



**Verified Carbon
Standard**

HUNAN DONGPING 72MW HYDROPOWER PROJECT



Document Prepared by Climate Bridge (Shanghai) Ltd.

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1 PROJECT DETAILS

1.1 Summary Description of the Implementation Status of the Project

Hunan Dongping 72MW Hydropower Project (hereinafter referred to as “the project”) is a grid-connected run-of-river hydropower project located on the main stream of Zishui River in Anhua County, Yiyang City, Hunan province, China. The primary objective of the project is to generate electricity to meet the ever-increasing demand in Hunan Province and contributes to the sustainability of the Central China Power Grid (hereafter refers to as the CCPG). The expected average annual electricity exported by project is 271.1GWh. Thus, the project will lead to estimated annual emission reductions of approximately 253,336 tCO_{2e}.

The total installed capacity of the project is 72MW and the designed operation lifetime is 30 years. The technology employed in the project is conventional hydropower design using the natural water flow of the river and low head. The turbines are bulb-type through-flow turbines that are suitable for hydropower schemes with low head. The detailed implementation timetable for the project can be seen as follows:

Event	Time
Starting of the Construction ¹	10/11/2004
Crediting period	01/04/2007 – 31/03/2017
Operation of the 1 st unit ²	30/04/2007
Operation of the 2 nd unit ³	30/07/2007
Operation of the 3 rd unit ⁴	31/10/2007
Operation of the 4 th unit ⁵	31/12/2007

¹ Dongping Hydropower Plant Civil Construction Contract

² Start-up Acceptance Report for the 1st unit

³ Start-up Acceptance Report for the 2nd unit

⁴ Start-up Acceptance Report for the 3rd unit

⁵ Start-up Acceptance Report for the 4th unit

1 st monitoring period (CDM)	12/02/2008 – 30/09/2008
2 nd monitoring period (CDM)	01/10/2008 – 31/07/2009
3 rd monitoring period (CDM)	01/08/2009 – 31/08/2010
4 th monitoring period (CDM)	01/09/2010 – 31/08/2011
5 th monitoring period (CDM)	01/09/2011 – 30/06/2012
6 th monitoring period (CDM)	01/07/2012 – 30/09/2012
1 st monitoring period (VCS)	01/04/2007 – 11/02/2008
2 nd monitoring period (VCS)	01/10/2012 – 31/03/2017

Emission reductions generated during the monitoring period (01/10/2012 ~ 31/03/2017) are 1,051,933 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	Wuling Power Corporation, Ltd. (Project Owner)
Contact person	Shan Le
Title	Manager
Address	No.188 Wuling Street, Tianxin District, Changsha City, Hunan Province
Telephone	+86-2162462036
Email	3542346576@qq.com

1.4 Other Entities Involved in the Project

Organization name	Climate Bridge (Shanghai) Ltd.
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Role in the Project	Consultancy
Contact person	Zhiwen Gao
Title	General Manager
Address	Block B, Level 24, Jiangong Mansion, 33 Fushan Road, Pudong New Area, Shanghai, China 200
Telephone	+86-2162462036
Email	projects@climatebridge.com

1.5 Project Start Date

01/04/2007

1.6 Project Crediting Period

01/04/2007 – 31/03/2017

1.7 Project Location

The project site is located on the middle reaches of Zishui River where is in the vicinity of Minjiawan, Dongping Town, Anhua County, Yiyang City, Hunan Province, and is 10 km down-stream of Zhexi hydropower plant. The geographical coordinates of the project site are 111 ° 20' east longitude and 28 ° 20' north latitude. The following figure 1 shows the location of the project.



Figure 1: Location of project

1.8 Title and Reference of Methodology

ACM0002: "Consolidated methodology for grid connected electricity generation from renewable source" and "Consolidated monitoring methodology for zero-emissions grid-connected electricity generation from renewable sources", version 06, in effect as of 19 May 2006.

"Tool for demonstration and assessment of additionality", Version 03.

"Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion", Version 02.

More information about the methodology can be obtained from:

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

1.9 Participation under other GHG Programs

The project was registered as a Clean Development Mechanism (CDM) project (reference number: 1311) in UNFCCC with the 21 (7 years x 3) years crediting period started from 12/02/2008. Please refer to the following link for details:

<https://cdm.unfccc.int/Projects/DB/TUEV-SUED1188225533.57/view?cp=1>

1.10 Other Forms of Credit

Start Date	End Date	GHG Emission Reduction (tCO ₂ e)	Credit	Program
01/04/2007	11/02/2008	54,914	VCU	VCS
12/02/2008	30/09/2008	131,297	CER	CDM
01/10/2008	31/07/2009	168,881	CER	CDM
01/08/2009	31/08/2010	207,044	CER	CDM
01/09/2010	31/08/2011	200,404	CER	CDM
01/09/2011	30/06/2012	172,646	CER	CDM

01/07/2012	30/09/2012	63,569	CER	CDM
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The emission reductions generated from this monitoring period (01/10/2012~31/03/2017) will request for VCUs and will not be submitted for any emission reduction certificate or carbon offset.

1.11 Sustainable Development

The construction and operation of the project has brought prominent environmental and social benefit, and contribute to region sustainable development through following aspects:

The Project will contribute to sustainable development in the following ways:

- Displacing part of the grid electricity mainly generated by fossil fuel combustion, thus reducing the emission of CO₂ and other air pollutants; 271.1GWh/yr of electricity from renewable sources will be supplied to the grid. Thus, the project will achieve SDG 7 Affordable and Clean Energy⁶.
- The project will achieve a GHG emission reduction of 253,336 tCO₂e/yr during the crediting period. Thus, the project will achieve SDG 13 Climate Action⁷.
- This project will increase income of local residences and accelerate economy development in rural areas. During the crediting period, direct and indirect employment opportunities will be generated. Thus, the project will achieve SDG 8 Decent Work and Economic Growth⁸.

2 SAFEGUARDS

2.1 No Net Harm

Construction and operation of this project does not result in any significant environmental impacts with following aspects being meticulously investigated:

AIR QUALITY

⁶ <https://sdgs.un.org/goals/goal7>

⁷ <https://sdgs.un.org/goals/goal13>

⁸ <https://sdgs.un.org/goals/goal8>

During construction, the main impacts on the air quality will come from flying dust and emission caused by cement mixture process and transportation. To avoid these impacts, the project owner will upgrade the construction techniques, spray water regularly, plant bush fences and build temporary cement road etc. In addition, the workers will be protected by masks. The submergence of the biomass will produce methane which will affect the air quality. But the biomass in the submerged area will be cleaned up and the area is small, the impact is anticipated to be negligible.

