Project design document form for CDM project activities

(Version 06.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Hunan Chenxi Dafutan Hydropower Station
Version number of the PDD	Version 5.0
Completion date of the PDD	23/11/2015
Project participant(s)	Hunan Chenxi Dafutan Hydropower Co., Ltd.
Host Party	P.R. China
Sectoral scope and selected methodology(ies), and where applicable, selected standardized baseline(s)	Sectoral Scope: 1 Energy industries (renewable energy resources Selected methodology: ACM0002: Grid-connected electricity generation from renewable sources --- Version 16.0
Estimated amount of annual average GHG emission reductions	376,659tCO_2e

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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The Hunan Chenxi Dafutan Hydropower Station Project (hereafter referred to as 'the project' or 'project') involves the construction and operation of a hydropower station with daily regulation in the middle of Yuanshui River in Chenxi County of Huaihua City in Hunan Province, China.

The main objective of the project is to generate power from clean renewable hydro power in Hunan Province and contribute to the sustainability of power generation of the Central China Power Grid (CCPG).

The project will install five turbines with a total installed capacity of 200MW. The surface area of the reservoir is 24.5km^2 with a power density is 8.16W/m^2. The average annual operating hours is 4,032 hours, the average annual electricity generation is 806,400MWh, and the electricity supplied to the grid is estimated to be 750,760MWh, corresponding to the annual emission reduction of 376,659tCO_2e. The total emission reduction in the second crediting period is 2,636,613tCO_2e.

The project will connect to Hunan Grid via a 220kV line and two 110kV lines, and finally to the CCPG.
The electricity generated by the project should have been supplied by the Central China Grid prior to the start of the implementation of the project activity, which is the same as the baseline scenario.

The project activity's contributions to sustainable development are:

- Reducing the dependence on exhaustible fossil fuels for power generation;
- Reducing air pollution by replacing coal-fired power plants with clean, renewable power;
- Adjusting the electricity structure of the local grid and the peak performance;
- Reducing the adverse health impacts from air pollution;
- Reducing the emissions of greenhouse gases, to combat global climate change;
- Contributing to local economic development through employment creation and increasing local financial incomes:
- Improving local transportation conditions.

The project is a registered CDM project activity (ref. No. 1872) and is not a CPA that has been excluded from a registered CDM PoA as a result of erroneous inclusion of CPAs.

A.2. Location of project activity

A.2.1. Host Party

>>
People's Republic of China

A.2.2. Region/State/Province etc.

>>
Hunan Province

A.2.3. City/Town/Community etc.

