMS-I.D version 18.0.

1 Tool 19– Demonstration of additionality of microscale project activities

2 Tool 21- Demonstration of additionality of small-scale project activities

3 Tool 01- Tool for the demonstration and assessment of additionality

The additionality of the Project shall be demonstrated by applying the following approach, consisting of two components:

(i) A Legal Requirement Test; and

(ii) An Additionality Test either based on a Positive List test or a projects-specific additionality test.

a) Legal Requirement Test

The project is not enforced by law. The project passes the legal requirement test since there are no enforced laws, statutes, regulations, court orders, environmental-mitigation agreements, permitting conditions of other legally-binding mandates requiring its implementation. Since voluntary commitments/agreements within a sector or by an entity do not constitute the legal requirement, the outcome of the legal requirement test is concluded as positive.

b) Additionality Test

"Attachment A of Appendix B of the Simplified Modalities and Procedures for Small Scale CDM project activities, Version 10.0, EB 116, Annex 24[26] refers to demonstrate that the project activity would not have occurred anyway due to at least one of the following barriers:

a) Investment barrier: a financially more viable alternative to the project activity would have led to higher emissions;

b) Technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions

c) Barrier due to prevailing practice: prevailing practice, existing regulatory, or policy requirements would have led to implementation of a technology with higher emissions;

d) Other barriers: Without the project activity, for another specific reason identified by the project participant, such as institutional barriers or limited information, managerial resources,

[26] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-21-v1.pdf

organizational capacity, financial resources, or capacity to absorb new technologies, emissions would have been higher.

Further, in line with paragraph 11 of EB 116, Annex 24, "The positive list of grid-connected renewable electricity generation technologies that are automatically defined as additional, without further documentation of barriers, consists of the following grid-connected renewable electricity generation technologies of installed capacity up to 15 MW:

a) Solar technologies (photovoltaic and solar thermal electricity generation);

b) Off-shore wind technologies;

c) Marine technologies (wave, tidal).

Additionality Assessment

As per Tool 19[27] 'Guidelines on the Demonstration of additionality of microscale project activities' (version 10.0), a positive list of grid-connected renewable electricity generation technologies is listed that are automatically defined as additional, without further documentation of barriers.

Project activities that employ renewable energy technology up to 5 MW installed capacity are additional if any one of the conditions below is satisfied:

(a) The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a SUZ of the host country;

(b) The project activity is an off-grid activity supplying energy to households/communities (less than 12 hours' grid availability per 24 hours is also considered "off-grid" for this assessment);

(c) The project activity consists of one or more of the following technologies/measures9 for distributed energy generation (not connected to a national or regional grid) where end users are households, communities or small and medium-sized enterprises (SMEs);

(i) Solar technologies (photovoltaic and solar thermal electricity generation);

(ii) Building-integrated wind turbines or rooftop wind turbines;

(iii) Micro/pico-hydro

(iv) Micro/pico-wind turbine;

(v) PV-Wind hybrid;

(vi) Geothermal;

(vii) Biomass gasification/biogas

[27] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v10.0.pdf

As per para 11 of the applied tool-19 (Demonstration of additionality of microscale project activities) ver-10.0. Since 3 project activity instances 1,2 & 3 are installed of solar photovoltaic units at various locations with capacity less than 5 MW which is in the LDC, it can be concluded from the above list that the project activity is automatically additional and does not require demonstration of barriers. Thus, it is well established that the proposed project activity is auto additional.

In this project activity out of 5 instances, 3 project activity instances are installed of solar photovoltaic units at various locations with capacity less than 5 MW, it can be concluded from the above list that the project activity is automatically additional and does not require demonstration of barriers. Thus, it is well established that the proposed project activity is auto additional. And 2 hydro instances are not auto additional hence additionality is demonstrated in below in this section.

Project activities that employ renewable energy technology up to 5 MW installed capacity are additional if any one of the conditions below is satisfied:	
(a) The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a SUZ of the host country;	The solar instances no 1, 2 & 3 of this grouped project activity are located in LDC country which is Nepal and also having capacity less than 5 mw. Hence this criteria is applicable and these three instances are additional.
(b) The project activity is an off-grid activity supplying energy to households/communities (less than 12 hours' grid availability per 24 hours is also considered "off-grid" for this assessment);	This grouped project activity is not off grid activity hence this criteria is not applicable.
(c) The project activity consists of one or more of the following technologies/measures9 for distributed energy generation (not connected to a national or regional grid) where end users are households, communities or small and medium-sized enterprises (SMEs); (i) Solar technologies (photovoltaic and solar thermal electricity generation); (ii) Building-integrated wind turbines or rooftop wind turbines; (iii) Micro/pico-hydro;	This project activity is not connected to any of the conditions given in applicability conditions hence this criteria is not applicable.
So as per the para condition (a) is stratified therefore solar instances of this grouped project activity are additional.	

As per the tool 19[28] (Demonstration of additionality of microscale project activities Version10.0) reference of additionality the Project Activity located in Nepal which is LDC country hence Said criteria is not applicable, like no additionality will be required.

The step-wise approach to establish additionality of the project has been followed, details of which are provided in the following paragraphs:

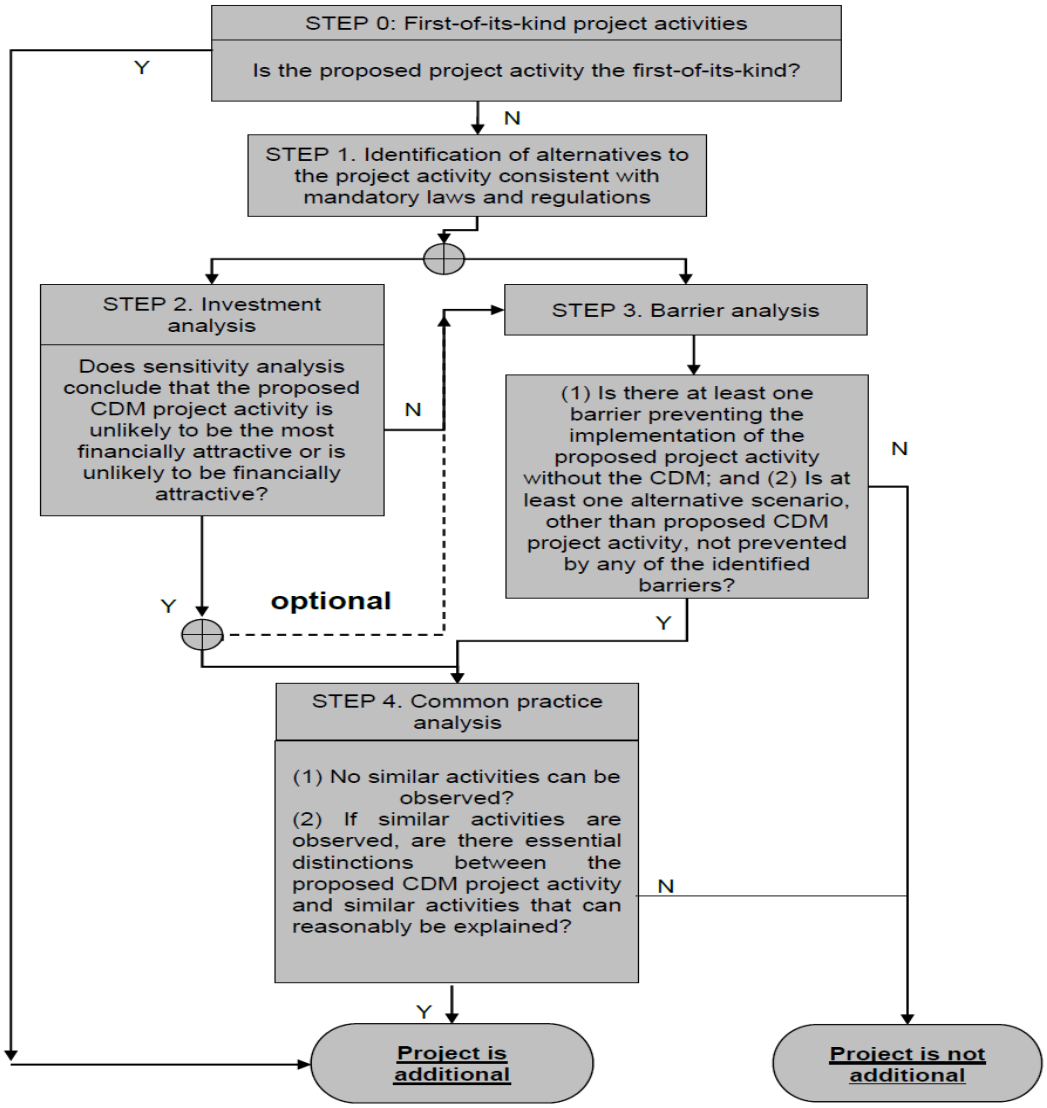
As per the Tool 19[29] Version 10.0 section 5 para 11 "Project activities that employ renewable energy technology up to 5 MW installed capacity are additional if any one of the conditions below is satisfied":

(a) The geographic location of the project activity is in one of the least developed countries or the small island developing States (LDCs/SIDS) or in a SUZ of the host country; - This project Activity is located in Nepal which is LDC country, hence below 5 mw projects are auto additional.

Demonstration of additionality for Hydropower projects site are as under.

[28] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v10.0.pdf

[29] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-19-v10.0.pdf



Step wise Demonstration of additionality for Kabeli B1 cascade Instance

Step 0: Demonstration whether the proposed project activity is the first-of-its-kind

The project activity is solar & Hydro project; hence not the first of its kind. Hence, this step is not applicable.

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

As per the applied methodology AMS-I.D, "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 plant and by the addition of new generation sources".

As the baseline scenario is prescribed by applied methodology, hence no further analysis is carried out to identify alternatives.

Step 2: Investment Analysis

As per para 29 of "Tool for the demonstration and assessment of additionality" v7.0.0[30] , it is determined that the project activity is not an economically or financially feasible option. To conduct the investment analysis, Methodological tool: Investment analysis, version 11.0 (EB 105 annex 06) has been referred.

Sub-step 2a: Determine appropriate analysis method

As per "Tool for the demonstration and assessment of additionality" (version 07.0.0), for financial analysis of the project, the following three options are available:

Option I: Simple Cost Analysis

Option II: Investment Comparison Analysis

Option III: Benchmark Analysis

The project will generate revenues from sale of electricity; therefore, Option I is not applicable. Option II also does not apply since there is no comparable investment alternative available to the project participant in line with para 32 of the Methodological tool: "Tool for the demonstration and assessment of additionality" (version 07.0.0)

The most appropriate financial analysis method is therefore option III: the benchmark analysis, where the returns on investment in the project activity are compared to benchmark returns that are available to any investors in the country.

