



Verified Carbon Standard

65MW DAGUSHAN HYDROPOWER PROJECT IN CHINA

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

This project activity is located in Su'nan Yugu Autonomous County and about 102 km far from Zhangye City in Gansu Province, China. The project activity is a project which is constructed and operated by Gansu Zhangye Dagushan Hydropower Co. Ltd. It is a run-of-river hydropower project with a total installed capacity of 65MW (2×26 MW+1×13 MW). The designed operation life of the project is 30 years with an annual electricity generation of 195.15GWh to the Northwest Power Grid of China (NWPG).

The project started the construction on 16-Nov-2007, and 3 units 26 MW, 26 MW and 13 MW are commissioned on 22-July-2009, 24-July-2009, and 26-July-2009 respectively. The project consists of diversion weir, a tunnel, a penstock, high pressure pipelines, a power station and a transfer station. Three units are three phases' vertical axis hanging turbines. As a renewable energy project, Dagushan Hydropower Plant (abbreviation "DHP") produces positive environmental and economic benefits and contributes to the local sustainable development.

The implementation of the project achieves CO₂ emission reduction by replacing electricity generated by fossil fuel fired power plants. The project's first crediting period under VCS program is from 22-July-2009 to 21-July-2019, and the second crediting period is from 22-July-2019 to 21-July-2029.

This monitoring period is from 01-Jan-2021 to 31-Dec-2021, which is within the second crediting period. During this monitoring period, a total of 256,209.026 MWh electricity has been supplied to NWPG by the project. However, electricity supplied to NWPG from 01-July-2021 to 30-July-2021 (35,651 MWh in total) has been issued as International Renewable Energy Certificates (IREC)¹, thus, to avoid double counting this electricity volume will not be claimed as VCUs. The total emission reductions claimed by the PP in this monitoring period are 122,100 tCO₂e.

1.2 Sectoral Scope and Project Type

Sectoral Scope 1: Energy industries (renewable - / nonrenewable sources);

Project type: Hydropower generation project;

The project is not a grouped project.

1.3 Project Proponent

Organization name	Gansu Zhangye Dagushan Hydropower Co., Ltd.
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¹ <https://evident.global/device-register/DAGUSHAN>

Contact person	Du Yong
Title	Legal Representative
Address	Cross at Qingnian East Street of Zhangye City, Su'nan Yugu Autonomous County, Zhangye City, Gansu Province, China
Telephone	+86 021-23019950
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1.4 Other Entities Involved in the Project

Organization name	Gansu Heihe Electric Power Sales Co. Ltd.
Role in the Project	Consultant
Contact person	Liu Mengde
Title	Project Manager
Address	6 th floor of Heihe Hydropower Complex Building, 116 Changshou Road, Ganzhou District, Zhangye City, Gansu Province, China 734000
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1.5 Project Start Date

The project start date is 22-July-2009 (The commissioning date of the 1st generator).

1.6 Project Crediting Period

The project crediting period is ten years, twice renewable for a total of 30 years. However, as the project is also registered as a CDM project with a seven year twice renewable project crediting period, it is not eligible for VCU issuance beyond the end of those 21 years (08-May-2031). The project's first crediting period under VCS program is from 22-July-2009 to 21-July-2019. And its second crediting period is from 22-July-2019 to 21-July-2029.

1.7 Project Location

This project activity is located in the middle of the upper steam of the Heihe River, within the territory of Su'nan Yugu Autonomous County of Gansu Province, approximately 102 km far from Zhangye City. The geographical coordinates of the project are east longitude of 100°01'29" and north latitude of 38°37'21", as shown in figure 1.