>>
Chenxi County, Huaihua City

A.2.4. Physical/Geographical location

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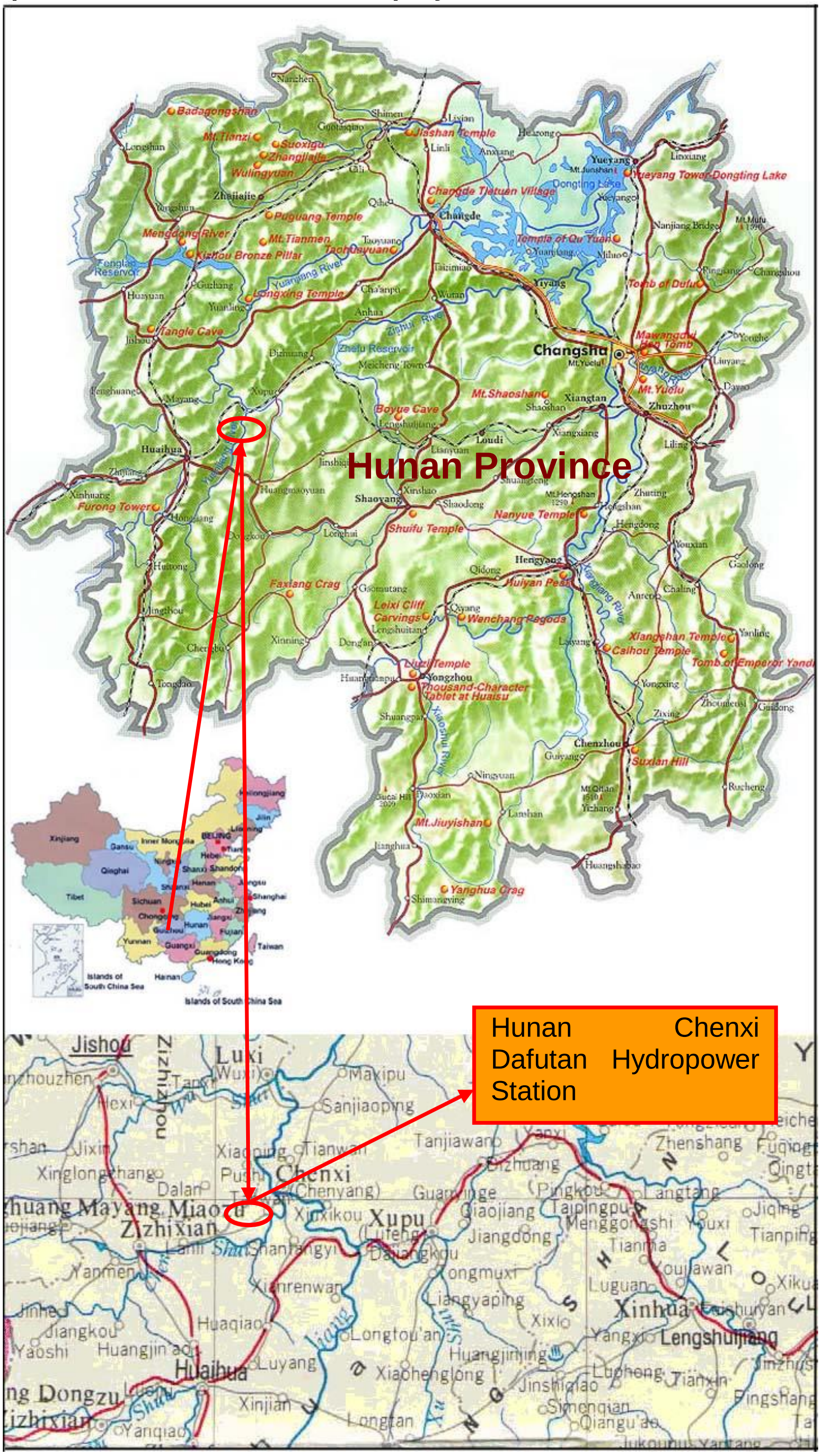
The project is located at the midstream of the Yuanshui River, bordering Muzhou village in Chenxi County of Huaihua City in Hunan Province, China. Yuanshui River belongs to Dongting water system, and the approximate coordinates of the project are east longitude of 110º15’46” and north latitude of 27º58’55”. The dam site is 8.5km away from Chenxi County. The project’s reach along the Yuanshui River extends across Chenxi and Xupu is 52 km. Figure A.1 shows the location of the project.

Figure A.1: Map of Hunan Province and the project location



A.3. Technologies and/or measures

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<u>The scenario existing prior to the start of the implementation of the project activity (the same as baseline scenario):</u>

The electricity should have been supplied by the Central China Grid, prior to the start of the implementation of the project activity, which is the same as the baseline scenario. The Central China Grid is dominated by electricity generated by fossil fuel fired plants, whose by-products are GHGs.

<u>The project scenario:</u>
The project involves the construction of an integrated dam / power house type hydropower station. The proposed project is located around a small island in the Yuanshui River. On the left bank, a gravity dam with twelve floodgates were constructed. Between this dam and the island, a sluicing structure was constructed to provide a passage to boats on the river. The dam between the island and the right bank of the river was consist of eight flood gates and a water intake / power house section. The water intake leaded the water into the turbines after which the water is returned to the river. The turbines that installed were bulb-type propeller turbines that are suitable for hydropower schemes with low head and medium / high water flow. The project installed five turbine/generator sets with an individual capacity of 40 MW. Also included in the project are 3 on-site transformer stations, one boosting generated electricity to 220kV and two boosting generated electricity to 110kV.

The normal water level of the reservoir is 129 meters above sea level. The reservoir capacity is 144,500,000m^3 with daily regulating capacity, the surface area of the reservoir is 24.5km^2 corresponding to a power density of 8.16W/m^2 and the length of backwater is 50.5km. The average annual operating hours is 4,032 hours, therefore, the load factor is 46%[1].

The power of the proposed project will be generated by five units of GZB845-WP-670 turbines with total installed capacity of 200MW, and five units of SFWG40-70/7450 generators are matched with the turbines. The key technology parameters are as shown in Table A.1.

