Monitoring report form
(Version 04.0)

MONITORING REPORT	
Title of the project activity	Sichuan Keguang 1st Level Hydropower Project
Reference number of the project activity	5612
Version number of the monitoring report	1.0
Completion date of the monitoring report	10/09/2014
Registration date of the project activity	06/03/2012
Monitoring period number and duration of this monitoring period	Monitoring Period：06/03/2012-18/07/2014
Project participant(s)	Jiangyou City Keguang Hydropower Co.，Ltd. Arcadia Energy (Suisse) SA
Host Party(ies)	The People's Republic of China Switzerland
Sectoral scope and selected methodology(ies), and where applicable, applied tandardized baseline(s)	Sectoral Scope： Energy industries (renewable sources) -- Hydropower Project Applied Methodologies： ACM0002 (Version 12.1.0)
Estimated amount of GHG emission reductions or net anthrop genic GHG removals by sinks for this monitorin period in the registered PDD	189,487tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	132,437tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period up to 31 December 2012(if applicable)	56,063tCO_2e
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved during the period from 1 January 2013 onwards (if applicable).	76,374tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Sichuan Keguang 1st Level Hydropower Project (hereafter referred to as "the project") is located in the Fujiang River of Jiangyou City, Sichuan Province, the People's Republic of China. The total installed capacity of the project is 20 MW, and the annual utilization hours are 4,735 h. The nominal water level surface of the reservoir is 0.518 km^2 and related power density is 38.61W/m^2.

After the proposed project is put into operation, the annual electricity generation is 94,700 MWh with the net electricity of 93,753 MWh will be supplied to Central China Power Grid (CCPG) annually. The baseline scenario is the same as the scenario existing prior to the start of implementation of the project activity.

The project won't produce any greenhouse gas (GHG) during the operation. The electricity generated by the project can displace part of the power from the fossil fuel-fired power plants of CCPG, and the expected annual GHG emission reductions are 79,957 tCO_2e.

The project activity will promote the local and national sustainable development powerfully in the following aspects:

- Reduce the GHG emission to mitigate the global warming trend by providing clean electric power;
- Mitigate the shortage of power in Sichuan Province, and promote the local economic development;
- The project activity can create considerable job opportunities during the construction period and operation period. The project will also promote the local development in industry, agriculture and service trade.

A.2. Location of project activity

>>

The project is located in Sanhe Town, Jiangyou City, Sichuan Province, P. R. China.

The geographical data is as follows:

104°43′30″E, 31°43′57″N

The project location is shown in Fig. 1.

A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
The Peoples' Republic of China (host)	Jiangyou City Keguang Hydropower Co., Ltd.	No
Switzerland	Arcadia Energy (Suisse) SA	No

A.4. Reference of applied methodology and standardized baseline

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1. Baseline and Monitoring methodology

Approved consolidated baseline and monitoring methodology ACM0002 (Version 12.1.0): Consolidated baseline methodology for grid-connected electricity generation from renewable sources

2. References:

Tool for the demonstration and assessment of additionally (Version 05.2);
Tool to calculate the emission factor for an electricity system (Version 2).

More information on the methodology and methodological tools listed above is available at the following website: http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

A.5. Crediting period of project activity

>>
06/03/2012-05/03/2022

A.6. Contact information of responsible persons/ entities

>>
F8,Keji A, Jinyang Knowledge Economic Industrial Zone, Guiyang City,550081,Guizhou Province, China.

Name: Long Wanying
Email: gz_lwy@126.com

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

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The Purchase Agreement of Water-turbine Generator Units was signed which is the earliest real action of the proposed project, and is marked as the project starting date. The construction of the project was started on October, 2010 due to the CDM incentives.

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline

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There is no request for deviation applied to this monitoring period.

B.2.2. Corrections

>>
There have not been any corrections to project information or parameters fixed at validation during the current monitoring period.

B.2.3. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

>>
There has not been any change in the monitoring plan during the current monitoring period.

B.2.4. Changes to project design of registered project activity

>>
There are no changes to the project design of registered project activity.

B.2.5. Changes to start date of crediting period

>>
There has not been any change in the monitoring plan during the current monitoring period.