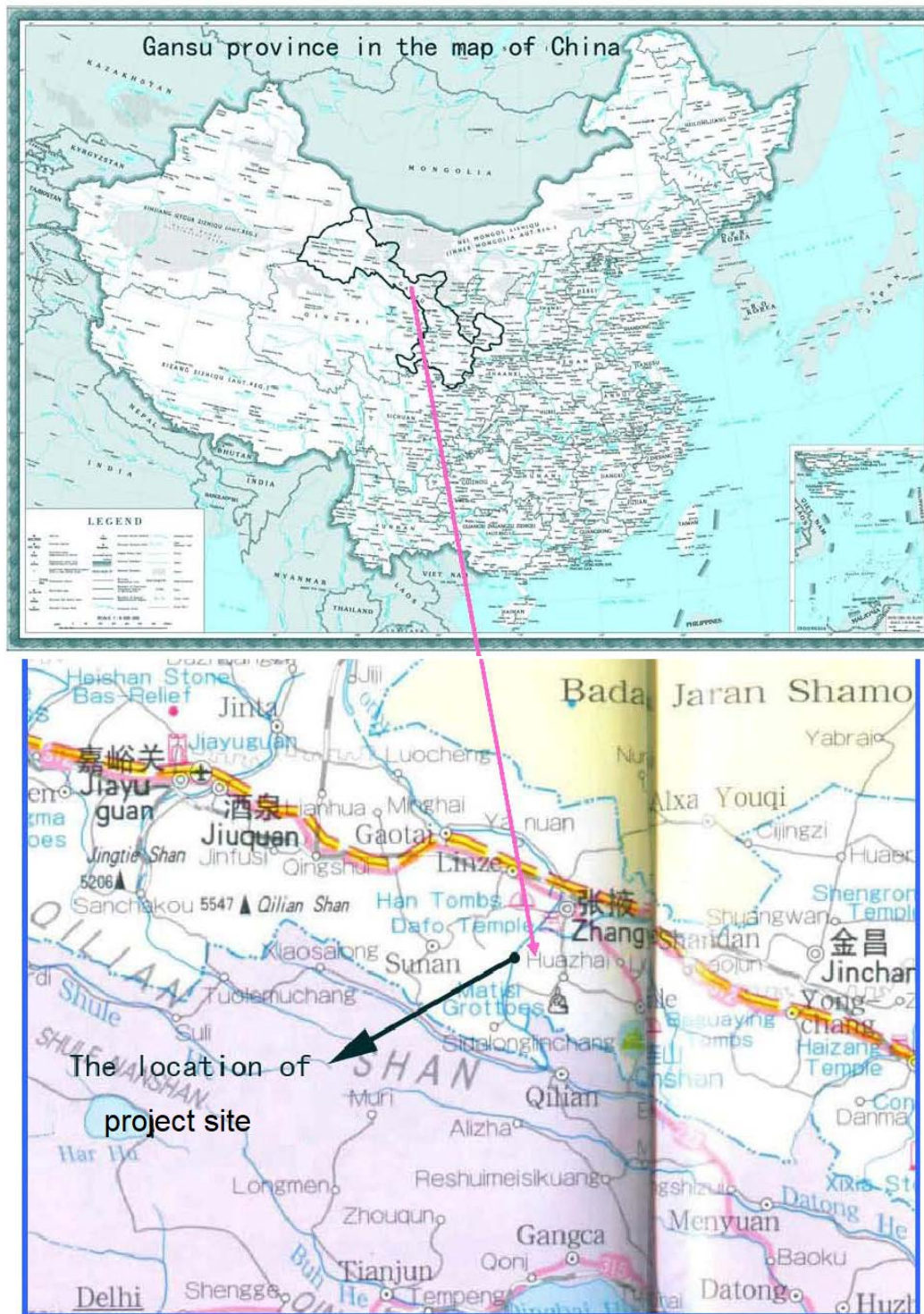


Figure 1 Location of Dagushan Hydropower Project.

1.8 Title and Reference of Methodology

Applied Methodology:

ACM0002 “Grid-connected electricity generation from renewable sources” (Version 20.0), available at

<https://cdm.unfccc.int/methodologies/DB/XP2LKUSA61DKUQC0PIWPGWDN8ED5PG>

Applied tools:

Tool to calculate the emission factor for an electricity system (version 07.0), available at

<https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v7.0.pdf>

1.9 Participation under other GHG Programs

The project was registered as a Clean Development Mechanism (CDM) project (reference number: 3045) in UNFCCC with the 21 (3*7) years crediting period started from 09-May-2010. Please refer to the following link for details:

<https://cdm.unfccc.int/Projects/DB/RWTUV1256040897.46/view?cp=1>

1.10 Other Forms of Credit

Emission Trading Programs and Other Binding Limits:

China has a national emissions trading scheme only cover the high-emission industries, such as thermal power generation, petrochemical, chemical, building materials, iron and steel, non-ferrous, paper, aviation and other key emission industries that emitted at least 26,000 tons of CO₂e/year, not including renewable project². Thus, the project proponent: Gansu Zhangye Dagushan Hydropower Co. Ltd., as an enterprise for renewable energy investment, is not included in the compliance entity list by China national Emission Trading Scheme (ETS).

Therefore, the project does not reduce GHG emissions from activities that are included in an emissions trading program or any other mechanism that includes GHG allowance trading. The net GHG emission reductions generated during this monitoring period have not been used for compliance under such programs or mechanisms.

Other Forms of Environmental Credit:

Apart from VCS program, the project was also a registered CDM project, and a registered IREC project under the International Renewable Energy Certificates program. No double counting occurred for the project. The issuance records of the project under other programs are summarized below:

Start Date	End Date	GHG Emission Reduction (tCO ₂ e) ³	Credit	Program
22/07/2009	08/05/2010	172,015	VCU	VCS

² http://www.mee.gov.cn/xxgk/xxgk05/202103/t20210330_826728.html

³ The credits issued under IREC program is in form of MWh. The GHG Emission Reduction in this table for IREC is calculated as electricity volume issued as IREC multiplies the baseline emission factor of the corresponding crediting period.