Table A.1 Technical data of the turbine / generator units

Turbine	Type	Designation	Rated Water Head	Rated Flow Rate	Rated Power	Lifetime[2]	Manufacturer
5	Bulb-type propeller	GZB845-WP-670	11.2 m	395.025 m^3/s	40.816 MW	150,000 hours	Sichuan Dongfeng Generators Co., Ltd.
Generator	Type	Designation	Rated Voltage	Rated Capacity	Power Factor	Lifetime[3]	Manufacturer
5	Integrated in bulb turbine	SFWG40-70/7450	10.5 kV	40 MW	0.95 (delay)	30 years	Sichuan Dongfeng Generators Co., Ltd.

The power generated was transmitted through three lines, one 220kV transmission line to Wantan 220kV transformer substation, one 110kV transmission line to Chenxi 110kV transformer substation, and one 110kV transmission line to Huomachong 220kV transformer substation, and then transmitted to Huaihua City Grid, and finally to the CCPG.

There is no technology transfer since all the technology employed is domestic.

The employees received the appropriate training regarding the employed technology, regulations and safety requirements before the start of operations. Beijing Tianqing Power International CDM Consulting, Co., Ltd. provided trainings on CDM monitoring.

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[1] The load factor is calculated as 4032/8760=46%.

[2] Data is abstracted from “Tool to determine the remaining lifetime of equipment”(Version 01)”

[3] Data is abstracted from “Tool to determine the remaining lifetime of equipment”(Version 01)”

A.4. Parties and project participants

Party involved (host) indicates 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)
China (host)	Hunan Chenxi Dafutan Hydropower Co., Ltd. (as the project owner)	No

A.5. Public funding of project activity

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There is no public funding from Annex Ⅰ parties available to the proposed project.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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Approved consolidated baseline and monitoring methodology ACM0002 (Version 16.0): Grid-connected electricity generation from renewable sourcess (Valid from 28 Nov. 14 onwards)

The methodology draws upon of the “Tool for the demonstration and assessment of additionality” (Version 07.0.0), “Tool to calculate the emission factor for an electricity system” (Version 04.0) and “Tool to calculated project or leakage CO_2 emission from fossil fuel combustion” (Version02).

The tool “Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)” will be employed, which is used for assessment of the validity of the original baseline and update of the baseline. The tool can be found from:
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-11-v3.0.1.pdf

For more information on the baseline and monitoring methodology we refer to the UNFCCC website: http://cdm.unfccc.int/methodologies/DB/EY2CL7RTEHRC9V6YQHLAR6MJ6VEU83

B.2. Applicability of methodology and standardized baseline

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The baseline and monitoring methodology ACM0002 is applicable to the proposed project, because the project meets all the applicability criteria stated in the methodology:

- The project is a Greenfield grid-connected renewable power generation project.
- The project is a Greenfield hydro power project, and the project results in new single reservoir and the power density is 8.16W/m^2, which is greater than 4W/m^2.
- The project does not involve an on-site switch from fossil fuels to a renewable source.

The latest version of ACM0002 (version 16.0) has been applied. In addition, the project also meets with the conditions included in the tools referred above.

B.3. Project boundary

The spatial extent of the project boundary includes the project power plant/unit and all power plants/units connected physically to the electricity system that the CDM project power plant is connected to.

The electricity system is defined according to the latest version of the *"Tool to calculate the emission factor for an electricity system" Version 04.0*.

In this specific case, the power generated by the project will be connected to the Hunan Grid, and finally to the CCPG. The CCPG, is a larger regional grid, which consists of six sub-grids: Hunan, Hubei, Jiangxi, Sichuan, Chongqing and Henan Grids. According to the guidance above, it is justifiable to clarify the CCPG as the right project boundary for this specific project activity, considering substantial inter-grid power exchange among the CCPG. As there is net power import from the Northwest China Power Grid (NWCPG) and North China Power Grid (NCPG), NWCPG and NCPG will be included into the physical boundary of the project. According to the guidance given above, it is justifiable to identify the CCPG, NWCPG and NCPG as the project boundary for this specific project.