Sub-step 2b: Option III. Apply benchmark analysis

Project proponents have considered Post-Tax Equity IRR for investment analysis which was referred at the time of decision-making. As Project proponent is only interested in the returns project is generating on the portion of investment costs, which is financed by them in the form of equity. As per Para 15 of TOOL 27: Investment analysis, Version 11.0 states that Required/expected returns on equity are appropriate benchmarks for an equity IRR. Therefore, the Expected return on equity is considered appropriate benchmark. Accordingly, the post-tax Equity IRR has been considered as the relevant financial indicator for Investment Analysis.

Benchmark Calculation

At the time of decision made of project activity, Version 9.0 of methodological tool "Investment Analysis" (EB 101, Annex 11) was the latest available tool to Project owner. Hence, Project owner has used Methodological Tool for Investment Analysis version 09 (EB 101, Annex 11). Upon comparison of the detail of latest version at the time of project public comment period is 12.0

[30] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v7.0.0.pdf

and version 9.0 which is the available version at the time of decision of the methodological tools, it was observed that, there is no major difference in the versions except for the change of default value for benchmark calculation. The default value as mentioned in version 12[31] is 12.62 % for the group 1 projects in Nepal and Value as mentioned in version 9.0[32] is 12.79% for group 1 project in Nepal, Considering the both values the project additionality will not be affected, However Version 12.0 value used as this was the available at the time global comment period which is more conservative for benchmark calculation and Project owner has considered the same tool for default value of return on equity for the project. The default value of Return on Equity for Group-1 projects in Nepal is 12.62 % as per EB 116, Annex 02.

Sr. No.	Instance Name	Investment Decision Date
1.	Kabeli B1 cascade	29-November-2018

Default Value Benchmark for Kabeli B1 cascade project-

The benchmark has been considered in accordance with EB 101, Annex 11, "The values in the table in Appendix A may also be used, as a simple default option".

As suggested in Appendix A, in EB 101, Annex 11 of the "investment analysis" version 09.0, the default value benchmark of expected return on equity, in real terms for Energy Industries (Group 1) in Nepal = 12.79%.

Methodology deployed for arriving at a suitable value of Benchmark using Default Value has been described below:

- As the proposed project activity generates power utilizing hydro energy, Group 1 as per para 6 of Appendix of EB 101 Annex 11 has been identified as a suitable category.

Selection of Benchmark & Financial Indicator:

According to the "Demonstration of additionality of small-scale project activities", the financial indicator can be based either on (1) project IRR or (2) equity IRR. There is no general preference between the approaches (1) or (2). The benchmark chosen for analysis shall be fully consistent with the choice of approach. Therefore, in accordance with the guidance, the relevant financial indicator for project activity has been chosen as post tax equity IRR.

The Required return on equity (benchmark) was computed in the following manner:

Nominal Benchmark[33] = {(1+Real Benchmark) *(1+Inflation rate)}-1

Nominal Benchmark = {(1+12.79%) * (1+4.20%)} - 1 = 17.53%

[31] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v12.pdf

[32] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v9.0.pdf

33 As per Fisher Equation, https://en.wikipedia.org/wiki/Fisher_equation

Where:

- Default value for Real Benchmark is the default value of expected return on equity in real terms for Energy Industries (Group 1) in Nepal as provided in the Appendix

  Default value for Real Benchmark = 12.79% (CDM tool 27, version 09),

- Inflation Rate forecast for by Nepal Rashtra Bank.[34]

Benchmark estimation for Kabeli B1 cascade Hydro Project Activity

The Cost of Equity has been considered using the latest version (version 11.0) of the "Guidelines on the assessment of investment Analysis" available at the time of submission of the project for global stake holder consultation.

Benchmark Calculations	Value	Sources Link	Document Date
Default Value for Nepal as per UNFCCC guidelines	12.79 %	https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-27-v9.0.pdf	29-11-2018
Inflation forecast (WPI Mean) as per Nepal rashtra bank for 10yrs	4.20 %	https://tradingeconomics.com/nepal/inflation-cpi	
Benchmark (with 10yrs Forecast)	17.53 %	Calculated	
Benchmark	17.53 %	Calculated	

The project proponent has calculated Benchmark based on CPI mean inflation rate. As per Para 16 of TOOL 27: Methodological tool: Investment analysis, Version 12.0, the inflation forecast should be for the duration of the crediting period. The project investor has calculated benchmark using 10 years inflation as Benchmark for the project activity.

Sub-step 2c: Calculation and comparison of financial indicators (only applicable to Options II and III):

Input values used in the investment analysis: For Kabeli- B1 cascade –Hydro instance

Details of the project		Source
State where the project is situated	Kabeli- B1 cascade	As per DPR page no 1
Total Capacity (MW)	9.94	As per DPR page no 1
Expected Date of Commissioning	26-Mar-22	As per DPR
Life of the plant (Yrs.)	25	As per DPR
Generation of electricity		

[34] https://www.nrb.org.np/

PLF (%)	65.40%	As per DPR, page no iv
Annual generation (kWh)	5,69,46,658	Calculated Value
Auxiliary consumption	1.00%	https://ntpc.co.in/media/employee-blog/role-water-batteries-energy-transition-and-green-energy-integration-india#:~:text=Currently%20allowable%20normative%20Aux%20power,by%20reducing%20the%20silt%20erosion.
Tariff rate at the decision making (NR/kWh)	6.00	As per DPR, page no 104
Transmission losses (%)	0.00%	As per DPR
Operation and maintenance cost and Insurance		
O & M Expenses (NR Mn.)	15.83	As per DPR, page no 108 (0.8% of Project Cost)
O & M free for (Yr.)	-	-
Escalation in the operational expenses (%)	5.00%	As per DPR, page no 108
insurance %	1.18%	As per DPR
Insurance (NR Mn.)	23.35	Calculated value
Financial parameters		
TOTAL COST (NR Mn.)	1,979.23	As Per DPR page no 108
Loan Amount (NR Mn.)	1,385.46	As Per DPR, page no 109
Equity Investment (NR Mn.)	593.77	Calculated value
Term loan		
Loan Amount (NR Mn.)	1,385.46	As Per DPR, page no 109
Interest rate (%)	10.12%	As Per DPR, page no 108
Loan Tenure (Qtr.)	48	As Per DPR, page no 109
Moratorium Period (Qtr.)	-	Not Applicable
Repayment Period (Qtr.)	48	Calculated Value
Repayment instalments value (NR Mn.)	28.864	Calculated Value
1st instalment from (Qtr. end)	30-Jun-22	Considered from the next Quarter End
Book Depreciation (SLM Method)		
Land	40.00	As per DPR, page no 108
Gross Depreciable Value (NR Mn.)	1,939.23	Calculated Value
Salvage Value (%)	20.00%	As per DPR, page no 108
Salvage value (NR Mn.)	387.85	Calculated Value
Net Depreciable Value (NR Mn.)	1,551.39	Calculated Value

Residual Value (NR Mn.)	427.85	Calculated Value
IT Depreciation		
IT Depreciation (%)	15.00%	IT act https://www.nrb.org.np/contents/uploads/2021/09/vol15_art5.pdf
Income Tax		
Income tax rate (%)	25.00%	https://nbsm.com.np/uploads/large/162132900647479.pdf
Corporate Tax / MAT (%)	25.00%	
VAT (%)	13.00%	https://tradingeconomics.com/nepal/sales-tax-rate
Surcharge (%)	20.00%	https://www.nrb.org.np/contents/uploads/2020/09/Annual-Report-2018.19.pdf
Education cess (%)	4.00%	https://cag.gov.in/webroot/uploads/download_audit_report/2020/Report%20No.%204%20of%202020_Eng-05f808ecd3a8165.55898472.pdf
Final Tax rates		
Income tax rate (%)	31.20%	Calculated Value
MAT (%)	31.20%	Calculated Value
VAT (%)	13.52%	Calculated Value

Sub-step 2d: Sensitivity Analysis

In line with Guidance 27 & 28 of TOOL 27: Methodological tool: Investment analysis, following factors has been subjected to sensitivity analysis:

1. PLF

2. O&M Cost

3. Project Cost

4. Tariff

The rationale of sensitivity is, "The ultimate objective of the sensitivity analysis is to determine the likelihood of the occurrence of a scenario other than the scenario presented, in order to provide a cross-check on the suitability of the assumptions used in the development of the investment analysis."

The results of sensitivity analysis for Kabeli- B1 cascade

Sensitivity Analysis	Equity IRR			
Variation %	-10%	Normal	10%	Breaching Value
PLF	11.85%	14.31%	16.90%	12.35%
O&M	14.48%	14.31%	14.14%	-191.00%
Project Cost	16.99%	14.31%	12.23%	-11.72%
Tariff Rate	11.85%	14.31%	16.90%	12.35%

The result of the analysis is as follows:

This substantiates that the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark Equity IRR) for any of the investor. Thus, it can be easily concluded that project activity is additional & is not business as usual scenario.

Sr. No.	project	Equity IRR	Benchmark (Equity IRR)
1	Kabeli- B1 cascade	14.31%	17.53%

Outcome of Step 2:

This substantiates that the investment is not financially attractive (Equity IRR for the project activity is less than the Benchmark Equity IRR). Thus, it can be easily concluded that project activity is additional & is not business as usual scenario.

Step 3: Barrier analysis

Barrier analysis has not been used.

The Characteristics of Nepal's Tax Regime –

The main tax categories in Nepal are income taxes, VAT, excises and custom duties, Nepal's tax regime has evolved over the years, with various changes implemented through diffe rent Finance Acts[40].These tax regimes have been updated and amended over the years to adap t to the changing economic landscape and government policies. Same tax regime has been used for IRR calculation of this project activity and following inputs and assumptions have been considered during the calculation of IRR.

1. Income Tax: The Income Tax Act, 2002, with amendments introduced in recent years, includ ing significant changes in the Finance Bill, 2081 (2024)1. The rates range from 1% to 30% depending on income levels.
2. Value
   Added Tax (VAT): The VAT Act, 2058 (2002), with amendments, sets the VAT rate at 13%.
3. Customs Duty: The Customs Act, 2010, with amendments, imposes customs duties ranging from 0% to 40% depending on the product.
4. Excise Duty: Levied on specific goods like alcohol and tobacco, with rates varying based on the product.

[40] https://www.elibrary.imf.org/view/journals/002/2011/319/article-A001-en.xml

5. Property Tax: Imposed by provincial governments, with rates varying by province.

3.6 Methodology Deviations

There is no methodology deviations applied during this monitoring period.

4 IMPLEMENTATION STATUS

4.1 Implementation Status of the Project Activity

For Solar Project

It is envisaged that the project will have the below mentioned phase of activities. These phases are not mutually exclusive; to implement the project on FastTrack basis some degree of overlapping is envisaged.