09/05/2010	31/03/2011	196,425	CER	CDM
01/04/2011	28/04/2012	232,859	CER	CDM
29/04/2012	31/03/2018	1,338,561	VCU	VCS
01/01/2019	21/07/2019	115,605	IREC	IREC
22/07/2019	29/07/2019	7,994	IREC	IREC
01/08/2019	19/09/2019	34,547	IREC	IREC
01/01/2020	30/04/2020	22,886	IREC	IREC
01/07/2021	30/07/2021	19,736	IREC	IREC

The electricity supplied to NWPG from 01-July-2021 to 30-July-2021 (35,651 MWh in total) has been issued as IRECs. To avoid double counting, this part of electricity is not claimed as VCUs by the PP. Please refer to the following link for the issuance records of IREC in 2021 for the project: <https://evident.global/device-register/DAGUSHAN>

1.11 Sustainable Development Contributions

The project activity is a hydro power project located in Gansu Province, China.



The project utilizes wind resources to generate and supply renewable electricity to the power grid, which contributes to SDG 7.



The project provides long-term job opportunities for local residents, which has a positive effect on the local economy and contributes to SDG 8.



The renewable electricity generated by the project replaces electricity generation by fossil-fuel power plants of the power grid, which reduces GHG emissions and contributes to SDG 13.

Please refer to Appendix 1 of this monitoring report for the evidence of the project's contribution to SD 7 and SDG 13. And the evidence for SDG 8 is submitted as a separate document to VVB due to confidentiality requirement of the project proponent.

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	Renewable energy supplied to the power grid	Implemented activities to increase	220,558.026 MWh of electricity from renewable sources has been supplied to the power grid during the reporting period	Since the project operation start date, an accumulated 3,197,943.070 MWh of electricity from renewable sources has been supplied to the power grid by end of the reporting period
2)	8.5	Numbers of job opportunities provided by implementation of the project	Implemented activities to increase	74 people have been employed by the project as long-term employee	74 people have been employed by the project as long-term employee by end of the reporting period
3)	13.0	Tonnes of greenhouse gas emissions avoided	Implemented activities to increase	The project has achieved a total GHG emission reduction of 122,100 tCO ₂ e during the reporting period.	Since the project operation start date, an accumulated 2,387,684 tCO ₂ e of GHG emission reduction have been achieved by the project by end of the reporting period

2 SAFEGUARDS

2.1 No Net Harm

The Environmental Impact Assessment (EIA) of the project has been conducted and approved by local government officials. The EIA report has assessed every possible aspect of environmental impacts of the project and recommended corresponding measures, where applicable. The environmental impacts and corresponding mitigation measures during operation have been discussed in the registered PD. No negative environmental impacts have been identified.

Furthermore, the project makes positive contribute to the sustainable development as described in section 1.11 of this report.

In conclusion, no net harm on local environment and social community has been detected for the project.

2.2 Local Stakeholder Consultation

LSC prior to the project implementation

Local stakeholder consultation has been conducted in October 2006. All comments received have been well addressed. Please refer to section E of the registered PD 2nd CP-update (version 06.1 dated 03-Feb-2021) of the project for detailed information.

LSC during the operation period

Communications with Local stakeholders have been carried out at periodic intervals. Key implementation schedules and changes of the project have been communicated to the local authority, the neighbourhood committee, and local residents. The comments and suggestions from residents were collected by the local authority, if any.

The project owner carried out questionnaire survey for the local stakeholders to collect the relevant comments and suggestions in July 2021 during this monitoring period. The local authority also conducts spot checks on the implementation of the project at periodic intervals as per relevant regulations. There have been no negative comments received for the project so far.

2.3 AFOLU-Specific Safeguards

NA.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

This project is a run-of-river hydropower project, the total installed capacity is 65 MW served by two 26 MW generators and one 13 MW generator. The designed operation life of the project is 30 years. After commissioning, the project is operating in good conditions. In this monitoring period, the project was also running orderly without any overhauling and downtimes of equipment. No special events occurred during the monitoring period which may impact the applicability of the methodology.

The main construction of the project consists of a diversion weir, a tunnel, a penstock, high pressure pipelines, a power station and a transfer station. The voltage of the generated electricity is increased to 330 kV and the electricity is delivered to the NWPG. The powerhouse installed three sets of turbines and generators, and more details of the equipment can be referred to Table 1 below.

Table 1. Summary of key equipment in the project.

Equipment	Parameter	Unit	Amount
Turbine	Units(large/small)	-	3 (2*large/1*small)
	Model(large/small)	-	HL(257)-LJ-225 HL(257)-LJ-160
	Rated Head	m	73
	Rated Flow (large/small)	m ³ /s	40/21
	Rated Rotation Speed (large/small)	r/min	300/428.6
	Rated Power (large/small)	MW	27.3/13.6
	Annual operation time	h	3,094
Generator	Model (large/small)	-	SF-J26-20/4800 SF-J13-14/3400
	Rated Power	MW	26/13
	Rated Voltage	kV	10.5
	Rated Rotation Speed	r/min	300/428.6
Manufacturer	Hangzhou Resource Power Equipment Co., Ltd.		