B.2.6. Types of changes specific to afforestation or reforestation project activity

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N/A

SECTION C. Description of monitoring system

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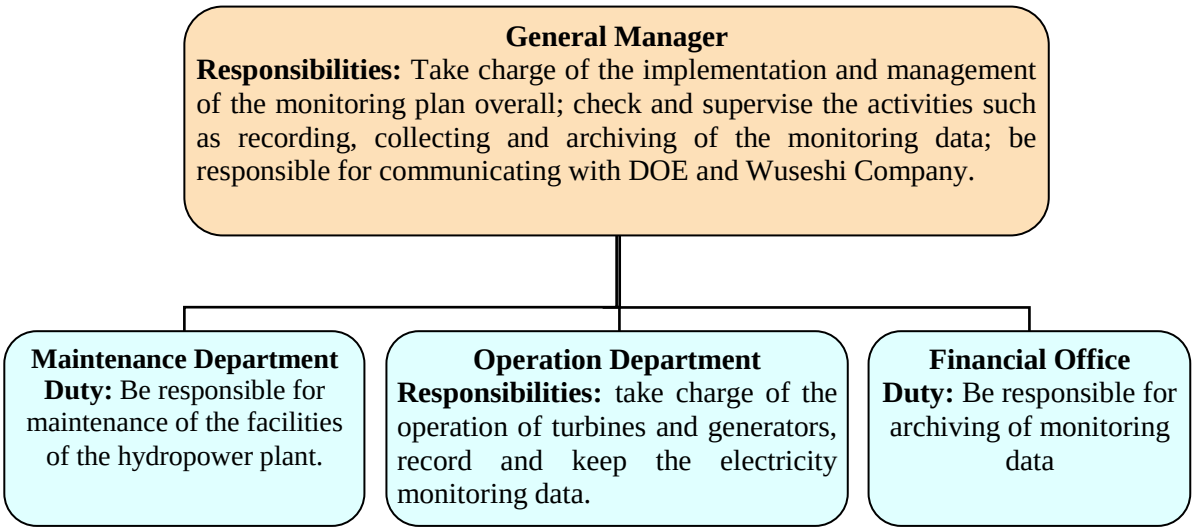
1. Monitoring subject

The main data monitored are the net electricity delivered to CCPG by the project, the installed capacity of the project and the area of the reservoir measured in the surface of the water, when the reservoir is full. The net electricity is calculated according to the generated electricity and the purchased electricity and supplied to the grid, thus to calculate the emission reduction of the project.

2. Monitoring management structure

In order to obtain reliable monitoring data, the project owner will establish a monitoring management structure prior to the start of the crediting period. Clear responsibilities will be assigned to all staffs involved in the CDM project. A General Manager will be appointed who has the overall responsibilities for the monitoring of the project, other staffs will be responsible for the data recording, data collecting, data archiving and emission reductions calculation. The detailed structure is as follows:

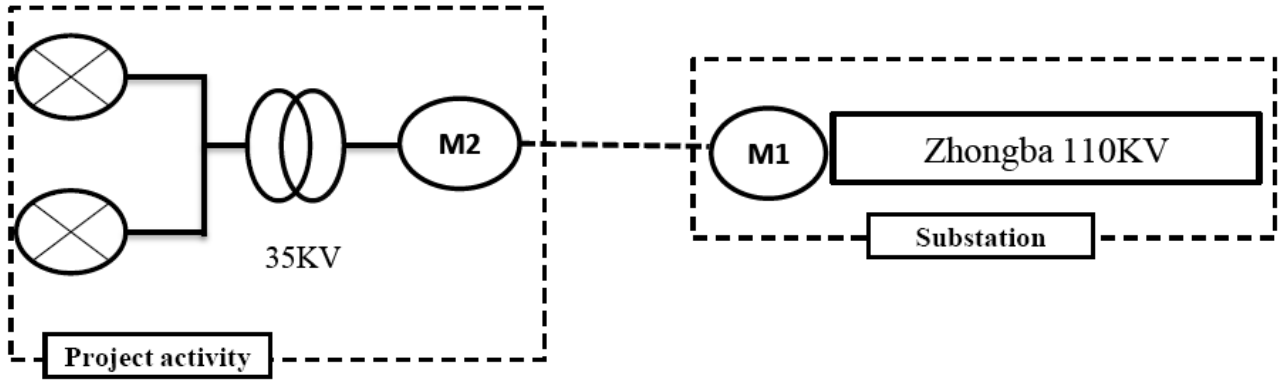


3. Monitoring programmed and equipments

Grid-connected electricity generated by the proposed project will be monitored through metering equipment M1 (main meter) at the Zhongba Substation (interconnection facility connecting the plant to the grid), M2 (backup meter) at the output end of the proposed project.The meters will be installed in accordance with "Technology & Management Regulations for Power Metering Devices" (DL/T448-2000), the accuracy of the meters will be 0.5S or the accuracy of 0.5S or more accurate.

The simplified monitoring diagram is as follow:

The simplified monitoring diagram is as follow:



So the net electricity supplied to the grid of the project used for calculating its emission reduction is calculated as:

$$EG_{facility,y} = EG_{output,y} - EG_{linput,y}$$

Where:
$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant/unit to the grid in year y
$EG_{output,y}$ = Quantity of the electricity supplied by the proposed project to the grid in year y
$EG_{linput,y}$= Quantity of the electricity imported by the proposed project from the grid in year y

4. Data monitoring
The readings of the main meter are used for calculating the emission reductions when the main meter is in normal operation state. The monitoring processes are as follows:
(1) The installed capacity of the hydro power plant after the implementation of the project activity and area of the reservoir measured in the surface of the water, after the implementation of the project activity, when the reservoir is full will be measured annually by a qualified third entity.
(2)In each of month, the designated persons from the grid company and the project company record the readings of the meter for the electricity delivered to CCPG and consumed by the project activity from CCPG for last month;
(3) The project owner provides the power grid company with a sale receipt, and preserves the copy of the sale receipt.

5. Quality control
1) Calibration of meters
The calibration of meters conducted by a qualified organization must comply with "Technology & Management Regulations for Power Metering Devices" (DL/T448-2000) to ensure the accuracy. The main meter and back-up meter at the connection point to the grid will be calibrated once per year.
When the main meter or back-up meter have a breakdown, the party finding the breakdown should tell another party and inform the qualified calibration organization to check, calibrate, test and treat the meter so as to recover the normal monitoring state.
2) Emergency treatment
When the main meter or back-up meter have a breakdown, the electricity generation difference will be treated as follows:
(1) When one of the two meters has a breakdown, the readings of another meter will be adopted;
(2) According to the conservative principle, if both the main and back-up meters are damged, the ERs must be abandoned..

6. Data management
All monitoring data and records will be archived electronically and be kept at least for 2 years after the end of the last crediting period.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data / Parameter:	$NCV_{i,y}$
Unit:	kJ/kg or kJ/m^3
Description:	The net calorific value (energy content) per mass or volume unit of fuel i in year y
Source of data:	China Energy Statistical Yearbook 2008
Value(s) applied):	See Annex 3 for details
Purpose of data:	Data used are from Chinese authorities
Additional comment:	

Data / Parameter:	$EG_{Thermal,j,y}$
Unit:	MWh
Description:	The electricity generated by fuel-fired power plants in province j in CCPG in year y
Source of data:	China Electric Power Yearbook 2006-2008
Value(s) applied):	See Annex 3 for details
Purpose of data:	Data used are from Chinese authorities
Additional comment:	

Data / Parameter:	$IPCR_{j,y}$
Unit:	%
Description:	The internal power consumption rate of power plants in province j in CCPG in year y.
Source of data:	China Electric Power Yearbook 2006-2008
Value(s) applied):	See Annex 3 for details
Purpose of data:	Data used are from Chinese authorities
Additional comment:	

Data / Parameter:	$EF_{CO2,\ i,y}$
Unit:	10^4 t, 10^8 m3
Description:	he quantity of fuel i (in a mass or volume unit) consumed by CCPG in year y
Source of data:	China Energy Statistical Yearbook 2008
Value(s) applied):	See Annex 3 for details
Purpose of data:	Data used are from Chinese authorities
Additional comment:	