NOISE

Operation of the instruments will temporarily increase the noise. Thus the project owner will construct sound barriers, control the work time and offer compensation to the surrounding people etc. In addition, the workers will be protected by ear-muffs and helmets.

WATER LOSE AND SOIL EROSION

As business as usual, the project construction will increase water lose and soil erosion in the affected area. To minimize the impact more efficiently, the project owner will construct retaining walls around dumping zones, plant trees around the project site and afforest the sandpits etc. By these measures, it is anticipated that the water and soil condition in the around area will not be damaged, on contrast, it will be improved.

WATER QUALITY

As a hydropower project, water is the main element at any stage, and it will be generally affected. During construction, the main impact will come from the waste water generated by construction, installation and domestic usage. This waste water will be collected and treated separately in respect of the different characters. When the project begins to store water, the main impact will become the decomposition products produced by the submerged biomass. According to China's regulation, before submerging, the biomass in the submerged area will be cleaned up to satisfy the acceptability of the environment. During implementation, after the construction of the dam, water will be raised and the flow speed will be decreased. It is anticipated that the remediation function of water will be improved. The river bed will be regularly cleaned to ensure the water quality.

Because the intake mouth of Dongping Water Purification Plant is only 550m down-stream to the dam, the water supplied to the plant will be heavily affected by the project construction. In order to avoid this pollution, the intake mouth was planned to reset at 500 – 1000 m upstream of the dam.

AQUATIC ECOSYSTEM

No rare and endangered aquatic species were found in reservoir inundation area and construction area. Because the small rise of the water level will not change the river aquatic system into lake type, it is anticipated that the existence of the project will have a

negligible impact on the existing aquatic ecosystem. Moreover, the fry will be regularly put into the river to optimize the aquatic ecosystem.

MIGRATION RESETTLEMENT

According to the related laws and regulations, a detailed resettlement plan was edited in the Preliminary Design. The purpose of the plan is to guarantee the migrations' living standard equal to or better than the previous situation and to achieve the sustainable development. The plans include details of the migrations, the housing plan and the developing plan etc. As migration resettlement will impact on the resettling area and the consequent community development will affect the surrounding environment, after related economical and environmental analysis, the plum plantations were selected as the core business to support the migrations. It is evaluated that planting plum will not have notable impact upon the surrounding environment but will produce prominent economical benefits. The investment on migration resettlement will be RMB 65 million.

2.2 Local Stakeholder Consultation

Local Stakeholder Consultation during the project preparation stage:

To evaluate the economic, social and environmental effects of the project, a wide range of stakeholders have been invited in June 2004, and comments were compiled by the project owner and Hunan Province Hydro & Power Design Institute. The invited stakeholders included the officials from local government, residents from the affected areas, migrations, and residents from the resettlement areas. Several approaches were used to achieve the comments as follows:

- Investigation meeting and direct visitation
- Experts' evaluation and consultation meeting
- Intensive public meeting with local residents: The meeting memo is available and can be provided to DOE as required.
- Questionnaires: 50 copies of questionnaires were handed out, and 50 out of 50 copies were returned. The completed questionnaires are available for DOE.

In Dec. 2006, a stakeholder comment for CDM development of the project was performed. Several approaches were used to collect the comments as follows:

- Comment invitation notice posted on the project site and resettlement areas;
- Comment invitation notice publicized through the TV;

- Questionnaires: 171 copies of questionnaires were handed out, and 171 out of 171 copies were returned. The completed questionnaires are available for DOE.

100% of the respondents support the project. 27.49% thought the project have positive influence on their life. 72.51% thought the project have no influence on their life. No person objected the CDM development of the project.

The project will sufficiently develop and utilize the hydro resource of Zishui River. The top-dam route will speed up the development of the south part of Anhua County. The project will bring outstanding social and economic benefits. Therefore, the project is expected to be started as soon as possible to benefit local residents and the sustainable development.

Local Stakeholder Consultation during the project implementation stage:

Communications with Local stakeholders are being carried out at periodic intervals. In this monitoring period, the project owner carried out questionnaire survey for the local stakeholders to collect the relevant comments and suggestions in October 2012, August 2013, June 2014, May 2015, April 2016 and March 2017. Meanwhile, the local authority has also conducted spot checks on the implementation of the project from time to time as per the request from the local governments' regulations. There are no negative comments received for the project. In line with VCS requirements all the processes have been implemented to receive comments from local stakeholders as well as communicate with them at periodic intervals.

2.3 AFOLU-Specific Safeguards

N/A.

3 IMPLEMENTATION STATUS

3.1 Implementation Status of the Project Activity

The project design consists of a run-of-river type hydro-electric facility with low head of 6.5 meters. The technology employed in the project is conventional hydropower design using the natural water flow of the river and low head. The structure consists of a low gravity dam with a maximum height of 19 meters, an overflow dam constructed from pebble rock and concrete, a navigation lock, an auxiliary dam and flood gate. The powerhouse of the station is located at the base of the dam and houses four turbine/generator units. The generators are driven by turbines which make use of water diverted from the dam into the powerhouse. All technologies utilized in the project are domestic technologies. There is no technology imported to China by the project. The specific technical data of the turbines/generators are listed in Table 1 and Table 2.

Table 1: Technical data of the turbines

	Model	Capacity	Rated flow rate
Unit 1 - 4	GZ(B113)-WP/620	18.56MW	320.2 m ³ /s

Table 2: Technical data of the generators

	Model	Capacity	Rated voltage
Unit 1- 4	SFWG18-76/6860	18MW	10.5kV

The project also involves the construction of two transmission lines (Line 502 and Line 504) that connect the project to the Hunan Provincial Grid, an integral part of the CCPG.