3.2 Deviations

3.2.1 Methodology Deviations

There is no methodology deviation applied to this monitoring period.

3.2.2 Project Description Deviations

The project is registered under VCS Version 2007.1 and completed validation before 21-July-2019, thus it remains eligible to apply the crediting period requirements under VCS Version 3, the first crediting period of the project should be updated from 22-July-2009~08-May-2010 to 22-July-2009~21-July-2019 (3*10 years). A deviation for the crediting period has been described in the previous monitoring period (29-Apr-2012 to 31-March-2018) and has been approved by VERRA in Nov. 2020. The deviation for the crediting period is also applicable to this monitoring period (01-Jan-2021 to 31-Dec-2021) and it has no impacts on the applicability, additionality or baseline of the project. There are no other project description deviations occurred in this monitoring period or a previous monitoring period.

3.3 Grouped Projects

N.A.

4 DATA AND PARAMETERS

4.1 Data and Parameters Available at Validation

Data / Parameter	$EF_{grid,BM,y}$
Data unit	tCO ₂ e/MWh
Description	The build margin emission factor for Northwest Power Grid
Source of data	“2019 Baseline Emission Factors for Regional Power Grids in China” published by China DNA
Value applied	0.4407
Justification of choice of data or description of measurement methods and procedures applied	As per the requirements in “Tool to calculate the emission factor for an electricity system version 07.0”
Purpose of Data	Calculation of $EF_{grid,CM,y}$
Comments	Calculated ex ante and fixed for the second crediting period.

Data / Parameter	ω_{OM}
Data unit	-
Description	Weighting of operation margin emission factor
Source of data	"Tool to calculate the emission factor for an electricity system version 07.0"
Value applied	0.25
Justification of choice of data or description of measurement methods and procedures applied	As per the requirements in "Tool to calculate the emission factor for an electricity system version 07.0"
Purpose of Data	Calculation of $EF_{grid,CM,y}$
Comments	Calculated ex ante and fixed for the second crediting period.

Data / Parameter	$EF_{grid,OM,y}$
Data unit	tCO ₂ e/MWh
Description	Baseline Emission Factor
Source of data	2019 Baseline Emission Factors for Regional Power Grids in China published by China DNA
Value applied	0.8922
Justification of choice of data or description of measurement methods and procedures applied	As per the requirements in "Tool to calculate the emission factor for an electricity system version 07.0"
Purpose of Data	Calculation of $EF_{grid,CM,y}$
Comments	Calculated ex ante and fixed for the second crediting period.

Data / Parameter	ω_{BM}
Data unit	tCO ₂ e/MWh
Description	Weighting of build margin emission factor

Source of data	"Tool to calculate the emission factor for an electricity system version 07.0"
Value applied	0.75
Justification of choice of data or description of measurement methods and procedures applied	As per the requirements in "Tool to calculate the emission factor for an electricity system version 07.0"
Purpose of Data	Calculation of $EF_{grid,CM,y}$
Comments	Calculated ex ante and fixed for the second crediting period.

Data / Parameter	$EF_{grid,CM,y}$
Data unit	tCO ₂ e/MWh
Description	The baseline grid emission factor
Source of data	"Tool to calculate the emission factor for an electricity system version 07.0"
Value applied	0.5536
Justification of choice of data or description of measurement methods and procedures applied	As per the requirements in "Tool to calculate the emission factor for an electricity system version 07.0"
Purpose of Data	Calculation of baseline emissions
Comments	Calculated ex ante and fixed for the second crediting period.

Data / Parameter	Cap _{BL}
Data unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero.
Source of data	Project Site
Value applied	0

Justification of choice of data or description of measurement methods and procedures applied	Determine the installed capacity based on recognized standards
Purpose of Data	Calculation of project emissions
Comments	Cap _{BL}

Data / Parameter	A _{BL}
Data unit	m ²
Description	Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m ²). For new reservoirs, this value is zero.
Source of data	Project Site
Value applied	0
Justification of choice of data or description of measurement methods and procedures applied	Measured from topographical surveys, maps, satellite pictures, etc
Purpose of Data	Calculation of project emissions
Comments	-

4.2 Data and Parameters Monitored

Data / Parameter	EG _{facility,y}
Data unit	MWh
Description	Quantity of net electricity generation supplied by the project plant/unit to the grid in year y.
Source of data	Project site
Description of measurement methods and procedures to be applied	- The measurement is conducted hourly and archived monthly. - The meter equipment is deployed under national standard DL/T 448. - Power Measurement Center of Gansu Province Electric Power