Data / Parameter:	$CAP_{j,\ y}$
Unit:	MW
Description:	The net calorific value (energy content) per mass or volume unit of fuel i in year y
Source of data:	China Energy Statistical Yearbook 2008
Value(s) applied):	See Annex 3 for details
Purpose of data:	Data used are from Chinese authorities
Additional comment:	

Data / Parameter:	$GENE_{Coal,Adv}$
Unit:	/
Description:	The power supply efficiency of coal-fired power plants with best technology commercially available
Source of data:	China's Regional Grid Baseline Emission Factors 2009
Value(s) applied):	38.10%
Purpose of data:	Data used are from Chinese authorities
Additional comment:	

Data / Parameter:	$GENE_{Oil,Adv,y}$
Unit:	/
Description:	The power supply efficiency of oil-fired power plants with best technologies commercially available
Source of data:	China's Regional Grid Baseline Emission Factors 2009
Value(s) applied):	49.99%
Purpose of data:	Data used are from Chinese authorities
Additional comment:	

Data / Parameter:	$GENE_{Gas,Adv,y}$
Unit:	/
Description:	The power supply efficiency of oil-fired power plants with best technologies commercially available
Source of data:	China's Regional Grid Baseline Emission Factors 2009
Value(s) applied):	49.99%
Purpose of data:	Data used are from Chinese authorities
Additional comment:	

D.2. Data and parameters monitored

Data / Parameter:	$EG_{facility,y}$
Unit:	MWh/yr
Description:	Quantity of net electricity generation supplied by the project plant/unit to the grid in year *y*
Measured/ Calculated / Default:	
Source of data:	Project activity site
Value(s) of monitored parameter:	155,287.475
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	Continuous measurement and at least monthly recording

QA/QC procedures:	The main meter will be calibrated once a year and net electricity supplied by the project activity to CCPG would be double checked by receipt of sales
Purpose of data:	
Additional comment:	/

Data / Parameter:	*EGoutput,y*
Unit:	MWh/yr
Description:	Quantity of the electricity supplied by the proposed project to the grid in year *y*
Measured/ Calculated / Default:	
Source of data:	Electricity meter
Value(s) of monitored parameter:	155,309.525
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	Continuous measurement and at least monthly recording
QA/QC procedures:	he electricity meter will be calibrated once a year and net electricity supplied by the project activity to CCPG would be double checked by receipt of sales, and the date will be archived for 2 years after the end of the crediting period.
Purpose of data:	
Additional comment:	

Data / Parameter:	$EG_{input,y}$
Unit:	MWh/yr
Description:	Quantity of the electricity imported by the proposed project from the grid in year *y*
Measured/ Calculated / Default:	
Source of data:	Electricity meter
Value(s) of monitored parameter:	22.050
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	Continuous measurement and at least monthly recording
QA/QC procedures:	The electricity meter will be calibrated once a year and net electricity supplied by the project activity to CCPG would be double checked by receipt of purchase, and the date will be archived for 2 years after the end of the crediting period.
Purpose of data:	
Additional comment:	

Data / Parameter:	Cap_{Pj}
Unit:	W
Description:	Installed capacity of the hydro power plant after the implementation of the project activity
Measured/ Calculated / Default:	
Source of data:	Project site
Value(s) of monitored parameter:	20,000,000
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	Yearly monitored based on recognized standards
QA/QC procedures:	/
Purpose of data:	
Additional comment:	

Data / Parameter:	A_{PJ}
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
Measured/ Calculated / Default:	
Source of data:	Project site
Value(s) of monitored parameter:	518,000
Monitoring equipment:	
Measuring/ Reading/ Recording frequency:	
Calculation method (if applicable):	Yearly measured from topographical surveys and maps
QA/QC procedures:	/
Purpose of data:	
Additional comment:	

D.3. Implementation of sampling plan

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N/A

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

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According to baseline methodology ACM0002 (Version 12.1.0), the baseline emissions are the CO_2 emissions from the equivalent electricity supply by CCPG that is displaced by the project activity. So the baseline emissions by the project activity during a given year y is obtained as follow:

$$BE_y = EG_{PJ,y} \bullet EF_{grid,CM,y} \quad (1)$$

Where:
BE_y = Baseline emissions in year y (tCO_2/yr)
EG_y = Electricity supplied by the project activity to the grid in year y (MWh)
$EF_{grid,CM,y}$, = Combined margin CO_2 emission factor for grid connected power generation in year y calculated using "Tool to calculate the emission factor for an electricity system" (version 2.2.1).