- Project Development
- Finalization of the Equipment and Contracts
- Procurement and Construction
- Plant Commissioning and performance testing

Project Development

In a power project, development of the project plays an important role. The below listed tasks will be under project development:

1) Preparation of Detailed Project Report (DPR)

2) In Principle clearances

3) Agreement b/w EPC Contractor and APCL

4) Financial closure

Finalization of the Equipment's and Contracts

For Solar PV plants, PV modules, inverters and transformers are long lead items and the planning schedule for the project implementation should provide adequate time period for the installation of these equipment. The specifications for major equipment like the Modules, Invertors and Transformer design shall be drawn up at an early stage of the project. Program of design information, from the equipment suppliers, that satisfies the overall project schedule shall be drawn up.

Since, the project execution calls for close coordination among the company and the EPC contractors, proper contract co-ordination and monitoring procedures shall be made to plan and monitor the project progress.

Procurement and Construction

The procurement is an important function of the implementation of the project. Once the purchase order is placed, the project team follows up regularly to ensure smooth and timely execution of the contract and for obtaining technical information for the engineering. The engineering activity includes review of drawings, expediting, stage and final pre-delivery inspection, supervision of installation and commissioning.

To expedite supplies from the manufacturers, regular visits to the supplier's works will have to be undertaken by the EPC Contractor to ensure adherence to the manufacturing program and quality plans finalized at the time of award of contract. Regular reports shall be prepared indicating the schedule variations, if any, their likely impact on the delivery schedule, and the recommendations to meet with the schedules.

Erection and Commissioning Phase

The commissioning phase in a project is one where design, manufacturing, erection and quality assurance expertise are put to test. The commissioning team will be from EPC Contractor, manufacturer of the equipment and the company. As discussed in the earlier section, staff identified to operate the plant will be involved in the commissioning phase of the project itself.

When construction phase is complete, thorough check listing shall be carried out to ensure that the plant has been properly installed with appropriate safety measures. The plant shall be subjected to a performance test, and subsequent to the successful completion of the performance test of the plant; the plant will be taken over by the company.

It is responsibility of the company to ensure that major civil work shall have to be planned in the nonm on soon period. All the statutory clearances shall be obtained much before of the start of the project commissioning.

ISSPL will be developing and implementing the 1 MW solar PV project through a turnkey engineering, procurement and construction (EPC) contract. ISSPL will soon appoint an EPC contractor.

We assume the overall project should be completed in 150 days from the date of award of the EPC Contractor. Project schedule, activities and tentative implementation plan are shown in table below.

1	Entire Solar Power Plant	01-July-2017	150	28-November-2017
2	Basic Design Submission and Lay out Approvals	01- July-2017	10	11- July-2017
3	Site Mobilization	08- July-2017	7	15- July-2017

4	Site Preparation and Development	11- July-2017	40	20-August-17
5	Detailed Project Design and BOQ Preparation	11- July-2017	12	23- July-2017
6	Invitation/Evaluation of Bids for Supply of Materials	11- July-2017	12	23- July-2017
7	Contract Finalization and Release of Advance	21-July-2017	32	22- August-2017
8	Material Dispatch	05-August-2017	75	19-Octomber-2017
9	Construction	15- August-2017	94	17-November-2017
10	Installation of Mounting Structure	15- August-2017	57	11-Octomber-2017
11	Module Erection	14-September-2017	31	15-Octomber-2017
12	DC Cabling Works	30- August-2017	27	26-Sepember-2017
13	DC Combiner Box Mounting	30- August-2017	27	26- Sepember-2017
14	Inverter Station	15- August-2017	40	24- Sepember-2017
15	Inverter Cabling Works	07-September-2017	12.5	19- Sepember-2017
16	Substation33kV	15- August-2017	75	29- Octomber-2017
17	Transmission Line	15- August-2017	75	29- Octomber-2017
18	Commissioning	14- Octomber-2017	19	02-November-2017
19	Stabilization and Handover	29- Octomber-2017	30	28- November-2017

For Hydro Power Plant

Stages of Project Implementation

Project implementation shall be done in four different stages of activities as follows:

- Development Stage
- Pre-Bid Stage
- Implementation Stage
- Operation Stage

Development Stage

The development stage includes all the development works starting from identification of project, acquiring licenses, Pre-Feasibility study, Feasibility Study, Investigations, Detail Project Report, Project Appraisal, Financial management, Detail Design, Project estimation to identify the quantum of cost required for the project, etc. This stage has been completed and project has completed PPA, acquired generation license.

Pre-Bid Stage

The Pre-Bid stage of the project is mainly focus on the bidding process it includes the preparation of solicitation Documents like Invitation to Bid (ITB), Request for Proposal (RFP) and

specifications. Company shall arrange a Pre-Bid meeting after request for proposal. The pre-bid meeting can reduce the claims and dispute during implementation of the project. Some key activities during Pre-Bid are;

- Bidding Strategy/Methods and Procurement Plan
- Pre-qualification/Post Qualification
- Invitation to bids
- Make Site Visit (optional)
- Hold pre-bid meeting
- Issue addenda

At the same time, the Employer shall manage all the preparatory works to be done before the physical construction work is started in field. The arrangement of camping and infrastructure facilities has already been started so the project is ready to start implementation stage.

Implementation Stage

Construction stage involves physical construction works of the project after site mobilization till project commissioning. This stage comprises the following to be completed within 2 years from date of contractor's mobilization:

- Contractors' mobilization
- LC Opening for metal sheets and machines and other equipment
- Construction management and supervision
- Quality Control plan
- Claim and Dispute management
- Issue of approval and work order
- Progress monitoring and reporting
- Design verification and change if required
- Measurement, verification, payment and disbursements
- Finalization of testing format
- Testing and commissioning
- Collection of test certificate and warrantee certificate

- Collection of operation and maintenance manuals
- Finalization of operation procedures and codes
- Commercial Operation

Operation Stage

This stage involves contractors' demobilization, operation and maintenance during defects liability period (DLP), handover process, etc. The total process takes time and comes to an end only after the handover is completed. Following activities are included in this stage.

- Commercial operation and billing procedures
- Staff training and regulations
- Defect liability maintenance and clearance
- Adjustments and provisions
- Initial operations and spare parts management
- Availability declaration
- Schedule and breakdown maintenance provisions.

Moreover, the operation of the project activity(s) during this monitoring period, including any information events that may impact GHG emission reduction or removals and monitoring is not applicable. And no breakdown occurred in this plant during the verification period of the project activity.

5 ESTIMATED GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

According to paragraph 22 of CDM Methodology AMS.I. D (Version 18.0), the baseline emissions are calculated as follows:

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

$BE_y = EG_{PJ,y} * EF_{grid,y}$

Where:

BE_y = Baseline Emissions in year y (tCO_2)

$EG_{PJ,y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{grid,\ y}$ = CO_2 emission factor of the grid in year y (tCO_2/MWh)

Quantity of net electricity supplied to the grid as a result of the implementation of the project activity in year y = Installed capacity of PV * Plant Load Factor * Annual Operating hours

Based on the above-mentioned parameters and calculations, the calculated baseline emissions are as follows:

S.No.	Instances Name	Location	Capacity (MW)	PLF		Annual Estimated Electricity generation
				Year 1	Year 2 (Degradation Factor)	
1	Chandranigahapur-Solar Power plant	Chandranigahpur	4.000	19.77%	19.67%	6,927.4
2	dhalkebar-Solar Power plant	Dhalkebar	1.000	19.45%	19.35%	1,703.8
3	simara-Solar Power plant	Simara	1.000	18.71%	18.62%	1,639.0
4	Kabeli B1 Cascade-Hydro Power plant	Ambrapur, Negi	9.940	65.40%	65.40%	56,946.7
Total			**15.94**			**67,216.88**

The project activity involves installation and generation of electricity using renewable energy resources i.e., by using the hydro and solar power (renewable sources) replacing electricity supply from a fossil-fuel dominated electricity, thus leads to reductions of anthropogenic GHG emissions from atmosphere.

The electricity generated is supplied to Integrated Nepal Power System (INPS) through, 33 kV Transmission line from the project to the 132/33 kV sub-stations of NEA. Emission factor of Nepal electricity system is not available as it is not published by Nepal Electricity Authority (NEA). Hence PP has taken the emission factor of Nepal is considered as zero from IFI Default Grid Factors 2021 v3.2 published by UNFCCC[41]. However, Nepal is importing electricity from India. Approximately 32% electricity is imported from Indian grid and emission factor of Indian grid is calculated as 0.9105 by using CEA database[42] as per TOOL 07. Hence the emission factor of

[41] https://unfccc.int/documents/461676

[42] https://cea.nic.in/wp-content/uploads/baseline/2023/01/Approved_report_emission__2021_22.pdf

Nepal is calculated as weighted average emission factor of Nepal and India. Asian Development Bank has published the emission factor of Nepal is 348 tCO_2/ GWh[43]. Weighted average of Nepal and Indian grid is taken as 0.2898 tCO_2/ MWh (i.e. 289 tCO_2/ GWh) which is lower than Asian Development Bank and should be considered as a conservative.

Determination of CO_2 emission factor of grid ($EF_{grid,y}$):

Option (a) under paragraph 23 of the methodology document is chosen to calculate the CO_2 emission factor of grid. The option (a) under paragraph 23 of the methodology document states as follows:

A combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) according to the procedures prescribed in the "Tool to calculate the Emission Factor for an electricity system"

Hence, the emission factor is calculated according to the CDM methodological tool - "Tool to calculate emission factor for an electricity system" (Version 07.0.0)

Applicability of the tool: The tool may be applied to estimate the OM, BM and/or CM when calculating baseline emissions for a project activity that substitutes grid electricity, i.e., 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).

The project activity supplies electricity to a Nepal electricity grid of Nepal Electricity system. Hence, this tool is applicable in case of project activity.

In accordance with the tool, CO_2 emission factor of grid is calculated in stepwise manner as follows:

Step 1: Identify the relevant electric power system

For the purpose of determining the electricity emission factors, a project electricity system and connected electricity systems are to be defined. The Nepal power system is divided into two independent Nepal Grid. Each grid covers several states. Regional Load Dispatch Centre (RLDC) manages power generation and supply within the Nepal grid. The Regional Power Committees (RPCs) provide a common platform for discussion and solution to the regional.

Source: CO_2 Baseline Database for the Nepal Power Sector, User Guide (Version 18; December 2022)[44]

The Nepal Electricity grid own power generating stations as well as centrally shared power-generating stations. While the power generated by own generating stations is fully owned and consumed through the respective state's grid systems, the power generated by central generating

[43] https://www.adb.org/sites/default/files/linked-documents/49086-001-crf.pdf

[44] https://cea.nic.in/cdm-co2-baseline-database/?lang=en

stations is shared by more than one state depending on their allocated share. Presently the share from central generating stations is a small portion of their own generation.