The technical process is shown in the following Figure 2:

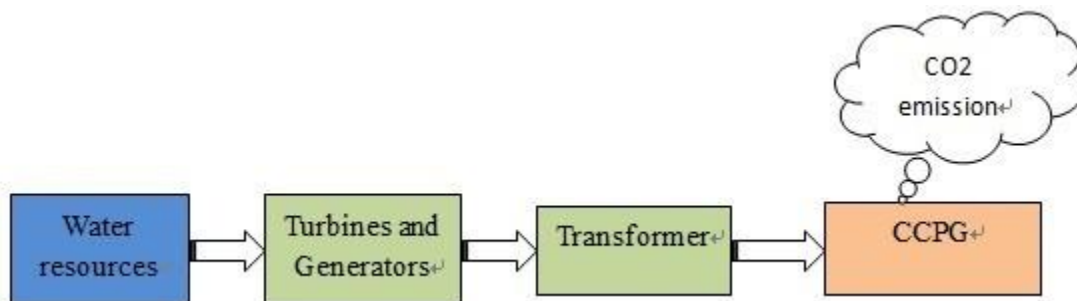


Figure 2. The diagram of the technical process of the project

The starting date of the construction of the project is 10/11/2004. The first turbine started full operation on 30/04/2007 and all 4 units of water turbines completed commissioning successfully and started full operation on 31/12/2007. The crediting period of the project is from 01/04/2007 to 31/03/2017, and the current monitoring period of the project is from 01/10/2012 to 31/03/2017.

The implementation of the project is consistent with the registered PDD and the approved revised monitoring plan. The project was full operated and there have been no emergencies happened during the monitoring period. There were no special events happened during the monitoring period. And there were no events or situations happened during the monitoring period that may impact the applicability of the methodology.

Changes of measuring meters during this monitoring period will be illustrated in Section 4.3.

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 was registered under VCS standard 2007 and completed validation before 19/03/2020. thus, it remains eligible to apply the crediting period requirements under VCS standard Version 3 which shall be a maximum of ten years and may be renewed at most twice. However, the project is also registered as a CDM project (CDM ref. 1311) and the crediting period under CDM is 21 years (7*3 renewable), therefore the total length of VCS crediting period should be no more than 21 years which is from 01/04/2007 to 31/03/2028 and the project is not eligible for VCU issuance beyond 31/03/2028. And the first renewable crediting period of the project should be updated from 01/04/2007~11/02/2008 to 01/04/2007~31/03/2017.

The project was registered under CDM (Reference number: 1311) on 12/02/2008 (7 years x 3, renewable). As stated in the registered PDD, a backup diesel generator was installed on site to supply emergency power to start the turbines and generators when the project is accidentally fully stopped and the connected grid failed. An electric meter was installed to exclusively monitor the electricity generated by the diesel generator, thus a request for revise the monitoring plan included the parameter related to the diesel consumption was raised by CDM EB and this revised monitoring plan was approved on 02/02/2011 and it is applicable to this monitoring period (01/10/2012~31/03/2017). The detail information of the monitoring plan refer to the Section 4.2.

The deviation for the crediting period is also applicable to this monitoring period (01/10/2012 to 31/03/2017) 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	$F_{i,j,y}$
Data unit	$10^4 \text{ t}, 10^7 \text{ m}^3$
Description	the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y
Source of data	China Energy Statistical Yearbook 2003-2005
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data that is collected from the official statistics.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	NCV_i
Data unit	TJ/ mass or volume unit of a fuel
Description	the net calorific value (energy content) per mass or volume unit of a fuel i
Source of data	China Energy Statistical Yearbook 2005
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Local values
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	$EF_{CO_2,i}$
Data unit	tC/TJ
Description	the CO ₂ emission factor per unit of energy of the fuel i
Source of data	1996 revised IPCC guidelines

Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data that is collected from the IPCC.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	OXID_i
Data unit	%
Description	Oxidation rate of the fuel
Source of data	1996 revised IPCC guidelines
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data that is collected from the IPCC.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	Installed Capacity
Data unit	MW
Description	Installed capacities of hydropower and fuel-fired power of the Central China Grid 2000-2004
Source of data	China Electric Power Yearbook 2001-2005
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data that is collected from the official statistics.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	GEN_{j,y}
Data unit	MWh

Description	Electricity delivered to the grid
Source of data	China Electric Power Yearbook 2001-2005
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data that is collected from the official statistics.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	Surface area of full reservoir level
Data unit	m ²
Description	The surface area of full reservoir level of the proposed project
Source of data	Preliminary Design of the proposed project
Value applied	2622366.45
Justification of choice of data or description of measurement methods and procedures applied	The submerged area includes the flooded land and the river surface area.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	Electricity Generation
Data unit	MWh
Description	The electricity generated by source j
Source of data	China Electric Power Yearbook 2001-2005
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data that is collected from the official statistics.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	Captive Power Ratio
Data unit	%
Description	The captive power ratio of source j
Source of data	China Electric Power Yearbook 2001-2005
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data that is collected from the official statistics.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	Captive Power Ratio
Data unit	%
Description	The captive power ratio of source j
Source of data	China Electric Power Yearbook 2001-2005
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data that is collected from the official statistics.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	COEF_i
Data unit	tCO ₂ / mass or volume unit of the fuel
Description	The CO ₂ emission coefficient of fuel i
Source of data	Data is obtained by the calculation.
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data used in the calculation is from China Energy Statistical Yearbook 2005 and IPCC.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	λ_i
Data unit	%
Description	The percentage of CO ₂ emissions from different fuel i power plant in total fuel-fired CO ₂ emission
Source of data	Data is obtained by the calculation.
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data used in the calculation is from China Electric Power Yearbook 2001- 2005, China Energy Statistical Yearbook 2005 and IPCC.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	EF_{OM}
Data unit	tCO ₂ /MWh
Description	The OM emission factor
Source of data	Data is obtained by the calculation.
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data used in the calculation is from China Electric Power Yearbook 2001- 2005, China Energy Statistical Yearbook 2005 and IPCC.
Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	EF_{BM}
Data unit	tCO ₂ /MWh
Description	The BM emission factor
Source of data	Data is obtained by the calculation.
Value applied	Annex 3 of registered PDD
Justification of choice of data or description of measurement methods and procedures applied	Data used in the calculation is from China Electric Power Yearbook 2001- 2005, China Energy Statistical Yearbook 2005 and IPCC.