According to baseline methodology ACM0002, for Greenfield renewable energy power plants:

$$EG_{PJ,y} = EG_{facility,y} \quad (2)$$

Where:
$EG_{PJ,y}$ = Quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y (MWh/yr)
$EG_{facility,y}$ = Quantity of net electricity generation supplied by the project plant to the grid in year y (MWh/yr)

The emission coefficient (measured in kg CO_2e/kWh) should be calculated in a transparent and conservative manner as: 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" (Version 2.2.1).
The data used for calculation are from an official source (where available) and publicly available. The calculation processes are as follows:

STEP 1: Identify the relevant electricity system.
STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional).
STEP 3: Select a method to determine the operating margin (OM).
STEP 4: Calculate the operating margin emission factor according to the selected method.
STEP 5: Identify the group of power units to be included in the build margin (BM).
STEP 6: Calculate the build margin emission factor.
STEP 7: Calculate the combined margin (CM) emissions factor.

STEP 1: Identify the relevant electricity system
According to "Tool to calculate the emission factor for an electricity system" (Version 2.2.1), as the generated electricity of the proposed project will be delivered to CCPG, relevant electricity system is defined as all power plants connected to CCPG, which includes Jiangxi Province, Henan Province, Hubei Province, Hunan Province, Sichuan Province and Chongqing City.

STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional)
According to "Tool to calculate the emission factor for an electricity system" (Version 2.2.1), there are two options to calculate e 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.

For the proposed project, Option I is chosen.

STEP 3: Select a method to determine the operating margin (OM)
According to "Tool to calculate the emission factor for an electricity system" (Version 2.2.1), there are four methods for calculating the $EF_{grid,OM,y:}$

(a) Simple OM, or
(b) Simple adjusted OM, or
(c) Dispatch Data Analysis OM, or
(d) Average OM

Method (a) can 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 data for hydroelectricity production. It can be found from Table 9 that the low-cost/must run resources including hydro, geothermal, wind, low-cost biomass constitute less than 50% of CCPG during year 2003 to 2007. Thus, method (a) is applicable to calculate $EF_{grid,OM,y}$.

Table 10 Percentage of low-cost/must run resources in CCPG during year 2003～2007 (China Electric Power Yearbook 2004~2008).

Year	2003	2004	2005	2006	2007
Percentage (%)	34.43	38.54	38.18	36.57	35.46

For the project, $EF_{grid,OMsimple,y}$ is calculated using ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period.

STEP 4: Calculate the operating margin emission factor according to the selected method
According to "Tool to calculate the emission factor for an electricity system" (Version 2.2.1), there are two options based on different data for calculating $EF_{grid,OMsimple,y}$:

Option A: Based on the net electricity generation and a CO_2 emission factor of each power unit; or
Option B: Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system.

For the project, the necessary data for Option A is not available, so Option A can't be used, Option B can be used if only nuclear and renewable power generation are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known and off-grid power plants are not included in the calculation. There isn't any nuclear power in CCPG at present and renewable power generation are considered as low-cost / must-run power sources in CCPG, and the quantity of electricity supplied to CCPG by these sources is known and off-grid power plants are not included in the calculation, so Option B is used for calculating EFgrid,OMsimple,y, the formula is as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i (FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y})}{EG_y} \quad (3)$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,y}$ = Amount of fossil fuel type i consumed in the project electricity system 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_y = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year y (MWh)
I = All fossil fuel types combusted in power plant/unit m in year y
y = The relevant year as per the data vintage chosen in step 3

The calculation method of $EF_{grid,OMsimple,y}$ issued by National Development and Reform Commission is referred to for the project, to see A1～A7 in Annex 3 for details.

STEP 5: Identify the group of power units to be included in the build margin (BM)
According to "Tool to calculate the emission factor for an electricity system" (Version 2.2.1), the sample group of power units m used to calculate the build margin consists of either:
(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.

The set of power units that comprises the larger annual generation should be used.