Since the project activity would be supplying electricity to the grid, it is preferable to take this grid as the project boundary rather than the state boundary. It also minimizes the effect of interstate power transactions, which are dynamic and vary widely. Considering free flow of electricity among the member states and the union territory, the entire Nepal electricity grid is considered as a single entity for estimation of baseline.

As per Para 15 and 16 of 'Tool to calculate the Emission Factor for an electricity system version-07.0' (Tool 07), Project owner has identified Project electricity system for determining the electricity emission factors and connected electricity systems as Nepal and Indian+Nepal Grid respectively.

As per para 17 of 'Tool to calculate the Emission Factor for an electricity system version-07.0' (Tool 7),

Project Owner has chosen the 'Option 3': A delineation of the project electricity system defined by more than one independent dispatch areas, e.g., multi-national power pools.

As per para 18 of 'Tool to calculate the Emission Factor for an electricity system version-07.0' (Tool 7): In case of option 3, transmission lines between dispatch areas included in the proposed delineation shall be checked for the existence or non-existence of transmission constraints.

As per para 19 of the 'Tool to calculate the Emission Factor for an electricity system version-07.0' (Tool 7):

There are no transmission constraints if any one of the following criteria is met:

(b) In case of electricity systems with spot markets for electricity: there are differences in electricity prices (without transmission and distribution costs) of less than five per cent between the two electricity systems at least during 90 per cent of the hours of the most recent year for which information is available (at least one year data is required); or

(c) The transmission line(s) is operated at 75 per cent or less of its rated capacity during 90 per cent or more of the hours of the most recent year for which information is available (at least one year data is required) using the algorithm below:

(i) For every hour of the year check whether the transmission line is operated at 75 per cent or less of its rated capacity;

(ii) Each hour of the year when the transmission line was operated at 75 per cent or less of its rated capacity should be counted as zero;

(iii) Each hour of the year when the transmission line was operated at 75 per cent or more of its rated capacity should be counted as one;

(iv) There is no transmission constraint if the total sum is less than ten per cent of the hours of the year (e.g., 876 for even year and 878 for leap year);

(v) The algorithm can be illustrated by the following equation:

$$\sum_{1}^{8760}\left[\frac{Hourly\ power\ transmission\ (MWh)}{[Maximum\ line's\ load\ capacity\ (MW)]} > 75per\ cent\right] < 876$$

(vi) The maximum line's load capacity should be based on official information (e.g., from the operator of the system);

(d) The transmission capacity of the transmission line(s) that is connecting electricity systems is more than 10 per cent of the installed capacity either of the project electricity system or of the connected electricity system, whichever is smaller.

Project Owner has shown below that there is no transmission constraint according to para 19 (c):

Transmission capacity of the transmission line(s) that is connecting electricity systems (Indian grid to Nepal Grid) = 700 MW

Installed Capacity of the project electricity system (Nepal[45]) = 1451. 34 MW Installed Capacity of connected electricity system (India[46]) = 3,95,075 MW

Hence, 10 % of the project electricity system is 145.13 MW. And thus, the transmission capacity of the transmission line(s) that is connecting electricity systems (700 MW) is more than 10 percent of the installed capacity (145.13 MW)[47].

As per Para 25 of 'Tool to calculate the Emission Factor for an electricity system version-07.0' (Tool 7): Project owner has chosen option b as mentioned in tool to calculate the simple operating margin emission rate of the exporting grid (in this project activity Indian grid is the exporting grid). And details have mentioned in Step 3.

Step 2: Choose whether to include off-grid power plants in the project electricity system (optional)

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

- Option I: Only grid power plants are included in the calculation.
- Option II: Both grid power plants and off-grid power plants are included in the calculation.

[45] https://www.nea.org.np/annual_report

[46] https://powermin.gov.in/en/content/power-sector-glance-all-india

[47] https://www.nea.org.np/annual_report

The project participant has chosen Option I for the calculation of the operating and build margin emission factor i.e., off-grid power plants are not being included in the calculation.

20. In addition, in cases involving international interconnection (i.e. transmission line is between different countries and the project electricity system covers national grids of interconnected countries) it should be further verified that there are no legal restrictions for international electricity exchange.

Justification: There are no legal restrictions between India and Nepal for interconnected electricity exchange. Hence para 20 is justified.

21. If the information required to demonstrate transmission constraints (or not) is not publicly available or where the application of these criteria does not result in a clear grid boundary, project participants shall use a regional (i.e. sub-national) grid definition in the case of large countries with layered dispatch areas (e.g. provincial/regional/national).

Justification: Nepal primarily operates on a centralized electricity grid managed by the Nepal Electricity Authority (NEA). Hence para 21 is justified.

22. A provincial grid definition may indeed in many cases be too narrow given significant electricity trade among provinces that might be affected, directly or indirectly, by a CDM project activity. In other countries, the national (or other larger) grid definition should be used by default. The project participant shall document the geographical extent of the project electricity system transparently and identify all grid power plants/units connected to the system.

Justification: Nepal has centralized electricity grid system, hence all grid power plants/units connected to the system. Hence para 22 is justified.

23. For the purpose of this tool, the reference system is the project electricity system. Hence electricity transfers from a connected electricity systems to the project electricity system are defined as electricity imports while electricity transfers from the project electricity system to connected electricity systems are defined as electricity exports.

Justification: Nepal grid is importing electricity from India country. Hence para 23 is justified.

24. For the purpose of determining the build margin emission factor, the spatial extent is limited to the project electricity system, except where recent or likely future additions to the transmission capacity enable significant increases in imported electricity. In such cases, the transmission capacity may be considered a build margin source.

Justification: projects in Nepal is considered determining the build margin emission factor. Hence para 24 is justified.

25. For the purpose of determining the operating margin emission factor, use one of the following options to determine the CO_2 emission factor(s) for net electricity imports from a connected electricity system

(a) 0 t CO_2/MWh; or

(b) The simple operating margin emission rate of the exporting grid, determined as described in Step 4 section 6.4.1, if the conditions for this method, as described in Step 3 below, apply to the exporting grid; or

(c) The simple adjusted operating margin emission rate of the exporting grid, determined as described in Step 4 section 6.4.2 below; or

(d) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in Step 4 section 6.4.4 below.

26. For imports from connected electricity systems located in Annex I country(ies), the emission factor is 0 tons CO_2 per MWh.

Justification: Import from annex 1countries is zero as Nepal is importing the electricity from India like non annex country, hence emission factor is considered. Hence para 26 is justified.

27. Electricity exports should not be subtracted from electricity generation data used for calculating and monitoring the electricity emission factors.

Justification: the electricity exports are not subtracted from electricity generation data used for calculating and monitoring the electricity emission factors. Hence para 27 is justified.

Step 3: Select an operating margin (OM) method

The calculation of the operating margin emission factor ($EF_{grid,OM,y}$) is based on one of the following methods:

a) Simple OM, or

b) Simple adjusted OM, or

c) Dispatch data analysis OM, or

d) Average OM.

As per the tool, any of the four methods can be used. For the proposed project activity, simple OM method has been chosen to calculate the operating margin emission factor ($EF_{grid, OM, y}$). However, the simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. The low-cost/must-run resources are defined as power plants with low marginal generation costs or power plants that are dispatched independently of the daily or seasonal load of the grid. They typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation.

Share of Low Cost / Must-Run (% of Net Generation)

	2016-17	2017-18	2018-19	2019-20	2020-21
India Electricity Authority	14.6%	14.3%	14.5%	17.0%	16.5%

Data Source: Central Electricity Authority (CEA) database Version 18.0, October 2022

The above data clearly shows that the percentage of total grid generation by low-cost/ must-run plants (because of average of five most recent years) for the Indian grid is less than 50 % of the total generation. Thus, the Average OM method cannot be applied, as low cost/must run resources constitute less than 50% of total grid generation.

The Simple OM emission factor can be calculated using either of the two following data vintages for years(s) y:

Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of this document to the validator for validation, without requirement to monitor and recalculate the emissions factor during the crediting period,

or

Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating, the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

The project proponents choose the Ex-ante option for estimating the simple OM emission factor wherein as described above a 3-year generation-weighted average, based on the most recent data available at the time of submission of the VCS PD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period will be undertaken.

Step 4: Calculate the operating margin emission factor according to the selected method

The simple OM method has been selected as justified above. The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units using the following formula:

$$EF_{grid,OM,simple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_{m} EG_{m,y}}$$

$EF_{grid,OM,simple,,y}$	:	Simple operating margin CO_2 emission factor of in year y (tCO_2/MWh)
$FC_{i,m,y}$	:	Amount of fossil fuel type i consumed by power unit m in year y (Mass or volume unit)
$NCV_{i,y}$	:	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)

$EF_{CO2,i,y}$	:	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$	:	Net electricity generated and delivered to the grid by power unit m inyear y (MWh)
m	:	All power units serving the grid in year y except low-cost / must-run power units
I	:	All fossil fuel types combusted in power plant / unit m in year y
Y	:	Either the three most recent years for which data is available at the time of submission of this document to the validator for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2.

In Nepal, the Central Electricity Authority (CEA) has estimated the baseline emission factor for the power sector. This data is considered to be the most authentic information available in the public domain for power sector in Nepal. The details of same can be found on CEA website at http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm.

The operating margin emission factor has been calculated using a 3-year data vintage:

	Net Generation in operating Margin (GWh) (Incl. Imports)		
	2019-20	2020-21	2021-22
Indian Grid (Connected System)	965,009	958,218	1,035,672

	Simple Operating Margin (t CO_2/MWh) (incl. imports)		
	2019-20	2020-21	2021-22
Indian Grid (Connected System)	0.9555	0.9405	0.9605

Weighted Generation Operating Margin	
Indian Grid (Connected System)	0.9524

Step 5: Calculate the build margin (BM) emission factor

In terms of vintage of data, project participants can choose between one of the following two options:

Option 1: For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of project description document submission to the validator for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information

available on units already built at the time of submission of the request for renewal of the crediting period to the validator. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

Option 2: For the first crediting period, the build margin emission factor shall be updated annually, ex-post, including those units built up to the year of registration of the project activity or, if information up to the year of registration is not yet available, including those units built up to the latest year for which information is available. For the second crediting period, the build margin emissions factor shall be calculated ex-ante, as described in option 1 above. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used.

The project proponents wish to choose option 1

Option 1 as described above is chosen by PP to calculate the build margin emission factor for the project activity. BM is calculated ex-ante based on the most recent information available at the time of submission of VCS Joint PDMR and is fixed for the entire crediting period.

Build Margin (tCO_2/MWh) (not adjusted for imports)	
Year	2020-21
Indian Grid	0.8687

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

The sample group of power units' m used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

a) Identify the set of five power units, excluding power units registered as CDM project activities that started to supply electricity to the grid most recently (SET5-units) and determine their annual electricity generation (AEGSET-5-units, in MWh);

b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities (AEG_{total}, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of AEG_{total} (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) (SET≥20%) and determine their annual electricity generation (AEGSET-≥20%, in MWh);

c) From SET5-units and SET≥20% select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin.