Purpose of Data	Calculation of baseline emission
Comments	Calculated ex ante and fixed for the crediting period

Data / Parameter	EF_{CM}
Data unit	tCO ₂ e/MWh
Description	Baseline emission factor of the CCPG
Source of data	Registered PDD
Value applied	0.940069
Justification of choice of data or description of measurement methods and procedures applied	Data used in the calculation is from China Electric Power Yearbook 2001 - 2005, China Energy Statistical Yearbook 2005 and IPCC.
Purpose of Data	Calculation of baseline emissions
Comments	Calculated ex ante and fixed for the crediting period

4.2 Data and Parameters Monitored

Data / Parameter	<i>Electricity Supply</i>
Data unit	MWh
Description	Electricity supplied to the grid by the project
Source of data	Data from meter readings.
Description of measurement methods and procedures to be applied	Measured by two bidirectional meters (M1 and M2) during the monitoring period. Hourly measurement and monthly recording. 100% of data will be monitored and electronic archived.
Frequency of monitoring/recording	The meters measure electricity on a continuous basis. Readings of the main metering systems are read and recorded monthly at 24:00 on the last day of each month by the assigned person from the project owner. The backup metering system is recorded monthly by the project owner. The main metering system operated well and the data from the backup metering system was not used during the monitoring period. The grid company also record the readings of the meter on the grid side monthly at 24:00 on the last day of each month by the assigned person from the grid company and form Electricity Sales Receipts, but the metering system information from grid side is not available. The lower values

	are used for the calculation of emission reduction to ensure the conservative quality.
Value monitored	1,118,997.790
Monitoring equipment	The data are measured by the bidirectional meters (M1 and M2). M1 is the main meter to measure the electricity supplied to the grid through the Line 502. M2 is the main meter to measure the electricity supplied to the grid through the Line 504. M3 is the backup meter when M1 is out of order and M4 is the backup meter when M2 is out of order. M1 and M3 are installed on the Line 502 at the project site, M2 and M4 are installed on the Line 504 at the project site.
QA/QC procedures to be applied	The data are measured by the main meters during the monitoring period. The backup metering system would be used only when the main metering system is out of order. Both the metering systems are designed and operated in compliance with the national guideline "Technical administrative code of electric energy metering" (DL/T448-2016) and "Technical code of electric energy measuring and metering system design" (DL/T5137-2001).
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	NA

Data / Parameter	<i>Achieved Electricity</i>
Data unit	MWh
Description	Electricity imported from the grid by the project
Source of data	Data from meter readings.
Description of measurement methods and procedures to be applied	Measured by the two bidirectional meters (M1 and M2) during the monitoring period. Hourly measurement and monthly recording. 100% of data will be monitored and electronic archived.
Frequency of monitoring/recording	The meters measure electricity on a continuous basis. Readings of the main metering systems are read and recorded monthly at 24:00 on the last day of each month by the assigned person from the project owner. The backup metering system is recorded monthly by the project owner. The main metering system operated well and the data from

	the backup metering system was not used during the monitoring period. The grid company also record the readings of the meter on the grid side monthly at 24:00 on the last day of each month by the assigned person from the grid company and form Electricity Sales Receipts, but the metering system information from grid side is not available.
Value monitored	0
Monitoring equipment	The data are measured by the bidirectional meters (M1 and M2). M1 is the main meter to measure the electricity supplied to the grid through the Line 502. M2 is the main meter to measure the electricity supplied to the grid through the Line 504. M3 is the backup meter when M1 is out of order and M4 is the backup meter when M2 is out of order. M1 and M3 are installed on the Line 502 at the project site, M2 and M4 are installed on the Line 504 at the project site.
QA/QC procedures to be applied	The data are measured by the main meters during the monitoring period. The backup metering system would be used only when the main metering system is out of order. Both the metering systems are designed and operated in compliance with the national guideline “Technical administrative code of electric energy metering” (DL/T448-2016) and “Technical code of electric energy measuring and metering system design” (DL/T5137-2001).
Purpose of the data	Calculation of baseline emissions
Calculation method	-
Comments	NA

Data / Parameter	<i>Surface area of full reservoir level</i>
Data unit	m ²
Description	The surface area of full reservoir level of the project
Source of data	Project site
Description of measurement methods and procedures to be applied	Measured by meters
Frequency of monitoring/recording	Measured at the start of the project.

Value monitored	2,230,000
Monitoring equipment	The surface area report of full reservoir level of the project was issued on 01/04/2007 by a qualified third party - Hunan Water Resources & Hydropower Investigation & Design Institute, which was accredited by State Bureau of Surveying and Mapping of the People's Republic of China.
QA/QC procedures to be applied	The measurement was performed by a qualified third party - Hunan Water Resource & Hydropower Investigation & Design Institute accredited by State Bureau of Surveying and Mapping of the People's Republic of China, and the results will be kept during the crediting period.
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	NA

Data / Parameter	<i>FC_{diesel}</i>
Data unit	L
Description	The quantity of diesel consumed by the backup diesel generator
Source of data	The recording from the project owner
Description of measurement methods and procedures to be applied	Measured by the fuel gauge of the diesel generator. The project owner will record the data periodically.
Frequency of monitoring/recording	The project owner records the data periodically
Value monitored	0 (There is no diesel consumption in this monitoring period)
Monitoring equipment	Fuel gauge of the diesel generator
QA/QC procedures to be applied	1. The project owner will record the time and the quantity of the added oil and the purchasing invoice will be archived by the project owner. 2. The project owner will record the process of starting the diesel generator, including the starting time and the continued time of the operation. 3. The electric meter was installed to measure the electricity

	generated by the diesel generator and will be calibrated periodically according to relevant national standards and regulations by Hunan Wuling Electric Power Engineer Co., Ltd., a third qualified authorized organization. The accuracy of the electric meter is 0.5S, which satisfies national guideline <i>“Technical administrative code of electric energy metering” (DL/T448-2016)</i>. 4. The recording of the time, the quantity of the added oil and the purchasing invoice can be used as the direct double-check to the quantity of the used diesel oil. The recording of the process of starting the diesel generator and the reading of meter installed at the diesel generator can be used as the indirect double-check to the quantity of the used diesel oil.
Purpose of the data	Calculation of project emissions
Calculation method	-
Comments	-

4.3 Monitoring Plan

1. Monitoring of reservoir surface area:

The surface area report of full reservoir level of the project was issued on 01/04/2007 by official entity Hunan Water Resources & Hydropower Investigation & Design Institute, which was accredited by State Bureau of Surveying and Mapping of the People’s Republic of China.