According to "China's Regional Grid Baseline Emission Factor 2009" issued by National Development and Reform Commission on 2 July 2009, because of the unavailability of the data at the power plant level in China, a deviation method is used to calculate the build margin emission factor, to see Step 5 for details.

STEP 6: Calculate the build margin emission factor
Build Margin emission factor (EF grid, BM, y) is calculated by utilizing an ex-ante 3 years data vintage for CCPG, the formulae as follow:

$$EF_{grid,BM,y} = \frac{\sum_{i,m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \quad (4)$$

Where：

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO2/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 (tCO2/MWh)
m	=	Power units included in the build margin
y	=	Most recent historical year for which power generation data is available

"Tool to calculate the emission factor for an electricity system" (Version 2.2.1) provides two options (Option 1 and Option 2) to calculate the build margin emission factor in terms of vintage of data.

Option 1 is chosen to calculate the build margin emission factor. 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 CDM-PDD submission to the DOE 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 DOE. 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.

Because of the data unavailability at the power plant level in China, the 22nd CDM EB meeting agreed the following deviation20 approaches for $EF_{grid,BM,y}$ calculation:
20 National Statistics Bulletin of Power Industry in 2009, China Electricity

1) Use the efficiency level of the most advanced commercialized technologies of provincial/regional or national grid of China, as a conservative proxy, for fuel i consumption estimation to estimate the $EF_{grid,BM,y;}$

2) Use of capacity additions during last several years for estimating the $EF_{grid,BM,y}$ i.e. the capacity addition over last several years, whichever results in a capacity addition that is closest to 20% of total installed capacity;

3) Use of installed capacity to replace annual power generation to estimate weights.

Due to the difficulty of separating the coal-fired, gas-fired or oil-fired installed capacity from the total thermal installed capacity, the $EF_{grid,BM,y}$ will be calculated as:

1) Based on the most recent years energy balance of the CCPG, calculating the proportions of CO_2 emissions from the coal-fired, oil-fired and gas-fired power plants in total CO_2 emissions of thermal power plants and taking them as weights of each type of plants in the following calculations;

2) Based on the most advanced commercialized technologies which applied by the coal-fired, oil-fired and gas-fired power plants, calculating the emission factor of thermal power plants in CCPG. This approach is more conservative as it assumes all recently built plants have the fuel efficiency as that of the most advanced commercialized technologies;

3) Calculating the $EF_{grid,BM,y}$ through multiplying the emission factor of thermal power plants by the percentage share of thermal power plants installed capacity addition within all recently built installed capacity. The proper year is selected so that it is the closest time when the last 20% of installed capacity was built.

The BM is calculated as the following sub-steps.

SUB-STEP 6a: Calculating the percentages of CO_2 emissions from the coal-fired, gas-fired and oil-fired power plants in CO_2 emissions from total thermal power plants

$$\lambda_{Coal,y} = \frac{\sum_{i \in Coal,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (5)$$

$$\lambda_{Oil,y} = \frac{\sum_{i \in Oil,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (6)$$

$$\lambda_{Gas,y} = \frac{\sum_{i \in Gas,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}} \quad (7)$$

Where:

$\lambda_{Gas,y}$ = Percentage of CO_2 emissions from the gas-fired power plants in CO_2 emissions from total thermal power plants in year y

$\lambda_{Oil,y}$ = Percentage of CO_2 emissions from the oil-fired power plants in CO_2 emissions from total thermal power plants in year y

$\lambda_{Coal,y}$ = Percentage of CO_2 emissions from the coal-fired power plants in CO_2 emissions from total thermal power plants in year y

$F_{i,j,y}$ = Amount of fuel i (mass or volume unit, t for solid and liquid fuel, m^3 for gas fuel) consumed by the power sources of province j in year y

$NCV_{i,j}$= Net calorific value (energy content) of fossil fuel type i in year y (GJ/t for solid and liquid fuel, GJ/m^3 for gas fuel)

$EF_{CO2,i,j,y}$= CO_2 emission factor of fossil fuel type i in year y (tCO_2/MWh)

SUB-STEP 6b: Calculating the fuel-fired emission factor ($EF_{Thermal}$)

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} \quad (8)$$

.