The greenhouse gases and emission sources included in or excluded from the project boundary are shown in Table B.1 as below:

Table B.1 Emission sources included in or excluded from the project boundary

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	CO_2 emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity	CO_2	Yes	Main emission source
		CH_4	No	Minor emission source
		N_2O	No	Minor emission source
Project scenario	For hydro power plants, emissions of CH_4 from the reservoir	CO_2	No	Minor emission source
		CH_4	Yes	Main emission source. The project activity is a renewable energy project which will not create emission itself. The power density of the project 8.16W/m^2, which is less than 10W/m^2. Therefore, project emission from water reservoirs is calculated in B.6.
		N_2O	No	Minor emission source

The below flow diagram physically delineates the project activity and its relevant information.

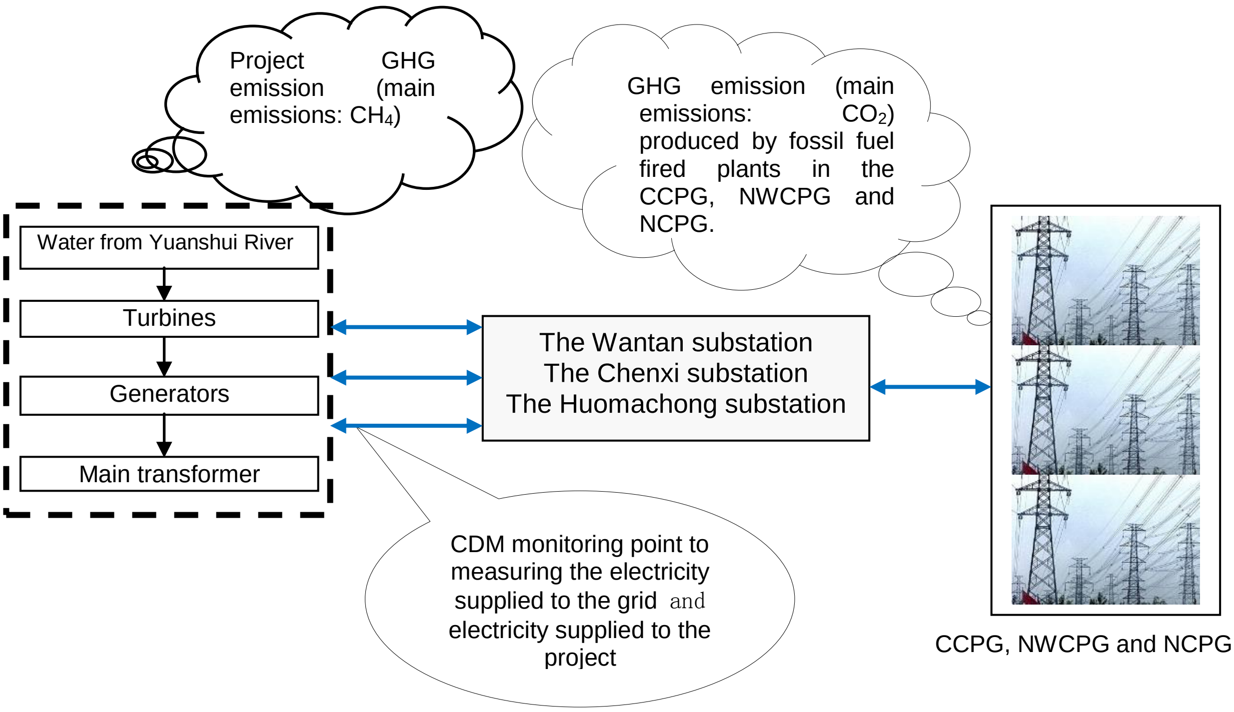

Figure B.1 Project Boundary

B.4. Establishment and description of baseline scenario

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The project power plant is connected to the Hunan Grid via the local grid network, and thus finally to the CCPG. The CCPG is a regional Grid which consists of six sub-grids: Hunan, Hubei, Jiangxi, Sichuan, Chongqing and Henan Grids. According to ACM0002, the baseline scenario of the project is:

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plant and by the addition of new generation sources connected to the CCPG, as reflected in the combined margin (CM) calculations described in the *"Tool to calculate the emission factor for an electricity system" Version 04.0.*

For the second crediting period, the continued validity of the original baseline should be assessed.

According to the tool "Assessment of the validity of the original/current baseline and update of the baseline at the renewal of the crediting period (version 03.0.1)", the stepwise procedure as follows should be adopted:

Step 1: Assess the validity of the current baseline for the next crediting period

Step 1.1: Assess compliance of the current baseline with relevant mandatory national and/or sectoral policies

There are no new national and/or sectoral policies that could affect the baseline scenario during the renewal of the crediting period. Although national policies favor the development of renewable energy sources, total renewable resource based power generation accounts for only

40.76% of total grid generating output in CCPG in 2012. Hence in the absence of the project activity electricity would still have been generated in the existing fossil fuel power plants or by the addition of new fossil fuel power plants connected to the CCPG.