The measurement was performed by a qualified Hunan Water Resource & Hydropower Investigation & Design Institute accredited by State Bureau of Surveying and Mapping of the People’s Republic of China, and the results will be kept during the crediting period.

2. Monitoring Management Structure:

The monitored parameter is the net electric power supplied to the grid. The net electric power supplied to the grid is obtained by the measurement of the electricity supplied by the project to the grid, and the measurement of the electricity supplied by the grid to the project. The electric output is the main product of the project, and the project owner has setup an operational and management structure for the electric power output. To monitor the project emission reductions and any leakage effects, the project owner will designate a qualified staff responsible for all relevant matters, including monitoring of emission

reductions, data collection and archiving, QA/QC, and verification. The structure of the operation and management for the activity of the project is shown as following figure 3:

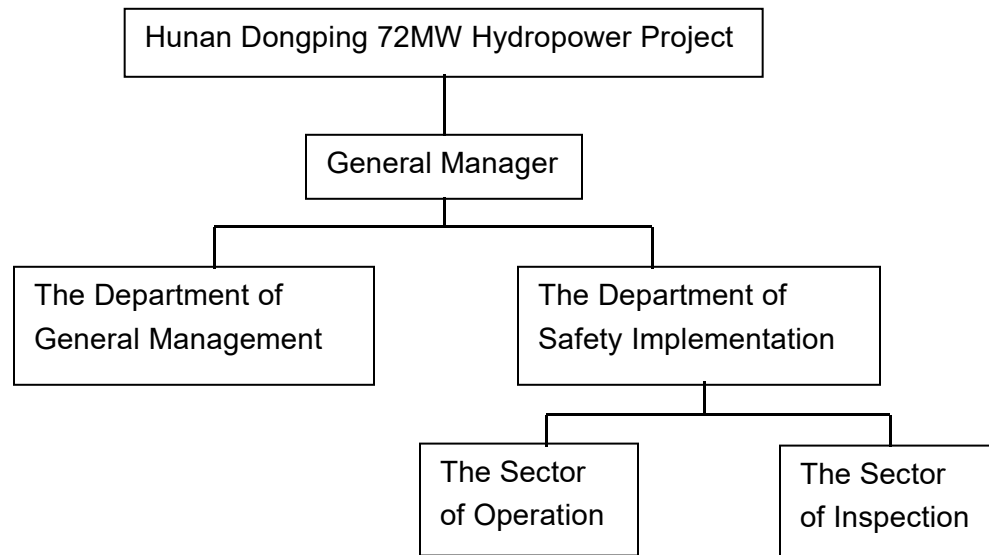


Figure 3: The structure of the operation and management for the project activity

The responsibilities of the departments are shown as followings:

- General Manager: Responsible for leading the implementation and management of the project.
- The Department of General Management: Responsible for administration and management, investment, equipment purchasing and storage, financing, and etc.
- The Department of Safety Implementation: Responsible for the control, operation and maintenance of all the equipments.

3. Main Interface

The electricity generation is 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 project involves two transmission lines (Line 502 and Line 504) that connect the project to the CCPG. The electricity supplied by the project to the grid and the electricity supplied by the grid to the project will be monitored by two metering system, a main

metering system and a backup metering system. The two metering systems are used to measure the Electricity Supply and the Achieved Electricity. The two metering systems are installed at the high voltage side of the step-up substation of the project. For clearly describing the information of the meters, the installation of the meters is outlined in the Figure 4.

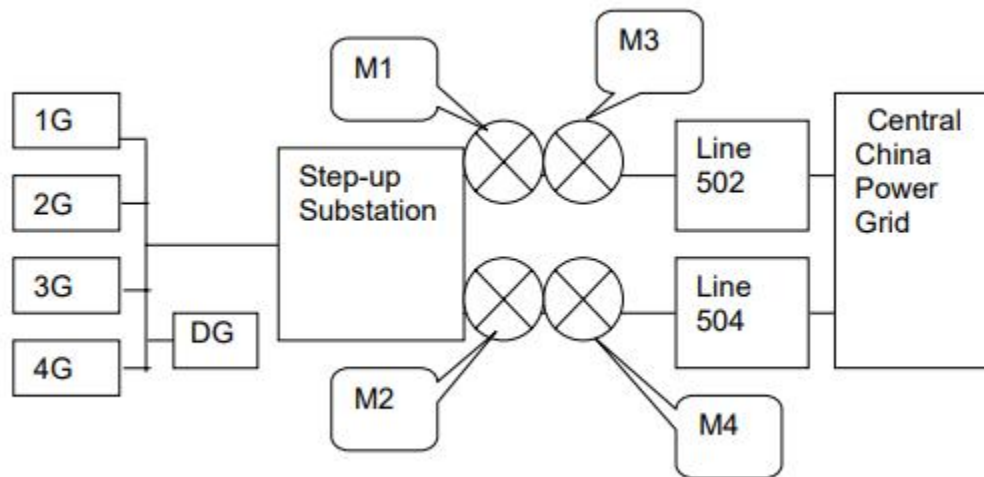


Figure 4: The installation of the meters

M1: Owned by the grid company, the main meter installed on Line 502;

M2: Owned by the grid company, the main meter installed on Line 504;

M3: Owned by the grid company, the backup meter installed on Line 502;

M4: Owned by the grid company, the backup meter installed on Line 504;

DG: the diesel generator. The diesel generator does not supply electricity to the grid, only supplies emergency power to start the turbines and generators when the power plant is accidentally fully stopped and the electricity supply from the connected grid is failed. There is an electricity meter of the diesel generator (M5). The electricity monitored by M5 is only used as the indirect double-check to the quantity of diesel consumed by the backup diesel generator..

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.