In India, the installed capacity and corresponding annual generation from power plants is quite high. The Central Electricity Authority (CEA) has estimated the annual electricity generation from SET≥20% to be larger than the generation from SET5-units. The details of same can be found on CEA website at http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm.

Further, none of the power units in SET≥20% started to supply electricity to the grid more than 10 years ago.

Therefore, SET_{sample} is selected as SET≥20% for the estimation of build margin.

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2 / MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO_2 emission factor of power unit m in year y (tCO_2 / MWh)

m = Power units included in the build margin

y = Most recent historical year for which electricity generation data is available

Calculations for the Build Margin emission factor $EF_{grid,BM,y}$ is based on the most recent information available on the plants already built for sample group m at the time of project description document submission. The sample group m consists of the power plant capacity additions in the electricity system that comprise 20 % of the system generation and that have been built most recently ($SET_{\geq 20\%}$).

Step 6. Calculate the combined margin emissions factor

The calculation of the combined margin (CM) emission factor ($EF_{grid,CM,y}$) is based on one of the following methods:

a) Weighted average CM; or

b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option. The combined margin emissions factor is calculated as follows:

$$EF_{grid,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

W_{OM} = Weighting of operating margin emissions factor (%)

w_{BM} = Weighting of build margin emissions factor (%)

The following default values should be used for w_{OM} and w_{BM}:

Wind and solar power generation project activities: w_{OM} = 0.5 and w_{BM} = 0.5 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.5 and w_{BM} = 0.5 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

As mentioned before, the baseline emission factors have been calculated as per CEA sourced data for various a Nepal electricity grid in Nepal according to the formulas specified above. As this is the most authentic information available in the public domain, the baseline emission factor used in the calculation of baseline emissions for the proposed project activity is being referred from the same for transparency and conservativeness[48].

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;

$EF_{grid,CM,y}$	Build margin CO_2 emission factor in year y (t CO_2/ MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (t CO_2/MWh)
W_{OM}	Weighting of operating margin emissions factor (per cent)
W_{BM}	Weighting of build margin emissions factor (per cent)

The following default values should be used for W_{OM} and W_{BM} as per Para 86 of Tool 7:

a) solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatch able nature) for the first crediting period and for subsequent crediting periods;

b) 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,8 unless otherwise specified in the approved methodology which refers to this tool.

For Hydro project activities W_{OM} = 0.5 and W_{BM} = 0.5 (owing to their intermittent and non-dispatchable nature) for the second crediting period and for subsequent crediting periods. Since

[48] http://www.cea.nic.in/reports/planning/cdm_co2/cdm_co2.htm

project activity is of power generation by using Hydro energy, the above weightage has been considered for OM and BM.

Therefore,
For Solar $EF_{grid,CM,y\ India}$ = 0.9524*0.75 + 0.8687*0.25
= **0.9314 CO_2/MWh**

Therefore,
For Hydro $EF_{grid,CM,y\ India}$ = 0.9524*0.5 + 0.8687*0.5
= **0.9105 CO_2/MWh**

- Combined Margin Emission Factor for Nepal:

$EF_{grid,CM,y\ Nepal}$ = 0.0 CO_2/MWh

Nepal Electricity Generation[49]	6,052,000	MWh
Power Purchase from India[50]	2,826,000	MWh

EFCM for Nepal is calculated as per formula given in appendix 4 equation 1 pf tool 7[51] in which Weighted average emission factor (tCO_2/MWh) based on average electricity production (the most recent one-year data) from each type of plant can be calculated.

- Connected system weighted average combined Emission Factor: =

$$EF_{grid} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{Bm}$$

$EF_{grid,CM,y}$	Build margin CO_2 emission factor in year y (t CO_2/ MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (t CO_2/MWh)
W_{OM}	Weighting of operating margin emissions factor (per cent)
W_{BM}	Weighting of build margin emissions factor (per cent)

For Hydro instances= 6,052,000 x 0 + 2,826,000 x 0.9105 / (6,052,000+2,826,000)
Connected system weighted average combined Emission Factor = 0.2898 tCO_2/MWh
For Solar instances= 6,052,000 x 0 + 2,826,000 x 0.9314 / (6,052,000+2,826,000)
Connected system weighted average combined Emission Factor = 0.2965 tCO_2/MWh

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

$BE_y = EG_{PJ,y} * EF_{grid,y}$

[49] https://www.nea.org.np/annual_report

[50] https://www.nea.org.np/annual_report

[51] https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf

Instance name	Annual Estimated Electricity generation $EG_{PJ,y}$	Baseline Emission factor $EF_{grid,y}$	Baseline emissions BE_y
Chandranigahapur-Solar Power plant	6,927.4	0.2965	2,053.0
dhalkebar-Solar Power plant	1,703.8	0.2965	505.0
simara-Solar Power plant	1,639.0	0.2965	485.0
cascade Kabeli B1-Hydro Power plant	56,946.7	0.2898	16,504.0

5.2 Project Emissions

As per the approved consolidated Methodology AMS I.D Version 18.0 para 39 "For most renewable energy power generation project activities, PE_y = 0. However, as per para 40 "CO_2 emissions from on-site consumption of fossil fuels due to the project activity shall be calculated using the latest version of the "Tool to calculate project or leakage CO_2 emissions from fossil fuel combustion". Where the project is hydro plant for which it does not involve the CO_2 emissions from on-site consumption of fossil fuels. Hence Project emission is considered as 0 (Zero).

Thus PE_y = 0.

Below is the demonstration of conditions as per para 39 of Methodology AMS I.D Version 18.0

a) Emissions related to the operation of geothermal power plants (e.g. no condensable gases, electricity/fossil fuel consumption); -this project activity do not include the operation of any geothermal power plants, Hence This condition is not applicable.

b) Emissions from water reservoirs of hydro power plants –No emissions from reservoirs as all instances consists run of river and their catchments. Hence not applicable

5.3 Leakage

According to CDM Methodology AMS.I. D, (Version 18), paragraph 22, if the energy generating equipment is transferred from another activity, leakage is to be considered. Since this is not the case in the proposed project activity, no leakage emissions are to be considered.

No leakage emissions are considered - in line with paragraph 27 of the small-scale methodology AMS-I.D (version 18.0)

Therefore, LE_y = 0.

5.4 Estimated Net GHG Emission Reductions and Removals

As per the para 28 of AMS-I.D version 18.0, the formula to calculate the emission reduction is

$ER_y = BE_y - PE_y - LE_y$

As the project activity is a hydropower project, there is no any leakage emissions from the project activity.

Hence, $LE_y = 0$

Therefore, Emission Reductions for this project activity are calculated as follows:
$ER_y = BE_y - PE_y$

Where:

ER_y	=	Emission reductions in year y (t CO_2e/yr)
BE_y	=	Baseline emissions in year y (t CO_2e/yr)
PE_y	=	Project emissions in year y (t CO_2e/yr)

Therefore, Net GHG Emission Reductions and Removals are calculated as follows:

$ER_y = BE_y - PE_y$

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)
22-August-2021 To 21-August-2022	19,547	0	0	19,547
22-August-2022 To 21-August-2023	19,547	0	0	19,547
22-August-2023 To 21-August-2024	19,547	0	0	19,547
22-August-2024 To 21-August-2025	19,547	0	0	19,547
22-August-2025 To 21-August-2026	19,547	0	0	19,547

22-August-2026 To 21-August-2027	19,547	0	0	19,547
22-August-2027 To 21-August-2028	19,547	0	0	19,547
Total	**136,829**	**0**	**0**	**136,829**

6 MONITORING

6.1 Data and Parameters Available at Validation

Data / Parameter	**$EF_{grid,OM,y}$ (Indian Grid)**
Data unit	tCO_2e/MWh
Description	Operating Margin CO_2 emission factor in year y
Source of data	CO_2 Emission Database, Version 18.0, December- 2022 published by Central Electricity Authority (CEA), Government of India.
Value applied:	0.9524
Justification of choice of data or description of measurement methods and procedures applied	Calculated as the last 3-year (2019-20, 2020-21, 2021-22) generation-weighted average, sourced from Baseline CO_2 Emission Database, Version 18.0, December- 2022 published by Central Electricity Authority (CEA), Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	**$EF_{grid,BM,y}$ (Indian Grid)**
Data unit	tCO_2e/MWh
Description	Build Margin CO_2 emission factor in year y

Source of data	CO_2 Emission Database, Version 18.0, December- 2022 published by Central Electricity Authority (CEA), Government of India.
Value applied:	0.8687
Justification of choice of data or description of measurement methods and procedures applied	Calculated as the last year (2021-22) build margin, sourced from Baseline CO_2 Emission Database, Version 17.0, October- 2021 published by Central Electricity Authority (CEA), Government of India.
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	**$EF_{grid, CM,y}$ (Indian Grid)**
Data unit	tCO_2e/MWh
Description	Combined Margin CO_2 emission factor in year y for Hydro project activity
Source of data	CO_2 Emission Database, Version 18.0, December- 2022 published by Central Electricity Authority (CEA), Government of India.
Value applied:	0.9105
Justification of choice of data or description of measurement methods and procedures applied	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 CO_2 emission factor in year *y* (tCO_2/MWh) $EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 50% W_{BM}= Weighting of build margin emissions factor (%) = 50%
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	**$EF_{grid, CM,y}$ (Indian Grid)**
Data unit	tCO_2e/MWh
Description	Combined Margin CO_2 emission factor in year y for solar project activity
Source of data	CO_2 Emission Database, Version 18.0, December- 2022 published by Central Electricity Authority (CEA), Government of India.
Value applied:	0.9314
Justification of choice of data or description of measurement methods and procedures applied	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 CO_2 emission factor in year *y* (tCO_2/MWh) $EF_{grid,OM,y}$= Operating margin CO_2 emission factor in year *y* (tCO_2/MWh) W_{OM} = Weighting of operating margin emissions factor (%) = 75% W_{BM}= Weighting of build margin emissions factor (%) = 25%
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	**$EF_{grid, CM,y}$ (Nepal Grid)**
Data unit	tCO_2e/MWh
Description	Combined Margin CO_2 emission factor in year y for hydro project activity
Source of data	Harmonized IFI Default Grid Factors 2021 v3.2
Value applied:	0.2898
Justification of choice of data or description of	NA

measurement methods and procedures applied	
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Data / Parameter	**$EF_{grid,CM,y}$ (Nepal Grid)**
Data unit	tCO_2e/MWh
Description	Combined Margin CO_2 emission factor in year y for solar project activity
Source of data	Harmonized IFI Default Grid Factors 2021 v3.2
Value applied:	0.2965
Justification of choice of data or description of measurement methods and procedures applied	NA
Purpose of Data	For the calculation of the Baseline Emission
Comments	This parameter is fixed ex-ante for the entire crediting period.