Step 1.2: Assess the impact of circumstances

There is no impact of circumstances existing at the time of requesting renewal of the crediting period on the current baseline emissions.

Step 1.3: Assess whether the continuation of the use of current baseline equipment(s) or an investment is the most likely scenario for the crediting period for which renewal is requested.

This sub-step is applicable to the project activity since the baseline is the continuation of the current practice, i.e. the electricity would be supplied by the power grid in the absence of the project activity. It is clear that the power grid as an electricity system would maintain its technical possibility for a much longer time than the crediting period of the project activity.

Step 1.4: Assessment of the validity of the data and parameters

There are some parameters, which were determined at the start of the first crediting period and not monitored during the first crediting period, are not valid anymore. So the current baseline needs to be updated for the second crediting period according to the tool. This update includes Grid Emission Factor and all values used in its calculation (including OM, BM and emission factors from fuels etc).

Application of Steps 1.1, 1.2, 1.3 and 1.4 confirmed that the current baseline is valid for the second crediting period but data and parameters needs to be updated. Therefore step 2 is used.

Step 2: Update the current baseline and the data and parameters

Step 2.1: Update the current baseline

The baseline emissions for the second crediting period has been updated, without reassessing the baseline scenario, based on the latest approved version of the methodology. This update was applied in the context of the sectoral policies and circumstances that is applicable at the time of requesting for renewal of the crediting period. More details for the updated baseline emissions for the second crediting period can be seen in section B.6.

Step 2.2: Update the data and parameters

As mentioned in step 1.4 above, all parameters regarding the grid emission factor calculation is updated for this second crediting period. More details can be seen in section B.6 and B.7.

B.5. Demonstration of additionality

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The demonstration of additionality is not applicable for the second crediting period.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Project Emissions

According to ACM0002, project emission is estimated as follows:

$$PE_y = PE_{FF,y} + PE_{GP,y} + PE_{HP,y} \quad \text{(Equation B.1)}$$

Where

PE_y = Project emissions in year *y* (tCO_2e/yr);

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y* (tCO_2e/yr);

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (tCO_2e/yr);

$PE_{HP,y}$ = Project emissions from water reservoirs of hydro power plants in year *y* (tCO_2e/yr).

The project utilizes hydropower to generate electricity, so, $PE_{GP,y} = 0$.

When the generators or turbines can not operate because of maintenance, repair, lacking of water and other reasons, the hydropower station will use the power from a diesel installed by the project owner.

Hence there are fossil fuel consumption from the project activity. The project emission from fossil fuel consumption is calculated based on the "Tool to calculated project or leakage CO_2 emission from fossil fuel combustion" (Version02).

Namely:

$$PE_{FF,y} = FC_{diesel} \times COEF_{diesel} \times 850kg/m^3 \text{[4]} \quad \text{(Equation B.2)}$$

Where,

FC_{diesel} is the actual diesel consumption of diesel generator, in m^3.

$COEF_{diesel}$ is the CO_2 emission coefficient of diesel (tCO_2/mass unit).

Since the weighted average mass fraction of carbon of the diesel is not available from the supplier of the diesel.

$COEF_{diesel}$ is calculated as option B ,

$$COEF_{diesel} = NCV_{diesel} \times EF_{CO_2,diesel} \quad \text{(Equation B.3)}$$

NCV_{diesel} is the net calorific value (energy content) per mass or volume unit of diesel, since it is not available from the supplier of the diesel, 2006 Revised IPCC Guidelines for default value *43.3TJ/Gg* is used ;

$EF_{CO_2,diesel}$ is the CO_2 emission factor per unit of energy of diesel, since it is not available from the supplier of the diesel, 2006 Revised IPCC Guidelines for default value 74800kg/TJ is used.

The power density of the project activity (*PD*) is calculated as follows:

$$PD = (Cap_{PJ} - Cap_{BL})/(A_{PJ} - A_{BL}) \quad \text{(Equation B.4)}$$

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[4] The conservative density for diesel 850kg/m^3 will be used.