4. Calibration

Year	Serial Number	Accuracy	Type	Calibration Date	Validity
------	---------------	----------	------	------------------	----------

M1	01/10/2012~05/10/2012	210328079	0.2s	MK6E	08/06/2012	07/06/2013
	05/10/2012~31/03/2017	217503487	0.2s	MK6E	05/10/2012 02/10/2013 28/09/2014 25/09/2015 21/09/2016	04/10/2013 01/10/2014 27/09/2015 24/09/2016 20/09/2017
M2	01/10/2012~25/11/2012	03219617	0.2s	AINRTAL-X	21/03/2012	20/03/2013
	25/11/2012~31/03/2017	214084395	0.2s	MK6E	25/11/2012 20/11/2013 17/11/2014 13/11/2015 11/11/2016	24/11/2013 19/11/2014 16/11/2015 12/11/2016 10/11/2017
M3	01/10/2012~05/10/2012	210328080	0.2s	MK6E	08/06/2012	07/06/2013
	05/10/2012~31/03/2017	217503488	0.2s	MK6E	05/10/2012 02/10/2013 28/09/2014 25/09/2015 21/09/2016	04/10/2013 01/10/2014 27/09/2015 24/09/2016 20/09/2017
M4	01/10/2012~25/11/2012	03219618	0.2s	AINRTAL-X	21/03/2012	20/03/2013
	25/11/2012~31/03/2017	214084394	0.2s	MK6E	25/11/2012 20/11/2013 17/11/2014 13/11/2015 11/11/2016	24/11/2013 19/11/2014 16/11/2015 12/11/2016 10/11/2017

M5	01/10/2012~31/03/2017	00325174	0.5s	DTSD51	16/02/2012	15/02/2013
					06/02/2013	05/02/2014
					02/02/2014	01/02/2015
					28/01/2015	27/01/2016
					26/01/2016	25/01/2017
					20/01/2017	19/01/2018

Due to regular replacement, state grid hunan electric power company research institute replaced new meters for M1 and M3 on 05/10/2012 and for M2 and M4 on 25/11/2012. Details are as follow:

Meter	Replacing time (start)	Replacing time (end)
M1	05/10/2012	05/10/2012
	09:45	10:00
M2	25/11/2012	25/11/2012
	10:21	10:30
M3	05/10/2012	05/10/2012
	10:06	10:15
M4	25/11/2012	25/11/2012
	10:35	10:43

5. Emergency procedures

If any accident happened, the calibration and testing of the meters should be performed according to a completed regulation. For example, if the metering system has failure, damage or missing, the operators will notice the other party in time, and the damage record and repair plan will be saved and available to the DOE for verification. The Electricity Supply is determined on the results of the calibration and relevant regulations agreed by both parties. If the parties have dissidence on the calibration results, a high qualification metrical organization will be authorized to re-calibrate the meters. No meter errors have occurred to-date.

5 QUANTIFICATION OF GHG EMISSION REDUCTIONS AND REMOVALS

5.1 Baseline Emissions

The baseline emissions (BE_y in tCO_2e) are the product of the baseline emissions factor (EF_{CM} in tCO_2e/MWh , calculated ex-ante and will not be updated during the first crediting period) times the net electricity supplied by the project to the grid (EG_y in MWh) during the monitoring period:

$$BE_y = EF_y \times EG_y$$

Where:

BE_y = Baseline emission in year y (tCO_2e/yr)

EG_y = the electricity supplied to the grid by the project (MWh/yr).

EF_y = the baseline emission factor.

The baseline emission factor EF_y with the value of $0.940069 tCO_2e/MWh$, is calculated ex-ante and is fixed during this monitoring period. The details⁹ of the electricity generation calculated after the deduction of electricity imported from electricity exported in this monitoring period (01/10/2012 ~ 31/03/2017) is shown in Table 3.

Table 3: The summarization of electricity generation from 01/10/2012 to 31/03/2017

Period	Electricity Supply			Achieved Electricity ($10^4 kWh$)	$EG_y = C - D$ ($10^4 kWh$)
	Electricity from	Electricity from	Electricity Supply for		

⁹ For more detailed calculation process, please refer to the Emission Reduction (ER) calculation sheet.

		meter readings (10 ⁴ kWh)	sales receipts (10 ⁴ kWh)	conservative value (10 ⁴ kWh)		
		A	B	C = Min(A, B)	D	
2012	01/10~31/10	930.8904	918.8420	918.8420	0	918.8420
	01/11~30/11	1,784.2836	1,729.8840	1,729.8840	0	1,729.8840
	01/12~31/12	1,187.5776	1,163.1520	1,163.1520	0	1,163.1520
	Subtotal	3,902.7516	3,811.8780	3,811.8780	0	3,811.8780
2013	01/01~31/01	2,402.2290	2,332.8260	2,332.8260	0	2,332.8260
	01/02~28/02	2,216.5580	2,152.7560	2,152.7560	0	2,152.7560
	01/03~31/03	1,975.0368	1,914.0790	1,914.0790	0	1,914.0790
	01/04~30/04	3,384.4800	3,247.0720	3,247.0720	0	3,247.0720
	01/05~31/05	3,956.9112	3,775.9850	3,775.9850	0	3,775.9850
	01/06~30/06	1,739.0604	1,685.6380	1,685.6380	0	1,685.6380
	01/07~31/07	1,477.0800	1,443.0080	1,443.0080	0	1,443.0080
	01/08~31/08	1,383.7032	1,349.8120	1,349.8120	0	1,349.8120
	01/09~30/09	1,467.2988	1,432.3690	1,432.3690	0	1,432.3690
	01/10~31/10	1,312.0932	1,289.7330	1,289.7330	0	1,289.7330
	01/11~30/11	574.7016	566.8390	566.8390	0	566.8390
	01/12~31/12	853.1952	836.9160	836.9160	0	836.9160
	Subtotal	22,742.3474	22,027.0330	22,027.0330	0	22,027.0330
2014	01/01~31/01	2,078.1680	2,030.8280	2,030.8280	0	2,030.8280
	01/02~28/02	1,753.8450	1,702.9160	1,702.9160	0	1,702.9160
	01/03~31/03	1,006.0908	986.2470	986.2470	0	986.2470
	01/04~30/04	3,478.3320	3,340.1600	3,340.1600	0	3,340.1600
	01/05~31/05	3,923.2776	3,747.5270	3,747.5270	0	3,747.5270
	01/06~30/06	4,594.2600	4,392.2970	4,392.2970	0	4,392.2970
	01/07~31/07	3,238.4616	3,105.4330	3,105.4330	0	3,105.4330
	01/08~31/08	2,651.8404	2,551.2930	2,551.2930	0	2,551.2930
	01/09~30/09	1,785.8016	1,741.0350	1,741.0350	0	1,741.0350
	01/10~31/10	1,548.2544	1,520.1030	1,520.1030	0	1,520.1030
	01/11~30/11	2,767.3681	2,674.9340	2,674.9340	0	2,674.9340
	01/12~31/12	1,346.2007	1,321.2210	1,321.2210	0	1,321.2210
	Subtotal	30,171.9002	29,113.9940	29,113.9940	0	29,113.9940
2015	01/01~31/01	579.3090	571.5650	571.5650	0	571.5650
	01/02~28/02	554.2280	546.3650	546.3650	0	546.3650
	01/03~31/03	1,326.6132	1,300.1200	1,300.1200	0	1,300.1200
	01/04~30/04	1,956.6888	1,903.7510	1,903.7510	0	1,903.7510
	01/05~31/05	2,499.8292	2,411.9580	2,411.9580	0	2,411.9580
	01/06~30/06	3,648.7572	3,486.0950	3,486.0950	0	3,486.0950
	01/07~31/07	1,961.6652	1,892.4830	1,892.4830	0	1,892.4830
	01/08~31/08	2,635.5516	2,528.9280	2,528.9280	0	2,528.9280
	01/09~30/09	2,493.7176	2,415.7370	2,415.7370	0	2,415.7370
	01/10~31/10	2,465.4828	2,389.5460	2,389.5460	0	2,389.5460