	Company, recognized by the National Metrology Administration and both parties, are responsible for the examination, test, malfunction investigation, and seal. - The calibration is carried out quarterly for main meters and yearly for backup meters. - The accuracy of the electric meters is 0.2s.
Frequency of monitoring/recording	The automatic monitoring system which monitors all the meters related will collect the data every 15 minutes and at 24:00 o'clock of the day at the end of each month. Gansu Power Grid will then collect the readings on M1, M2, M5, M7 and M9.
Value monitored	220,558.026 (after IREC deduction)
Monitoring equipment	M1, M2, M3, M4, M5, M6, M7, M8, M9, M10 (details are illustrated in Section 4.3)
QA/QC procedures to be applied	The meters are calibrated according to the relevant national standard and regulations; net electricity generation delivered to the grid are recorded by both the project owner and the grid company. The collected data are cross checked by sales invoices, and the lower values are used for the calculation of emission reduction to ensure the conservative quality.
Purpose of the data	Calculation of baseline emissions
Calculation method	The original data are collected and calculated by the Grid Company. This value ($EG_{\text{facility},y}$) is calculated by summing all the electricity generation from each month during the monitoring period. Monthly electricity generation is calculated from the following equation: $EG_{\text{facility},y} = (EG_{M1} + EG_{M2}) \times \frac{(EG_{M7} + EG_{M9})}{(EG_{M5} + EG_{M7} + EG_{M9})}$
Comments	NA

Data / Parameter	CapPJ
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Data unit	W
Description	Installed capacity of the hydropower plant after the implementation of the project activity.
Source of data	Project Site
Description of measurement methods and procedures to be applied	Determined installed capacity based on recognized standards.
Frequency of monitoring/recording	Yearly
Value monitored	65×10^6
Monitoring equipment	NA
QA/QC procedures to be applied	NA
Purpose of the data	Calculation of project emissions
Calculation method	Monitoring data from the nameplate of hydroelectric generating set.
Comments	NA

Data / Parameter	A_{PJ}
Data unit	m ²
Description	Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full.
Source of data	Calculated based on the design schematics and area maps.
Description of measurement methods and procedures to be applied	Measured
Frequency of monitoring/recording	Yearly
Value monitored	138,047 (2021)
Monitoring equipment	NA
QA/QC procedures to be applied	Project direct emission is excluded because the project's power density is 471W/m ² which is much higher than 10 W/m ² . Further QA/QC procedures are therefore considered not necessary.
Purpose of the data	Calculation of project emissions

Calculation method	NA
Comments	The measurement will be carried out by the third authorized party.

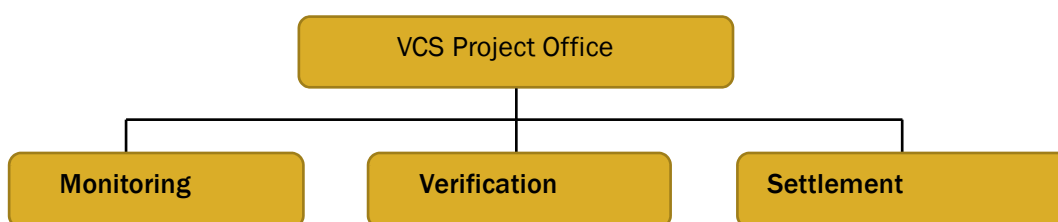
4.3 Monitoring Plan

1. Monitoring of reservoir surface area:

The project owner monitored the surface area of the reservoir by collecting photographic evidence of the surface level when the project became operational. This photographic evidence would compare with the design reservoir dimensions to confirm whether the actual surface area substantially deviates from the design surface area or not.

2. Monitoring Management Structure:

The management structure for monitoring of emission reductions is displayed as following chart:



The DHP entity sets up a VCS team/committee comprising of persons from relevant departments, which is responsible for monitoring of all the parameters mentioned in this section. The VCS team also comprised of a special group of operators who are assigned the responsibility of monitoring different parameters and record. On a weekly basis, the monitoring reports were checked and discussed by the senior VCS team members/managers. In case of any irregularity observed by any of the VCS team member, it was informed to the concerned person for necessary actions.

The responsibility of general manager is to supervise the whole process of monitoring activity; monitoring staffs are from Generation & Operation Department and VCS project office. Their responsibility is to collect the data from Grid Company and to prepare the monitoring report each year; verification staffs are from Operation and Management Department and Finance & Management Department. For the staff of Operation and Management Department, their responsibility is to compare and cross check the data, and for the Staff of Finance and management Department, their responsibility is to deal with the issuance of invoice and settlement of payment.

3. Main Interface:

The electricity generation was measured by the grid company and the project owner. An agreement has been signed between the project owner and the grid company that defines the metering arrangements and the required quality control procedures to ensure accuracy.

The power generated by the project was transmitted to Heihe Substation (330kV) together with the electricity of Erlongshan Hydropower Plant (EHP), a CDM project which is located in the upper reaches of the project, then to Gansu Power Grid and finally to Northwest Power Grid (NWPG).