PD is Power density of the project activity (W/m^2)
Cap_{PJ} is installed capacity of the hydro power plant after the implementation of the project activity (W);
Cap_{BL} is 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} is 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} is 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 hydro power plants, this value is zero.

The project is a new hydro power plant, so Cap_{BL} and A_{BL} are both zero. The surface area of the reservoir at full water level is $24.5km^2$ and installed capacity is 200MW. Therefore, the power density is $8.16W/m^2$, which is less than $10W/m^2$. Therefore,

$$PE_{HP,y} = \frac{EF_{Res} \times TEG_y}{1000} \quad \text{(Equation B.5)}$$

With:

- PE_y, emission from reservoir expressed as tCO_2e/year,
- EF_{Res}, default emission factor for emissions from reservoirs, and the default value as per EB23 is $90kgCO_2e/MWh$),
- TEG_y, total electricity produced by the project activity including the electricity supplied to the grid and the electricity supplied to internal loads, in year y, in MWh.

Therefore,

$$PE_y = PE_{FF,y} + PE_{HP,y} = FC_{diesel} \times COEF_{diesel} \times 850kg/m^3 + \frac{EF_{Res} \times TEG_y}{1000}$$

(Equation B.6)

Baseline Emissions

The baseline scenario of the project is the CCPG provides the equivalent electricity, the baseline emissions are calculated as follows:

$$BE_y = EG_{PJ,y} \times EF_{grid,CM,y} \quad \text{(Equation B.7)}$$

Where,

BE_y = Baseline emissions in year *y* (tCO_2e/yr);

$EG_{PJ,y}$ = 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);

$EF_{grid,CM,y}$ = Combined margin CO_2 emission factor for grid connected power generation in year *y* calculated using the latest version of the "Tool to calculate the emission factor for an electricity system" (tCO_2e/MWh).

The project activity is the installation of a new grid-connected renewable power plant/unit at a site where no renewable power plant was operated prior to the implementation of the project activity, then:

$$EG_{PJ,y} = EG_{facility,y} \quad \text{(Equation B.8)}$$

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/unit to the grid in year *y* (MWh/yr)

According to the “Tool to calculate the emission factor for an electricity system” (version 04.0), baseline emissions of the project activity substituted by electricity generated by the power plants in an electricity system is calculated based on the estimation of the “operating margin”(OM) and “build margin”(BM), as well as the “combined margin”(CM).

The tool provides procedures to determine the following parameters:

Parameter	SI Unit	Description
$EF_{grid,CM,y}$	tCO_2e/MWh	Combined margin CO_2 emission factor for the project electricity system in year y
$EF_{grid,BM,y}$	tCO_2e/MWh	Build margin CO_2 emission factor for the project electricity system in year y
$EF_{grid,OM,y}$	tCO_2e/MWh	Operating margin CO_2 emission factor for the project electricity system in year y

$EF_{grid,OM,y}$, $EF_{grid,BM,y}$ $EF_{grid,CM,y}$ calculation for the CCPG is calculated as follows:

According to the “Tool to calculate the emission factor for an electricity system” (version 04.0), the project participants shall apply the following six steps to calculate the combined margin CO_2 emission factor for the CCPG.

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. Calculate the build margin (BM) emission factor
Step 6. Calculate the combined margin emission factor

The Operating Margin Emission Factor ($EF_{grid,OM,y}$) and the Build Margin Emission Factor ($EF_{grid,BM,y}$) calculation for the CCPG is calculated as follows:

Step 1. Identify the relevant electricity system

The Chinese DNA (Office of National Coordination Committee on Climate Change) has published a delineation of the project electricity system and connected electricity systems, which are used for the project, derived from the “*2014 Baseline Emission Factors for Regional Power Grids in China*”, updated by the Chinese DNA on May 11, 2015.
The electricity generated by the project is connected to the CCPG. The CCPG is a larger regional grid, which consists of six sub-grids: Hunan, Hubei, Jiangxi, Sichuan, Chongqing and Henan grid. Therefore, the project selects the CCPG for the calculation of Operating Margin emission factor.
In addition, there is net imported power to the CCPG from the NCPG and NWCPG. Therefore, the NCPG and the NWCPG are considered as part of the relevant electricity system.
To determine the CO_2 emission factor(s) for net electricity imports from the NCPG and the NWCPG, the tool provides three options:
a) $0tCO_2e/MWh$, or

b) The simple operating margin emission rate of the exporting grid, determined as described in step 4 section 6.4.1, if the conditions for this method, as described in step 3 below, apply to the exporting grid; or
c) The simple adjusted margin emission rate of the exporting grid, determined as described in step 4 section 6.4.2 below; or
d) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in step 4 section 6.4.4 below.