	01/11~30/11	2,620.3320	2,522.8360	2,522.8360	0	2,522.8360
	01/12~31/12	2,419.0584	2,334.4740	2,334.4740	0	2,334.4740
	Subtotal	25,161.2330	24,303.8580	24,303.8580	0	24,303.8580
2016	01/01~31/01	2,748.9924	2,680.8390	2,680.8390	0	2,680.8390
	01/02~29/02	2,958.6350	2,911.8390	2,911.8390	0	2,911.8390
	01/03~31/03	2,877.8508	2,770.6250	2,770.6250	0	2,770.6250
	01/04~30/04	3,514.5264	3,358.8110	3,358.8110	0	3,358.8110
	01/05~31/05	3,738.9924	3,582.2040	3,582.2040	0	3,582.2040
	01/06~30/06	2,811.6264	2,773.2160	2,773.2160	0	2,773.2160
	01/07~31/07	2,690.2128	2,646.4900	2,646.4900	0	2,646.4900
	01/08~31/08	1,227.0984	1,211.0620	1,211.0620	0	1,211.0620
	01/09~30/09	980.0057	975.9080	975.9080	0	975.9080
	01/10~31/10	754.3668	748.6390	748.6390	0	748.6390
	01/11~30/11	741.2196	735.1550	735.1550	0	735.1550
	01/12~31/12	647.5260	643.1110	643.1110	0	643.1110
	Subtotal	25,691.0527	25,037.8990	25,037.8990	0	25,037.8990
2017	01/01~31/01	2,662.6908	2,634.6190	2,634.6190	0	2,634.6190
	01/02~28/02	2,099.4734	2,084.3690	2,084.3690	0	2,084.3690
	01/03~31/03	2,932.4328	2,886.1290	2,886.1290	0	2,886.1290
	Subtotal	7,694.5970	7,605.1170	7,605.1170	0	7,605.1170
01/10/2012 ~ 31/03/2017	Total	115,363.8819	111,899.7790	111,899.7790	0.0000	111,899.7790

Period		EG _y		EF _y	BE _y
		10 ⁴ kWh	MWh	tCO ₂ /MWh	tCO ₂
2012	01/10~31/10	918.8420	9,188.4200	0.940069	8,638
	01/11~30/11	1,729.8840	17,298.8400	0.940069	16,262
	01/12~31/12	1,163.1520	11,631.5200	0.940069	10,934
	Subtotal	3,811.8780	38,118.7800	0.940069	35,834
2013	01/01~31/01	2,332.8260	23,328.2600	0.940069	21,930
	01/02~28/02	2,152.7560	21,527.5600	0.940069	20,237
	01/03~31/03	1,914.0790	19,140.7900	0.940069	17,994
	01/04~30/04	3,247.0720	32,470.7200	0.940069	30,525
	01/05~31/05	3,775.9850	37,759.8500	0.940069	35,497
	01/06~30/06	1,685.6380	16,856.3800	0.940069	15,846
	01/07~31/07	1,443.0080	14,430.0800	0.940069	13,565
	01/08~31/08	1,349.8120	13,498.1200	0.940069	12,689
	01/09~30/09	1,432.3690	14,323.6900	0.940069	13,465
	01/10~31/10	1,289.7330	12,897.3300	0.940069	12,124

	01/11~30/11	566.8390	5,668.3900	0.940069	5,329
	01/12~31/12	836.9160	8,369.1600	0.940069	7,868
	Subtotal	22,027.0330	220,270.3300	0.940069	207,069
2014	01/01~31/01	2,030.8280	20,308.2800	0.940069	19,091
	01/02~28/02	1,702.9160	17,029.1600	0.940069	16,009
	01/03~31/03	986.2470	9,862.4700	0.940069	9,271
	01/04~30/04	3,340.1600	33,401.6000	0.940069	31,400
	01/05~31/05	3,747.5270	37,475.2700	0.940069	35,229
	01/06~30/06	4,392.2970	43,922.9700	0.940069	41,291
	01/07~31/07	3,105.4330	31,054.3300	0.940069	29,193
	01/08~31/08	2,551.2930	25,512.9300	0.940069	23,984
	01/09~30/09	1,741.0350	17,410.3500	0.940069	16,367
	01/10~31/10	1,520.1030	15,201.0300	0.940069	14,290
	01/11~30/11	2,674.9340	26,749.3400	0.940069	25,146
	01/12~31/12	1,321.2210	13,212.2100	0.940069	12,420
	Subtotal	29,113.9940	291,139.9400	0.940069	273,691
2015	01/01~31/01	571.5650	5,715.6500	0.940069	5,373
	01/02~28/02	546.3650	5,463.6500	0.940069	5,136
	01/03~31/03	1,300.1200	13,001.2000	0.940069	12,222
	01/04~30/04	1,903.7510	19,037.5100	0.940069	17,897
	01/05~31/05	2,411.9580	24,119.5800	0.940069	22,674
	01/06~30/06	3,486.0950	34,860.9500	0.940069	32,772
	01/07~31/07	1,892.4830	18,924.8300	0.940069	17,791
	01/08~31/08	2,528.9280	25,289.2800	0.940069	23,774
	01/09~30/09	2,415.7370	24,157.3700	0.940069	22,710
	01/10~31/10	2,389.5460	23,895.4600	0.940069	22,463
	01/11~30/11	2,522.8360	25,228.3600	0.940069	23,716
	01/12~31/12	2,334.4740	23,344.7400	0.940069	21,946
	Subtotal	24,303.8580	243,038.5800	0.940069	228,473
2016	01/01~31/01	2,680.8390	26,808.3900	0.940069	25,202
	01/02~29/02	2,911.8390	29,118.3900	0.940069	27,373
	01/03~31/03	2,770.6250	27,706.2500	0.940069	26,046
	01/04~30/04	3,358.8110	33,588.1100	0.940069	31,575
	01/05~31/05	3,582.2040	35,822.0400	0.940069	33,675
	01/06~30/06	2,773.2160	27,732.1600	0.940069	26,070
	01/07~31/07	2,646.4900	26,464.9000	0.940069	24,879