The collected data are delivered to Gansu Provincial Power Trading Centre (hereunder abbreviated as GPPTC) and local grid company by the same system. GPPTC then issues a monthly power settlement notice to inform the monthly generation amount for settlement. Afterwards, project owners will dispatch corresponding receipts.

There are 10 meters, including both main and backup meters, installed to measure the electricity delivered from different sources:

M1 and M2 (0.2S, bi-directional): Owned by the grid company. M1 and M2 were installed at the Heihe Substation (330kV) of the Grid Company. Both of them measures the net electricity generation supplied to the grid by the DHP and EHP.

M3 and M4 (0.2S, bi-directional): Owned by the project owner. M3 and M4 are located at the exit of booster station of DHP, as the backup meter of M1 and M2.

According to Power Purchasing Agreement (PPA), once M1 and M2 have a breakdown, the electricity will be measured accordingly by M3 and M4. The caused line loss will be negotiated by project owner and the grid company.

M5 and M6 (0.2S, single-directional): M5 is owned by the grid company, which are located at the inlet of booster station of DHP on the transmission line from EHP to DHP. M6 is owned by the project owner, which is located in the booster station of EHP. The reading on M5 is employed to record the net electricity generation supplied by EHP. M6 is the backup meter for M5.

M7 and M9 (0.2S, bi-directional): Owned by the grid company, which are located at the powerhouse of DHP. M7 and M9 measure the electricity exported from No.1 and No.2 main transformer respectively of DHP.

M8 and M10 (0.2S, bi-directional): Owned by the grid company, which are located at the powerhouse of DHP. Both of them are used as the backup meters of M7 and M9 correspondingly.

Figure 2. shows the grid connection of DHP:

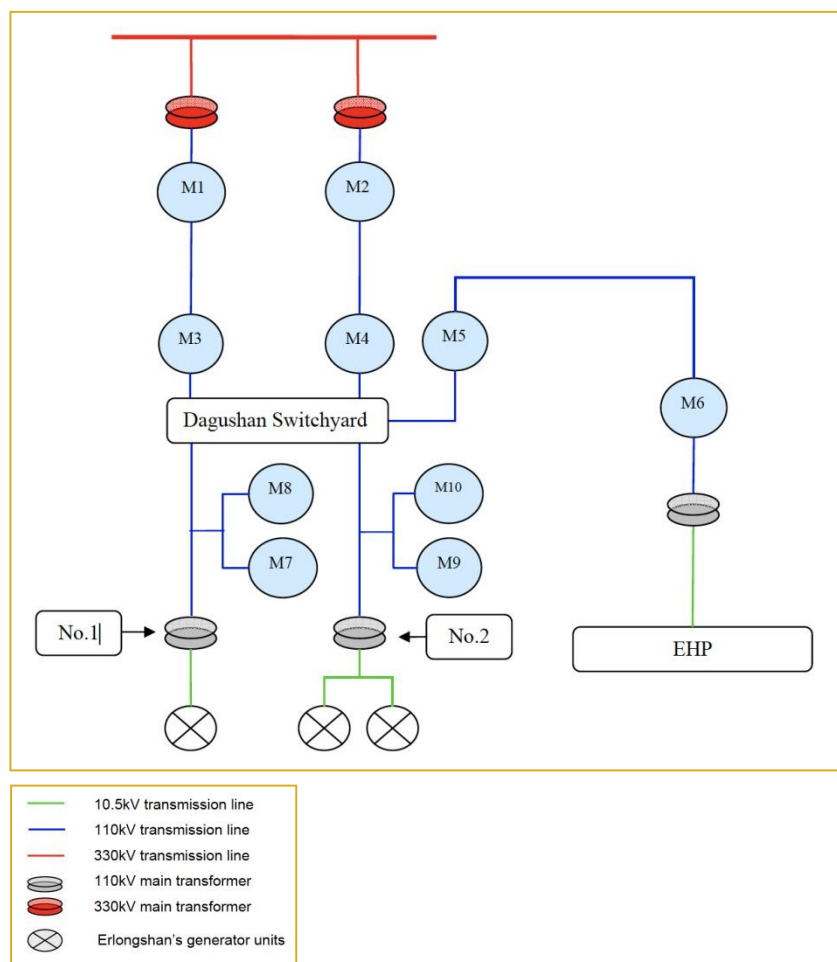


Figure 2. Monitoring system of the project.

Monitoring Procedure:

M1, M2, M5, M7, M9 Monitoring: At the end of each month, the data on M1, M2, M5, M7 and M9 will be collected by provincial power grid company. Based on that, the sales invoice will be issued.

M3, M4, M6, M8, M10 Monitoring: The Generation & Operation Department will manually record the electricity quantity data daily. Every day the computer monitoring system will prepare a data recording table. At the end of each month, the monthly recorded data of electricity will be sent to the Operation & management Department by the staff of generation and operation department. The data will be rechecked and kept by Operation& management Department.