The PDD will choose option b).

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

Option Ⅰ: Only grid power plants are included in the calculation.
OptionⅡ: Both grid power plants and off-grid power plants are included in the calculation.
Based on the actual situation of China, Option Ⅰ has been chosen for the calculation (because Option Ⅱ aims to reflect that in some countries, off-grid power generation is significant and can partially be replaced by CDM project activities).

Step 3. Select a method to determine the operating margin (OM)

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

- Simple OM, or
- Simple adjusted OM, or
- Dispatch Data Analysis OM, or
- Average OM.

From 2008 to 2012, in the composition of gross annual generation power for the CCPG, the ratio of power generated by hydropower and other low cost/compulsory resources is as following[5]: 39.29% in 2008, 37.63% in 2009, 37.63% in 2010, 33.84% in 2011 and 40.76% in 2012, obviously far lower than 50%. Based on these considerations, the OM has been calculated according to the Simple OM. Simple OM is appropriate because low cost/ must run resources that account for far less than 50% of the power generation in the CCPG in the most recent years. The “ex-ante” will be employed for OM calculation of the project.

According to “Tool to calculate the emission factor for an electricity system” (Version 04.0), the Simple OM has been employed to calculate the OM.

For simple OM, the emission factor can be calculated using either of the two following data vintages:

- Ex ante option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage. Thus, no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation weighted average. This based on the most recent data available at the time of submission of the CDM-PDD for validation, or
- Ex post option: If the *ex post* option is chosen, the emission factor is determined for the year in which the project activity displaces grid electricity, requiring the emission factor to be

[5] Detailed information is provided in Table 1 of Appendix 4.

updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year y-1 may be used. If the data is usually only available 18 months after the end of the year y, the emission factor of the year proceeding the previous year y-2 may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

Project participant employs “ex-ante vintage” for its operation margin calculation.

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

The simple OM emission factor is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO_2e/MWh) of all generating power plants serving the system, not including low-cost/must-run power/units. The “Tool to calculate the emission factor for an electricity system” (Version 04.0) offers two options for calculating the Simple OM.
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.
Option B can only be used if:
(a) The necessary data for Option A is not available; and
(b) 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
(c) Off-grid power plants are not included in the calculation (i.e., if Option Ⅰ has been chosen in Step-2).

As the net electricity generation and a CO_2 emission factor of each power unit are not available in China, and the nuclear and renewable power generations are considered as low-cost/must-run power sources and the quantity of electricity supplied to the grid by these sources is known in china, at the same time, off-grid power plants are not included in the calculation. So the project uses Option B for calculating the simple OM emission factor, as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{EG_y}$$ (Equation B.9)

Where
$EF_{grid,OMsimplei,y}$ =Simple operating margin CO_2 emission factor in year *y* (tCO_2/MWh);
$FC_{i,y}$ =Amount of fuel type i consumed in the electricity system in year *y* (mass or volume unit);
$NCV_{i,y}$ =Net calorific value (energy content) of fuel type *i* in year y (GJ/mass or volume unit)
$EF_{CO_2 i,y}$ =CO_2 emission factor of 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-must –run power plants/units, in year *y* (MWh).
i = all fuel types combusted in power sources in the project electricity system in year *y*;
y = the relevant year as per the data vintage chosen in Step 3.

The Operating Margin emission factors for 2010, 2011 and 2012 are calculated. The three-year average is calculated as a 3-year generation-weighted average of the emission factors. The

Operating Margin emission factor of the baseline is calculated ex-ante and will not be renewed in the second crediting period of the project activity. The three-year average is calculated as a weighted average of the emission factors. The Operational Margin Emission Factor is **0.9724**tCO_2e/MWh.

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

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

Option 1. For the first crediting period, calculate the build margin emission factor *ex-ante* based on the most recent information available on units already built for sample group *m* at the time of 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 of the emission factor during the crediting period.

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

Project participants have chosen Option 1, which requires the project participant to calculate the build margin emission factor $EF_{grid,BM,y}$ *ex-ante* based on the most recent information available already built for sample group m at the time of submission of the request for renewal of the crediting period to the DOE.