Emission factor of Nepal electricity system is not available as it is not published by Nepal Electricity Authority (NEA). Hence PP has taken the emission factor of Nepal is considered as zero from IFI Default Grid Factors 2021 v3.2 published by UNFCCC[52]. However, Nepal is importing electricity from India. Approximately 32% electricity is imported from Indian grid and emission factor of Indian grid is calculated as 0.9105 by using CEA database[53] as per TOOL 07. Hence the emission factor of Nepal is calculated as weighted average emission factor of Nepal and India. Asian Development Bank has published the emission factor of Nepal is 348 tCO_2/ GWh[54]. Weighted average of Nepal and Indian grid is taken as 0.2898 tCO_2/ MWh (i.e. 289 tCO_2/ GWh) which is lower than Asian Development Bank and should be considered as a conservative.

[52] https://unfccc.int/documents/461676

[53] https://cea.nic.in/wp-content/uploads/baseline/2023/01/Approved_report_emission__2021_22.pdf

[54] https://www.adb.org/sites/default/files/linked-documents/49086-001-crf.pdf

6.2 Data and Parameters Monitored

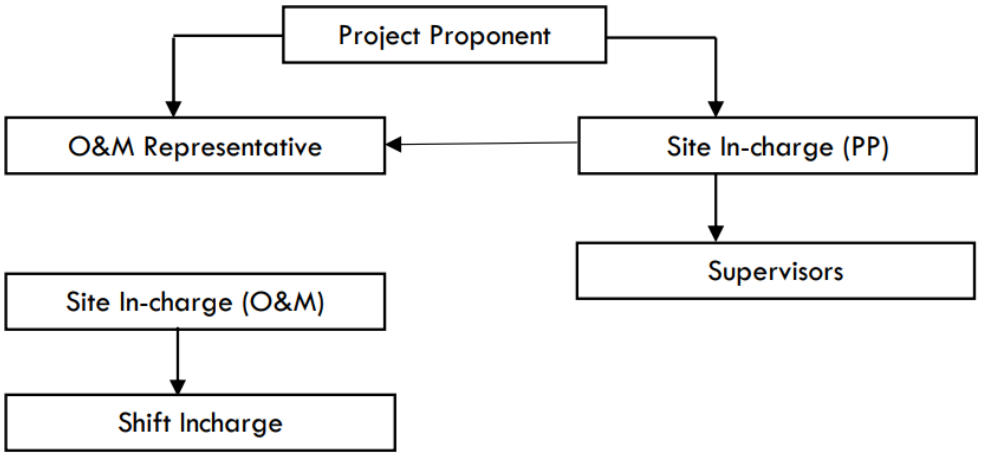
Data / Parameter	$EG_{PJ,facility,y}$
Data unit	MWh/year
Description	Quantity of net electricity supplied (MWh) to the grid as a result of the implementation of the project activity instances in year y
Source of data	Credit note/ JMR/B Form reports/ monthly generation report from state electricity board/DISCOM
Description of measurement methods and procedures applied	-
Frequency of monitoring/recording	Continuous monitoring and monthly recording
Value applied:	67,216.88 (estimated value)
Monitoring equipment	Type: Electricity Meter of Elester & Ametek make Accuracy of meters: 0.2s & 0.1s
QA/QC procedures applied	The calibration of all the meters will be undertaken at required intervals and faulty meters will be duly replaced immediately. The meters will be of accuracy class 0.2 or 0.1. The meter accuracy class and calibration interval are under purview of state electricity board and PP/Project Activity Instances owner do not have any control on it. It is also noted that apportioning procedure (if applicable for project activity instances) is under control of state electricity board and PP do not have any control on it. The available parameter to PP/project activity instance owner is the net electricity supplied to grid and same parameter is mentioned as monitoring parameter.
Purpose of data	The Data/Parameter is required to calculate the baseline emission
Calculation method	The parameter is measured and if any calculation is required, the calculation is based on measured parameters.
Comments	Data will be archived electronically for a period of 2 years beyond the end of crediting period.

6.3 Monitoring Plan

The monitoring plan is developed in accordance with the modalities and procedures for CDM project activities. The monitoring plan, which will be implemented by the project participant describes about the monitoring organisation, parameters to be monitored, monitoring practices, quality assurance, quality control procedures, data storage and archiving.

Organizational structure and responsibilities:

The authority and responsibility for registration, monitoring, measurement, reporting and reviewing of the data rests with the project participant. PP proposed the following structure for data monitoring, collection, data archiving and calibration of equipment for this project activity. The team comprises of the following members:



Responsibilities of Site Incharge (PP): Overall functioning and maintenance of the project activity, the Site incharge shall coordinate with the O&M operator as well as the site supervisors.

Responsibilities of O&M Representative: Co-ordination between Site incharge of the O&M operator as well as the project participant and further report to PP head office.

Responsibilities of Site In-charge (O&M Operator): Responsibility for maintaining the data records, ensures completeness of data, and reliability of data (calibration of equipment) as well as data recording for all the parameters.

Responsibilities of Shift In-charge: Responsibility for day-to-day data collection and maintains day to day monitored data.

Data Measurement

The export and import energy or net electricity displaced by project will be measured continuously using above mentioned energy meter located after inverters. Readings of meters shall be taken on monthly basis by authorized officer of developer in the presence of PP or representative of PP. In the event of failure of generation meter, the user energy meter or inverter generation value will be used in monitoring the electricity generation data.

Data collection and archiving

Readings from meters will be collected in the presence of the plant in-charge. Export and import or net electricity displaced by project would be recorded and stored in logs as well as in electronic form on a daily basis. The records are checked periodically by the Plant Manager and discussed thoroughly with the plant supervisor. The period of storage of the monitored data will be 2 years after the end of crediting period or till the last issuance of VERs for the project activity whichever occurs later.

Emergency preparedness

The project activity will not result in any unidentified activity that can result in substantial emissions from the project activity. No need for emergency preparedness in data monitoring is visualized.

QA/QC Procedures

Their energy meters are installed at the respective project site. 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. Records of calibration certificates will be maintained for verification purposes. Hence, a reliable method will be ensured with monitoring of the parameters. The invoice records will be used and kept for cross checkingthe consistency of the recorded data.

Sampling Approaches

Not required

Personnel training

In order to ensure a proper functioning of the project activity and a properly monitoring of emission reductions, the staff will be trained. The plant helpers will be trained in equipment operation, data recording, reports writing, operation and maintenance and emergency procedures in compliance with the monitoring plan

Monitoring system for all Solar power plants would require state of the art technology to allow for regular real time monitoring and analysis. Some of these requirements are lined out below:

- Monitors the performance of the entire power plant (string wise monitoring, junction boxes, inverters, etc.)
- Evaluates (strings, power produced, inverter, nominal/actual value), quantity of DC Power & AC
- Measures instantaneous irradiation level and temperature at site along with module back surface temperature.

- Alerts in case of error (discrepancy in normal operation of components, like module string/ diodes/ inverter/ junction box / loose contacts/ etc.) to facilitate recognition and correction of the fault with minimum downtime.
- Visualizes nominal status of the connected components via Control Centre PC Software (diagnosis on site or remote)
- Logs system data and error messages for further processing or storing
- Stores and visualizes energy yield data (for life of the plant) in the Portal from where the data can be accessed remotely.

The DC electricity generated by modules is converted to AC in inverters. ISSPL has proposed to go for inverters having capacities of a 1000 kW for 1 MW solar PV plant. In view of the current boom in the global solar PV market and short project implementation period, timely deliveries of the inverters have been a major concern for project development.

Central inverters are ideal for large PV power plants but are also suitable for large-sized power plants installed in commercial or industrial buildings. Inverters are designed for fast and easy installation. The industrial design and modular platform provide a wide range of options like remote monitoring, fieldbus connection and modular and flexible DC input cabinet.

The Central 1000 kW AC inverter, selected for the Project. With peak efficiency above 98.60 %, it is amongst the most efficient central inverter in the market and can be used with both crystalline and thin-film modules. The main technical characteristics of these inverters are illustrated.

For Hydro Power Plant

The following instruments will be installed along with the powerhouse mechanical equipment so as to monitor the functions of them during the operation:

- Necessary numbers of pressure taps will be installed in the non-embedded parts of penstock to measure the penstock pressure. Such taps will also be provided in the inlet conduit pipe of the inlet valve.
- A transducer will be provided to indicate wicket gate opening status of the turbine.
- Servomotor locking device switches will be provided. Limit switch on each servomotor will indicate the fully open and closed position of the locking device.
- Instruments for measuring bearing pads temperatures, oil tank levels, oil temperatures, cooling water flows, cooling water pressures etc. will be installed.
- Proximity sensors will be installed for detection of speed, through which speeds ranging from zero to 140% of nominal speed can be measured and detected.
- A number of vibration probes and vibration proximity transducers will be installed to detect and measure vibrations in turbine.
- Filter high and low differential pressure, inlet and outlet water flow etc. will be monitored through instrumentation.

7 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

7.1 Data and Parameters Monitored

Data / Parameter	$EG_{PJ,facility,y}$ Solar
Data unit	MWh
Description	Quantity of net electricity supplied (MWh) to the grid as a result of the implementation of the project activity instances in year y for solar power plant instances
Value applied:	13,627
Comments	-

Data / Parameter	$EG_{PJ,facility,y}$ Hydro
Data unit	MWh
Description	Quantity of net electricity supplied (MWh) to the grid as a result of the implementation of the project activity instances in year y for hydro power plant instances
Value applied:	48,979
Comments	-

7.2 Baseline Emissions

According to paragraph 22 of CDM Methodology AMS-I.D (Version 18), the baseline emissions are calculated as follows:

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

$BE_y = EG_{PJ, y} * EF_{grid, y}$

Where:

BE_y: Baseline Emissions in year y (t CO_2)

$EG_{PJ, y}$ = Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year y (MWh)

$EF_{grid, y}$ = Combined Margin Emission factor for the project activity = 0.2898 for Hydro power project & 0.2965 for solar power project tCO_2e/MWh Baseline emissions calculations are provided below,

Baseline emissions for Hydro power plant instances for this monitoring period.

$BE_y = EG_{PJ, y} * EF_{grid, y}$

$BE_y = 48,979 * 0.2898$

$BE_y = 14,194\ tCO_2e$ For Hydro instance

Baseline emissions for Solar power plant instances for this monitoring period.

$BE_y = EG_{PJ, y} * EF_{grid, y}$

$BE_y = 13,627 * 0.2965$

$BE_y = 4,040\ tCO_2e$ For Solar instances

Baseline Emission for both the solar and hydro instances monitoring period are

= 18,234 tCO_2e (rounded down)

7.3 Project Emissions

As per paragraph 39 of CDM Methodology AMS-I.D, (Version 18), since the project activity is electricity generation based on solar photovoltaic technology, there is no fossil fuel combustion during the project activity and hence there is no project emissions. Therefore, the project emissions,

$PE_y = 0\ tCO_2e$

7.4 Leakage

According to Methodology AMS-I.D, (Version 18), paragraph 22, if the energy generating equipment is transferred from another activity, leakage is to be considered. Since this is not the case in the proposed project activity, no leakage emissions are to be considered.