4. Calibration:

Inspection and calibration on meters are carried out according to national standard. The routine check and calibration activities for electricity monitoring apparatus are being done by the national authorized duly accepted power metering authority which is Power Measurement Center of Gansu Province Electric Power Company. The meters installed at

the Heihe substation and the power plant is checked, sealed by the authority calibration entity. The detailed information is as follow:

Electricity Meter	Serial Number	Accuracy	Type	Calibration Date
M1	215294377	0.2S	MK6E	08/11/2020 26/01/2021 25/04/2021 24/07/2021 23/10/2021
M2	215294356	0.2S	MK6E	08/11/2020 26/01/2021 25/04/2021 24/07/2021 23/10/2021
M3	20080850060011	0.2S	DTSD341	18/10/2020 05/10/2021
M4	20080850060012	0.2S	DTSD341	18/10/2020 05/10/2021
M5	215294945	0.2S	MK6E	15/10/2020 26/01/2021 25/04/2021 24/07/2021 23/10/2021
M6	6022100934603	0.2S	DTSD50	18/10/2020 05/10/2021
M7	215294941	0.2S	MK6E	15/10/2020 26/01/2021 25/04/2021 24/07/2021 23/10/2021
M8	215294942	0.2S	MK6E	18/10/2020 05/10/2021
M9	215294943	0.2S	MK6E	15/10/2020 26/01/2021 25/04/2021 24/07/2021 23/10/2021
M10	215294944	0.2S	MK6E	18/10/2020 05/10/2021

5. Emergency Procedures:

Under normal circumstances, the settlement of electricity is measured from the main meter. However, either DHP or the grid company, who finds abnormality on main meters or finds troubles impacting the metering of generation amount, should inform immediately the other party and metering apparatus inspection organization accepted by both parties to examine problems together in order to resume normal condition as soon as possible. The process of dealing with the problem is as following:

Representatives from the Gansu Power Grid Company, Zhangye branch of Gansu Power Grid and DHP will negotiate and deal with the problem together. They will check the malfunctional meters and conduct the maintenance work. Meanwhile, electricity data will be collected, checked, and calculated from the corresponding backup meters. If both the main and backup meters are abnormal, data will be determined by the alternate measuring point from the main meter from the other party. If the main meter from the other party is abnormal, data will be determined by the corresponding backup meter from the other party. Data will then be confirmed by the three parties. Finally, the undercounting amount of electricity generation during the maintenance period will be added to the electricity data of this month.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The emission reduction by the project is calculated according to approved consolidated methodology ACM0002 (Version 20). The equation is showed below:

$$ER_y = BE_y - PE_y$$

Where:

ER_y is the emission reductions in year y (tCO₂e/yr)

BE_y is baseline emissions in year y (tCO₂e/yr)

PE_y is project emissions in year y (tCO₂e/yr)

$$BE_y = EG_{PJ,y} \times EF_y$$

Where:

BE_y = Baseline emission in year y (tCO₂e/yr)

$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid in year y (MWh/yr).

$$EG_{PJ,y} = EG_{\text{facility},y}$$

Where,

$EG_{\text{facility},y}$ = Quantity of net electricity generation supplied by the project plant to the grid in year y (MWh/yr).

EF_y = Combined margin CO₂ emission factor for grid connected power generation in year y (tCO₂e/MWh)

The emission factor $EF_{\text{grid,CM},y}$ with the value of 0.5536 tCO₂e/MWh is calculated ex-ante and fixed during this monitoring period. The monitored values of $EG_{\text{facility},y}$ during this monitoring period are shown in Table below.

2021			
Period	Meter Readings (MWh)	Electricity Data in Sales Receipt (MWh)	$EG_{\text{facility},y}$ (MWh)
	A	B	min(A,B)
01/01 ~ 31/01	6,177.844	6,177.844	6,177.844
01/02 ~ 28/02	6,606.435	6,606.435	6,606.435
01/03 ~ 31/03	11,352.610	11,352.610	11,352.610
01/04 ~ 30/04	11,086.356	11,086.356	11,086.356
01/05 ~ 31/05	24,516.223	24,516.223	24,516.223
01/06 ~ 30/06	37,064.144	37,064.144	37,064.144
01/07 ~ 31/07	36,989.129	36,989.129	36,989.129
01/08 ~ 31/08	43,720.298	43,720.298	43,720.298
01/09 ~ 30/09	39,535.218	39,535.218	39,535.218
01/10 ~ 31/10	20,374.312	20,374.312	20,374.312
01/11 ~ 30/11	11,791.643	11,791.643	11,791.643
01/12 ~ 31/12	6,994.814	6,994.814	6,994.814
Total	256,209.026	256,209.026	256,209.026

The electricity supplied to NWPG from 01-July-2021 to 30-July-2021 (35,651 MWh in total) has been issued as IRECs. To avoid double counting, this part of electricity is deducted when calculating the emission reductions of the project activity, details as follows:

Year	$EG_{\text{facility},y}$ (MWh)	IRECs issued (MWh)	$EG_{\text{facility},y}$ after IREC deduction (MWh)	Baseline Emission BE_y (tCO ₂ e)
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	A	B	C=A-B	D=C×EF _{grid,CM,y}
01/01/2021~ 31/12/2021	256,209.026	35,651.000	220,558.026	122,100

Thus, the baseline emission during this monitoring period is **122,100 tCO₂e**.