Where:

$EF_{Thermal,y}$= Emission factor of thermal power plants

$EF_{Coal,Adv,y}$= Emission factor of coal-fired power plants applying the most advanced commercialized technologies

$EF_{Oil,Adv,y}$= Emission factor of oil-fired power plants applying the most advanced commercialized technologies ,,
$EF_{Gas,Adv,,y}$= Emission factor of gas-fired power plants applying the most advanced commercialized technologies
SUB-STEP 6c: Calculating the Build Margin (BM) emission factor ($EF_{grid,BM,y}$)

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (9)$$

Where:
$EF_{grid,BM,y}$ = Build Margin (BM) emission factor with advanced commercialized technologies for year y of CCPG
$CAP_{Total,y}$ = Incremental installed capacity of recently built power plants, which constitutes near and greater than 20% of the total installed capacity
$CAP_{Thermal,y}$= Newly installed capacity of recently built thermal power plants
$EF_{Thermal,y}$= Emission factor of thermal power plants

$EF_{grid,BM,y}$is calculated according to the latest available data at the submission time of this PDD, the detailed data for the calculations is shown in Table A8-Table A10 of Annex 3.

STEP 7: Calculate the combined margin (CM) emissions factor
According to "Tool to calculate the emission factor for an electricity system" (Version 2.2.1), baseline emission factor EF_y is calculated as the weighted average of the Operating Margin emission factor ($EF_{grid,OM,y}$) and the Build Margin emission factor ($EF_{grid,BM,y}$):

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \quad (10)$$

Where:
w_{OM} = Weighting of operating margin emission factor (%)
w_{BM} = Weighting of build margin emission factor (%)

The weighs w_{OM} and w_{BM}, by default, are 50% (i.e., w_{OM}= w_{BM}= 0.5) in the first crediting period , and w_{OM}= 0.25,w_{BM}= 0.75 in the second and third crediting period.

According to the formula (2)-(10) in section E.1,the result of $EF_{grid,OM,y,}$ $EF_{grid,BM,y}$and $EF_{grid,CM,y}$ are lisred in following Table 11,the detailed calculation is shown in annex3.
Table 11 Calculating result of baseline emission factor of CCPG

$EF_{grid,OM,y}$ (tCO_2e/MWh)	$EF_{grid,BM,y}$ (tCO_2e/MWh)	$EF_{grid,CM,y}$ (tCO_2e/MWh)
1.1255	0.5802	0.85285

According to the formula (1) in section E.1,the baseline emissions (BE_y) of the project in a typical year are calculated as follows:

$$BE_y = EG_y \bullet EF_y = 0.85285\ tCO_2e/MWh \times 155287.475\ MWh = 132{,}437 tCO_2$$

E.2. Calculation of project emissions or actual net GHG removals by sinks

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According to the baseline methodology ACM0002 (Version 12.1.0), the power density of the project is calculated as follows:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$

Where:
PD = Power density of the project activity (W/m^2)
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 (m^2)
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 (m^2). For new reservoirs, this value is zero

As the project will build a new reservoir, Cap_{BL} and A_{BL} are zero.

PD = (20,000,000 W-0) / (518,000 m^2-0) = .38.61 W/m^2

The power density of the project is larger than 10 W/m^2, so PE_y =0.

E.3. Calculation of leakage

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According to baseline methodology ACM0002 (Version 10), no leakage emissions are considered.

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO_2e)	Project emissions or actual net GHG removals by sinks (t CO_2e)	Leakage (t CO_2e)	Emission reductions or net anthropogenic GHG removals by sinks (t CO_2e)
Total	132,437	132,437	0	132,437

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO_2e)	79,957	132,437

E.6. Remarks on difference from estimated value in registered PDD

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NA

E.7. Actual emission reductions or net anthropogenic GHG removals by sinks during the first commitment period and the period from 1 January 2013 onwards

Item	Actual values achieved up to 31 December 2012	Actual values achieved from 1 January 2013 onwards
Emission reductions or GHG removals by sinks (t CO_2e)	56,063	76,374

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Appendix 1. Contact information of project participants and responsible persons/ entities

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for completing the CDM-MR-FORM
Organization name	Jiangyou City Keguang Hydropower Co., Ltd.
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