Therefore, $LE_y = 0$

7.5 Net GHG Emission Reductions and Removals

Formula used to calculate the net emission reduction for the project activity is

The total emission reduction for current monitoring period (22-August-2021 to 31-May-2023) is = 18,234 tCO_2e.

The total monitoring period (22-August-2021 to 31-May-2023) is of 648 days. The estimated annual emission reduction as per PDMR is 19,547 tCO_2 for first crediting period.

Instance name	Annual Estimated Electricity generation $EG_{PJ, y}$	Baseline Emission factor $EF_{grid,y}$	Baseline emissions BE_y in tCO_2e	No of days in Monitoring period	estimated emission reduction for the current monitoring period
Chandranigahapur-Solar Power plant	6,927.4	0.2965	2,053.0	648	3,638
dhalkebar-Solar Power plant	1,703.8	0.2965	505.0	501	692
simara-Solar Power plant	1,639.0	0.2965	485.0	312	415
cascade Kabeli B1-Hydro Power plant	56,946.7	0.2898	16,504.0	432	19,534
		Total	**19,547 tCO_2e**		**24,279 tCO_2e**

Hydro -estimated emission reduction for the current monitoring period = 19,534 tCO_2e.

Solar -estimated emission reduction for the current monitoring period = 4,745 tCO_2e.

So, the estimated emission reduction for the current monitoring period will be 24,279 tCO_2e.

Hydro -estimated net electricity generation for the current monitoring period = 67,400 Mwh.

Solar -estimated net electricity generation for the current monitoring period = 16,008 Mwh.

So estimated net electricity generation for current monitoring period is 83,408 Mwh.

The % fall in emission reduction in current monitoring period as compared to estimated emission reduction is =

instance	estimated emission reduction for the current monitoring period	The total emission reduction for current monitoring period	The % fall in emission reduction in current monitoring period
Hydro	19,534 tCO_2e.	14,194 tCO_2e.	= (14,194-19,534)/ 19,534 = -27.34%
solar	4,745 tCO_2e.	4,040 tCO_2e.	= (4,040-4,745)/ 4,745 = -14.86%

The net GHG emission reduction for this project activity for current monitoring period is shown table below:

$ER_Y = BE_Y - PE_Y - LE_Y$

$ER_Y = 14,194 - 0 - 0$

$ER_Y = 14,194$ for hydro power plant instances

$ER_Y = 4,040 - 0 - 0$

$ER_Y = 4,040$ for solar power plants instances

$ER_Y = 18,234$ for both solar and hydro power plants instances

Where,

ER_Y = Emission Reduction in $tCO_2/year$

BE_Y = Baseline emission in $tCO_2/year$

PE_Y = Project emissions in $tCO_2/year$

LE_Y = Leakage Emissions in $tCO_2/year$

Vintage wise Net GHG emission reductions or removals (tCO_2e) – For Hydro power plant instances

Year	Baseline emissions or removals (tCO_2e)	Project emissions or removals (tCO_2e)	Leakage emissions (tCO_2e)	Net GHG emission reductions or removals (tCO_2e)
22-August-2021 to 31-December-2021	0	0	0	0
01-January-2022- to 31-December-2022	10,910	0	0	10,910
01-January-2023 to 31-May-2023	3,285	0	0	3,285
Total	**14,194**	**0**	**0**	**14,194**

Vintage wise Net GHG emission reductions or removals (tCO_2e) – For Solar power plant instances

Year	Baseline emissions or	Project emissions or	Leakage emissions (tCO_2e)	Net GHG emission

	removals (tCO_2e)	removals (tCO_2e)		reductions or removals (tCO_2e)
22-August-2021 to 31-December-2021	688	0	0	688
01-January-2022- to 31-December-2022	2,500	0	0	2,500
01-January-2023 to 31-May-2023	852	0	0	852
Total	**4,040**	**0**	**0**	**4,040**

Ex-ante emissions reductions /removals	Achieved emissions reductions /removals	Percent difference	Justification for the difference for Hydro & Solar power plant instance
19,534	14,194	-27.34%	For Hydro power plant instance - During the present monitoring period, the project witnessed a decrease of -27.34% in emission reductions as compared to ex-ante emissions, which is due to variation is majorly due to the variations in temperature pattern and river runoff, grid availability and other parameters which are not in the control of PP.
4,745	4,040	-14.86	For Solar power plant instance - During the present monitoring period, the project witnessed a decrease of -14.86% in emission reductions as compared to ex-ante emissions, which is due to variation is majorly due to the variations in temperature pattern and river runoff, grid availability and other parameters which are not in the control of PP.

APPENDIX 1: METER AND CALIBRATION DETAILS

Calibration Detail								
S.No.	Location	Main Meter Serial No.	Check Meter Serial No.	Make	Accuracy class	Year	Date of calibration	Validity of calibration
1	Simara	2914526	2914527	Elester	0.2s	2021	19-01-2022	18-01-2027[55]
2	Dhalkebar	2914524	2914525	Elester	0.2s	2022	10-01-2022	09-01-2027
3	Chandranighapur	210404445	210404447	Ametek	0.1	2021	19-04-2021	18-04-2026
4	kabeli B1 cascade	211304602	211304601	Ametek	0.1	2021	07-03-2022	06-03-2027

[55] Calibration frequency is once in five years

APPENDIX 2: LOCAL STAKEHOLDER CONSULTATION DETAILS

PAN 300847884 Regd No. 1075/064/065

रिडी पावर कम्पनी लिमिटेड

Ridi Power Company Limited

5th Floor, Trade Tower, Thapathali, Kathmandu

Ref. No.:

This is to clarify that the following informations are the authenicated translated version of the details shared as per the original stakeholder document.

Project Name	Capacity in MW	Date of Invitation	Date of Meeting	Location of Meeting
		In AD	In AD	
Kabeli B1 Cascade Hydroelectric Project	9.94	28th May 2017	02-Jun-17	Hilihang VDC & Amarpur VDC, Panchthar District. Yangwarak VDC Taplejung District
Upper Ingwa Hydropower Project	9.70	25th Feb 2022	4th March 2022	Powerhouse of Project, Ambot, Yangwarak R. Municipality, Panchthar
Dahlkebar Solar Project	1.00	22nd Aug 2018	27th Aug 2018	Dhalkebar, Mithila Municipality, Dhanusa district
Chandranighapur Solar Project	4.00	10th Aug 2018	22nd Aug 2018	Chandrapur Municipality Ward No. 5 Rautahat
Simara Solar Project	1.00	8th Nov 2019	15th Nov 2019	Jitpur Simara Municipality Ward no 14, Bara District

Authenticated By:

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Managing Director
Ridi Power Company Limited

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आर्थिक अभियान

हरेक दृष्टि, आर्थिक कोण

रौतहट जिल्ला, चन्द्रपुर नगरपालिकामा ४ मेगावाटको ग्रिडमा आवद्ध सौर्य उर्जा आयोजना निर्माण तथा संचालन गर्ने सिलसिलामा प्रारम्भिक वातावरणीय परीक्षण (IEE) अध्ययनका लागि रायसुझाव संकलन गर्ने सम्बन्धमा सार्वजनिक सूचना

(प्रकाशित मिति २०७५/०४/२५)

रौतहट जिल्लाको चन्द्रपुर नगरपालिका, वडा नं ५ मा ४ मेगावाट क्षमताको ग्रिडमा आवद्ध सौर्य उर्जा आयोजना निर्माण गरिनेछ । यो आयोजना ८.१ हेक्टर खाली जमीनमा ३१५-३३० वाट क्षमताका १५,२३८-१४,५४५ मोड्युलहरु जडान गरेर १,००० किलोवाटका ४ वटा इन्भर्टर मार्फत ४ मेगावाट विद्युत उत्पादन गरिनेछ र उक्त विद्युत २.८ कि.मि. लामो ३३ के.भि. प्रसारण लाइन मार्फत् नेपाल विद्युत प्राधिकरणको चन्द्रनिगाहपुर सवस्टेशनमा लगेर जोडिनेछ ।

प्रस्तावको नाम : ग्रिडमा आवद्ध सौर्य उर्जा आयोजना (४ मेगावाट), चन्द्रनिगाहपुर

प्रस्तावकको नाम : अपि पावर कम्पनी लिमिटेड, थापाथली, काठमाडौं

प्रस्ताव कार्यान्वयन हुने स्थान : रौतहट जिल्लाको चन्द्रपुर नगरपालिका, वडा नं ५

वातावरण संरक्षण नियमावली, २०५४ को अनुसूचि १ मा परेको प्रस्तावित ग्रिडमा आवद्ध सौर्य उर्जा आयोजना (४ मेगावाट), चन्द्रपुर नगरपालिकाको प्रारम्भिक वातावरणीय परिक्षण (IEE) अध्ययनको सिलसिलामा निम्न क्षेत्रसंग सम्बन्धित सवालहरुका बारेमा प्रस्ताव कार्यान्वयन हुने क्षेत्रका सरोकारवाला व्यक्ति वा संस्थाको लिखित राय सुझाव लिनुपर्ने भएकोले यही नियमावलीको नियम ४ अनुसार यो सार्वजनिक सूचना प्रकाशित गरिएको छ । उक्त प्रस्ताव कार्यान्वयनबाट प्रभाव पर्नसक्ने नगरपालिका तथा त्यस क्षेत्रका विद्यालय, अस्पताल, स्वास्थ्य चौकी तथा सरोकारवाला व्यक्ति वा संस्थाले यो सूचना प्रकाशित भएको मितिले १५ (पन्ध्र) दिनभित्र निम्न ठेगानामा आइपुग्ने गरी रायसुझाव उपलब्ध गराइदिनुहुन अनुरोध गरिन्छ ।

राय सुझाव पठाउने ठेगाना :

प्रस्तावक :	परामर्शदाता :
अपि पावर कम्पनी लिमिटेड,	Environmental Services Nepal Pvt. Ltd. (ESN)
ट्रेड टावर, थापाथली, काठमाडौं,	सेन्ट्रल बिजनेस पार्क, डोल्पा तल्ला, थापाथली,
फोन : ०१-५१११०९३,	पोष्ट बक्स नं.: ११६०५, काठमाडौं, फोन : ०१-४१०१६९५
E-mail: info@sae.com.np	E-mail: info@esn.com.np,
Url: www.apihydro.com.np	Url: www.esn.com.np

अपि पावर कम्पनी लिमिटेड, ट्रेड टावर, थापाथली, काठमाडौं प्रस्तावक रही रौतहट जिल्ला, चन्द्रपुर नगरपालिकाको वडा नं ५ मा निर्माण तथा संचालन गरिने ४ मेगावाटको ग्रिडमा आबद्ध सौर्य विद्युत आयोजनाको प्रारम्भिक वातावरणीय परीक्षण अध्ययन सम्बन्धि मिति २०७७/०४/२९ को 'आर्थिक अभियान' नेपाली राष्ट्रिय दैनिकमा प्रकाशित सार्वजनिक सूचना अनुसार सार्वजनिक परामर्श गर्ने सिलसिलामा सम्बन्धित वातावरणीय सवालहरूका बारेमा प्रस्ताव कार्यान्वयन हुने क्षेत्रका सरोकारवाला व्यक्ति, संस्थाको लिखित राय सुझाव लिन देहायका स्थान र मितिमा सार्वजनिक बैठक आयोजना गरि छलफल गर्ने तथा रायसुझावहरु लिने कार्य सम्पन्न भयो ।

स्थान: [illegible] प्रतिक्षालय ([illegible] घर) (चन्द्रपुर-५)

मिति: २०७७/०५/०६.