5.2 Project Emissions

The power density of this project is 471 W/m², much greater than 10 W/m², since this project is a run-of river hydropower clean energy project, so there is no GHG emission from the project activity. Therefore, PE_y = 0 tCO₂e.

The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = (65 \times 10^6 - 0) / (138,047 - 0) = 471 \text{ (W/m}^2\text{)}$$

Where:

PD = Power density of the project activity, in W/m².

Cap_{PJ} = Installed capacity of the hydro power plant after the implementation of the project activity (W).

Cap_{BL} = Installed capacity of the hydro power plant before the implementation of the project activity (W). For new hydro power plants, this value is zero.

A_{PJ} = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full (m²).

A_{BL} = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m²). For new reservoirs, this value is zero.

5.3 Leakage

According to methodology ACM0002 (ver.20) and VCS-PD for the second crediting period, the emissions potentially arising due to activities such as power plant construction and upstream emissions from fossil fuel use are neglected. Therefore, no leakage emissions are considered for the project.

5.4 Net GHG Emission Reductions and Removals

Year	Baseline emissions or removals (tCO ₂ e)	Project emissions or removals (tCO ₂ e)	Leakage emissions (tCO ₂ e)	Net GHG emission reductions or removals (tCO ₂ e)
01/01/2021 ~ 31/12/2021	122,100	0	0	122,100

According to the renewed PD for the second crediting period, the estimated annual emission reductions for the project in the second crediting period are 108,030 tCO₂e. Thus, the estimated emission reductions for this monitoring period is 108,030 tCO₂e since this monitoring period covers a whole year.

However, since the electricity volume from 01-July-2021 to 30-July-2021 has been issued as IREC and not claimed, the comparison of emission reductions shall be conducted based on the same time length. Therefore, the estimated emission reductions for this monitoring period is re-calculated as **108,030 tCO₂e × 335 days ÷ 365 days = 99,151 tCO₂e**

Estimated ER _y during Monitoring Period (tCO ₂ e)	Actual claimed ER _y during Monitoring Period (tCO ₂ e)	Difference Percentage (%)
99,151	122,100	23.15%

The actual emission reductions are 23.15% higher than the estimated emission reductions, which is due the increased water flow of the Heihe River in 2021. According to the monitored data by Zhangye Hydrology and Water Resources Survey Bureau of Gansu Province, the water flow of the Heihe River in 2021 was 30.18% higher than the annual average value of year 1974-2004 on which the estimated electricity generation of the project was based.

According to the registered PD, the maximum exceeding percentage of power generation is 37.5% when the Financial Internal Return Rate (FIRR) reaches the benchmark (8%). Thus, with 23.15% higher electricity generation, the FIRR of this project during this monitoring period is still lower than the benchmark, which retains the additionality of the project.

APPENDIX 1: <SUPPORTING EVIDENCE >

Evidence for SDG 7 and 13: From project operation date onwards, the net renewable electricity supplied to the grid and the GHG emission reductions in every monitoring period have been summarized below. Please refer to following links for details.

<https://cdm.unfccc.int/Projects/DB/RWTUV1256040897.46/view?cp=1>

<https://registry.verra.org/app/projectDetail/VCS/653>

Period		The net renewable electricity supplied to NWPG	Emission Reduction**	GHG program
From	To	MWh	tCO ₂ e	
22-07-2009	08-05-2010	197,447.777	172,015	VCS
09-05-2010	31-03-2011	225,465.992	196,425	CDM
01-04-2011	28-04-2012	267,285.434	232,859	CDM
29-04-2012	31-03-2018	1,536,460.700	1,338,561	VCS
01-04-2018	21-07-2019	349,156.620*	188,580	VCS
22-07-2019	31-12-2020	365,917.521*	137,144	VCS
01-01-2021	31-12-2021	256,209.026*	122,100	VCS
Cumulative values		3,197,943.070	2,387,684	-

*Note: All the renewable electricity issued under IREC program (287,721MWh in total) in 2019, 2020 and 2021 has been included in the net renewable electricity supplied to NWPG during the period from 01-04-2018 to 31-12-2021. Please refer to the following link for the issuance records of IREC of the project: <https://evident.global/device-register/DAGUSHAN>.

**Note: The Emission reductions only include those GHG emission reductions claimed and issued under CDM/VCS programs. The emission reductions resulting from the volume of electricity issued as IREC (in form of MWh) are not accounted. This is deemed conservative.