	01/08~31/08	1,211.0620	12,110.6200	0.940069	11,385
	01/09~30/09	975.9080	9,759.0800	0.940069	9,174
	01/10~31/10	748.6390	7,486.3900	0.940069	7,038
	01/11~30/11	735.1550	7,351.5500	0.940069	6,911
	01/12~31/12	643.1110	6,431.1100	0.940069	6,046
	Subtotal	25,037.8990	250,378.9900	0.940069	235,373
2017	01/01~31/01	2,634.6190	26,346.1900	0.940069	24,767
	01/02~28/02	2,084.3690	20,843.6900	0.940069	19,595
	01/03~31/03	2,886.1290	28,861.2900	0.940069	27,132
	Subtotal	7,605.1170	76,051.1700	0.940069	71,493
	Total	111,899.7790	1,118,997.7900	0.940069	1,051,933

The baseline emissions were calculated as total electricity generation multiply with the emission factor EF_{CM} :

$$BE_y = EG_y \times EF_y$$

$$= (\text{Electricity Supply} - \text{Achieved Electricity}) \times EF_{CM}$$

$$= 1,118,997.790 \text{ MWh} \times 0.940069 \text{ tCO}_2\text{e/MWh}$$

$$= 1,051,933 \text{ tCO}_2\text{e}$$

Thus, the baseline emission during this monitoring period is 1,051,933 tCO₂e.

5.2 Project Emissions

All of the possible emissions have been considered, including the emissions caused by submerged vegetations and the emissions caused by backup diesel generator.

$$PE_y = PE_{\text{submerged}} + PE_{\text{diesel}}$$

$$PE_{\text{submerged}}:$$

The power intensity of this project is 32 W/m², greater than 10 W/m². Therefore, $PE_{\text{submerged}} = 0 \text{ tCO}_2\text{e}$. The power density of the project activity is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}} = (72 \times 106 - 0) / (2,230,000 - 0) = 32 \text{ (W/m}^2\text{)}$$

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.

PE_{diesel} :

Moreover, the emission of the project by the backup diesel generator was considered through calculation. The function of the backup diesel generator is to supply emergency power to start the turbines and generators when the power plant is accidentally fully stopped and the electricity supply from the connected grid is failed. The calculation is as follows:

“Tool to calculate project or leakage CO₂ emissions from fossil fuel combustion” (Version 02) is selected to calculate this emission. The calculation is as follows:

$$PE_{diesel} = FC_{diesel} \times COEF_{diesel} \times p$$

Where:

PE_{diesel} , CO₂ emissions from diesel oil combustion, (Unit: tCO₂e);

FC_{diesel} , the quantity of the used diesel oil (Unit: l);

p , the weighted average density of the diesel oil (Unit: g/ml), the conservative density for diesel 0.85g/ml will be used;

$COEF_{diesel}$, the CO₂ emission coefficient of the diesel oil (Unit: tCO₂e/mass unit);

The CO₂ emission coefficient $COEF_{diesel}$ is calculated as follows:

$$COEF_{diesel} = NCV_{diesel} \times EF_{diesel}$$

Where:

NCV_{diesel} , net calorific value (Unit: GJ/mass unit), the default value from the latest China Energy Statistical Yearbook;

EF_{diesel} , CO₂ emission factor of the diesel oil (Unit: tCO₂e/GJ), IPCC default values (74,800 Kg/TJ) at the upper limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories.

$$\text{Therefore, } PE_{diesel} = FC_{diesel} \times NCV_{diesel} \times EF_{diesel} \times p$$

During this monitoring period, no diesel was consumed, thus $PE_{diesel} = 0$.

In conclusion, $PE_y = PE_{\text{submerged}} + PE_{\text{diesel}} = 0$

5.3 Leakage

According to the methodology, the leakage of the project need not be considered. $L_y=0$

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)
01/10/2012~31/12/2012	35,834	0	0	35,834
01/01/2013~31/12/2013	207,069	0	0	207,069
01/01/2014~31/12/2014	273,691	0	0	273,691
01/01/2015~31/12/2015	228,473	0	0	228,473
01/01/2016~31/12/2016	235,373	0	0	235,373
01/01/2017~31/03/2017	71,493	0	0	71,493
Total	1,051,933	0	0	1,051,933

According to the registered PDD, the estimated value of emission reduction during this monitoring period is 253,336 tCO₂e per year. The total estimated value of the emission reduction is calculated as:

$$\text{Total Estimated ER}_y = \frac{253,336 \text{ tCO}_2\text{e} \times \text{number of monitored days}}{365}$$

In the monitoring period from 01/10/2012 to 31/03/2017 (1,643 days), the estimated emission reduction is 1,140,359 tCO₂e, while the actual emission reduction is 1,051,933 tCO₂e.

Table 4: The comparison of emission reductions between the estimated and actual value.

Estimated ER _y during Monitoring Period (tCO ₂ e)	Actual ER _y during Monitoring Period (tCO ₂ e)	Difference Percentage (%)
1,140,359	1,051,933	-7.75%

Thus, the actual emission reduction is 7.75% lower than the estimated emission reduction, which caused by the increasing frequency of dry weather in Hunan Province, the reduction of rainfall, and the reduction of Zishui river water volume.