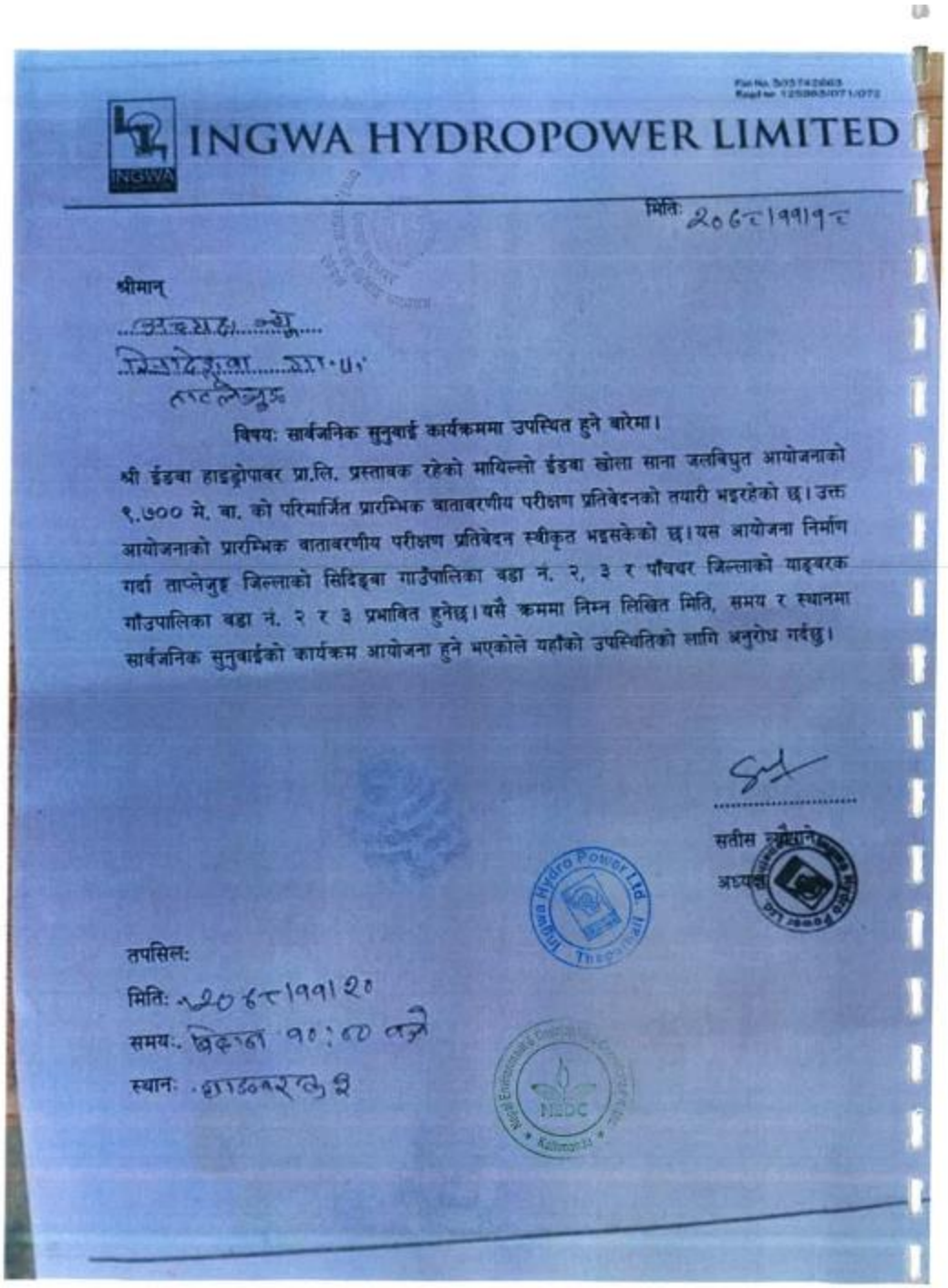
क्र सं	नाम, थर	सम्बन्धित कार्यालय, पेशा	ठेगाना	हस्ताक्षर
1	संजय कुमार [illegible] ९८४५२२२६८०	५ नं वडा अध्यक्ष चन्द्रपुर	चन्द्रपुर-५.	
२	प्रावल [illegible] ९८६४०४१५२८	व्यवसाय	" "	
३	देव राज [illegible] ९८६५०४११४३	विद्यार्थी	" "	
४	[illegible] सापकोटा ९८४५२२३४६४.	शिक्षक	" "	
५	राजन पंडित ९८४५०२८७३६९.	शिक्षक	" "	
६	नवराज दहाल ९८४५०६२४६७.	कृषी	" "	
७	दिपक मैनाली ९८४५०३२३३६.	"	" "	
८	अतुल [illegible] ९८४५२२३०७४	"	" "	
९	केशव दहाल ९८४५०९४६६२.	"	" "	
१०	[illegible] प्रसाद [illegible] ९८१४२०६७९८.	"	" "	
११	नवराज दाहाल ९८४५११८७३९.	शिक्षक	" "	
१२	[illegible] ९८४५६८९८	[illegible]	[illegible]-४	

अपि पावर कम्पनी लिमिटेड, ट्रेड टावर, थापाथली, काठमाडौं प्रस्तावक रही रौतहट जिल्ला, चन्द्रपुर नगरपालिकाको वडा नं ५ मा निर्माण तथा संचालन गरिने ४ मेगावाटको ग्रिडमा आबद्ध सौर्य विद्युत आयोजनाको प्रारम्भिक वातावरणीय परीक्षण अध्ययन सम्बन्धि मिति २०७५/०४/२९ को 'आर्थिक अभियान' नेपाली राष्ट्रिय दैनिकमा प्रकाशित सार्वजनिक सूचना अनुसार सार्वजनिक परामर्श गर्ने सिलसिलामा सम्बन्धित वातावरणीय सवालहरूका बारेमा प्रस्ताव कार्यान्वयन हुने क्षेत्रका सरोकारवाला व्यक्ति, संस्थाको लिखित राय सुझाव लिन देहायका स्थान र मितिमा सार्वजनिक बैठक आयोजना गरि छलफल गर्ने तथा रायसुझावहरु लिने कार्य सम्पन्न भयो ।

स्थान: जुडिबेला वन टोलको प्रतिक्षालय (चन्द्रपुर-२)
मिति: २०७५/०४/०६

क्र सं	नाम, थर	सम्बन्धित कार्यालय, पेशा	ठेगाना	हस्ताक्षर
१	नर बहादुर घिसिङ ९८४५२४३३६८	कृषी	चन्द्रपुर-२	[signature]
२	साजन परियार ९८४११७६४०५	ड्राईभर	" "	[signature]
३	सुशिल तामाङ ९८६४१६९१९५	"	" "	[signature]
४	रुद्र नारायण श्रेष्ठ ९८४५८६५०१७	ड्राईभर	" "	[signature]
५	रिकेन्द्र दास ९८६०४३२४३६	"	" "	Rikendra
६	लालबिर परियार	जागिरे (पेन्सन)	" "	[signature]
७	धर्म पाखिन	कृषी	" "	
८	अर्जुन सिंह	जागिरे	" "	[signature]
९	गुमान सिंह तामाङ	कृषी	" "	[signature]
१०	खुस बहादुर तामाङ ९८६४२६७३३५	कृषी	" "	[signature]
११				
१२				

तस्वीर १३: आयोजना क्षेत्रमा गरिएको सार्वजनिक सुनुवाई कार्यक्रम



INGWA HYDROPOWER LIMITED

मिति: २०८।१९।८

श्रीमान्

.....अध्यक्ष.....ज्यू.....

सिदिङ्बा.....गा.उ.

ताप्लेजुङ

विषय: सार्वजनिक सुनुवाई कार्यक्रममा उपस्थित हुने बारेमा।

श्री ईङ्वा हाइड्रोपावर प्रा.लि. प्रस्तावक रहेको मायिल्लो ईङ्वा खोला साना जलविद्युत आयोजनाको ९.७०० मे. वा. को परिमार्जित प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदनको तयारी भइरहेको छ। उक्त आयोजनाको प्रारम्भिक वातावरणीय परीक्षण प्रतिवेदन स्वीकृत भइसकेको छ। यस आयोजना निर्माण गर्दा ताप्लेजुङ जिल्लाको सिदिङ्बा गाउँपालिका वडा नं. २, ३ र पाँचथर जिल्लाको याङ्वरक गाँउपालिका वडा नं. २ र ३ प्रभावित हुनेछ। यसै क्रममा निम्न लिखित मिति, समय र स्थानमा सार्वजनिक सुनुवाईको कार्यक्रम आयोजना हुने भएकोले यहाँको उपस्थितिको लागि अनुरोध गर्दछु।

सतीस [illegible]
अध्यक्ष

तपसिल:

मिति: २०८।१९।२०

समय: बिहान १०:०० बजे

स्थान: [illegible]

APPENDIX 3: INSTANCES DETAILS

Sl. No.	SPV Name	Instance name	Site Name	capacity	Commissioning date	purpose	Location	
1	RIDI Power Company Limited	Arun Valley Hydropower Development Company Limited	Kabeli B1 cascade	9.94 mw	26-03-2022	sale to grid	27°16'22.7"N, 27.2729	87°46'58.8"E, 87.7829
2		Api Power Company Limited	Dhalkebar Solar 1	1 mw	16-01-2022	sale to grid	26°55'21.2"N, 26.9225	85°56'42.8"E, 85.9452
3			Chandranigahpur Solar	4 mw	22-08-2021	sale to grid	27°06'27.0"N, 27.1075	85°22'05.6"E, 85.3682
4			Simara Solar	1 mw	24-07-2022	sale to grid	27°09'04.0"N, 27.1510	85°00'44.7"E, 85.0124