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

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-units}}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-units}}$, in MWh);

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

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation (SET_{sample});

Identify the date when the power units in SET_{sample} started to supply electricity to the grid. If none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago, then use SET_{sample} to calculate the build margin. Ignore steps (d), (e) and (f). In China, the steps (d), (e) and (f) can be ignored because none of the power units in SET_{sample} started to supply electricity to the grid more than 10 years ago.

However, in China, it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and those that were built most recently. Taking notice of this situation, these are the following deviations in methodology application:

1) Capacity addition from one year to another is used as the basis for determining the build margin, i.e. the capacity addition over 1-3 years, whichever results in a capacity addition that is closest to 20% of the total installed capacity.
2) Use proportional weights that correlate to the distribution of installed capacity in place during the selected period above by using plant efficiencies and emission factors of the commercially available best practice technology in terms of efficiency. It is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China as a conservative proxy.

According to *"Tool to calculate the emission factor for an electricity system (Version 04.0)"*, the build margin emissions factor ($EF_{grid,BM,y}$) is calculated as the generation-weighted average emission factor (tCO_2e/MWh) of all power units *m* during the most recent year *y* for which power generation data is available. The calculation equation is as follows:

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

(Equation B.10)

Where

$EF_{grid,BM,y}$ =Build margin CO_2 emission factor in year y (tCO_2e/MWh);

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

$EF_{BL.m,y}$ =CO_2 emission factor of power unit m in year y (tCO_2e/MWh).

The CO_2 emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in Step 4(a) for the simple OM, using option A2.

Since there is no way to separate the different generation technology capacities as fuel coal, fuel oil, fuel gas etc from thermal power based on the present statistical data, the following calculating measures will be taken, the following deviation accepted by EB as step 5:

- First, according to the energy statistical data of most recent one year, determine the ratio of CO_2 emissions produced by coal, oil and gas fuels consumption for power generation;
- Second, multiply this ratio by the respective emission factors based on commercially available best practice technology in terms of efficiency;
- Finally, this emission factor for thermal power is multiplied with the ratio of thermal power identified within the approximation for the latest 20% installed capacity addition to the grid. The result is the BM emission factor of the grid.

Sub-step 1: Calculate the proportion of CO_2 emissions related to consumption of coal, oil and gas fuel used for power generation as compared to total CO_2 emissions from the total fossil fuelled electricity generation (sum of CO_2 emissions from coal, oil and gas).

$$\lambda_{Coal} = \frac{\sum_{i \in COAL} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$ (Equation B.11)

$$\lambda_{Oil} = \frac{\sum_{i \in OIL} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$ (Equation B.12)

$$\lambda_{Gas} = \frac{\sum_{i \in GAS} FC_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}{\sum_{i} F_{i,m,y} \times NCV_{i,y} \times EF_{CO_2,i,y}}$$ (Equation B.13)

Where

$FC_{i,m,y}$ =The amount of fuel i (in a mass or volume unit) consumed by power sources m in year(s) y;

$NCV_{i,y}$ =Net calorific value (energy content) of fossil fuel type *i* in year y (GJ/mass or volume unit);

$EF_{CO_2 i,y}$ =CO_2 emission factor of fossil fuel type *i* in year y (tCO_2/GJ).

Coal, Oil and *Gas* is solid, liquid and gas fuels respectively.

Sub-step 2: Calculate the operating margin emission factor of fuel-based generation:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv}$$ (Equation B.14)

Where

$EF_{Coal,Adv}, EF_{Oil,Adv}, EF_{Gas,Adv}$ are the emission factors for coal-fired, oil-fired and gas-fired generation technology according to commercially available best practice technology in terms of efficiency.

The weighted average coal efficiency of the first lowest 20 sets in new built 600-1000MW units in 2012is assumed to be the commercially available best practice technology in terms of efficiency. The estimated coal efficiency is 307gce/kWh, equal to 40.03% for electricity generation.

For gas and oil power plants, a 390MW combined cycle power plant with coal efficiency of 232.3gce/kWh, equal to 52.9% for electricity generation, is selected as the commercially available best practice technology in terms of efficiency[6].

Sub-step 3: Calculate the Building Margin emission factor

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal}$$ (Equation B.15)

Where

CAP_{Total} is the total capacity addition and $CAP_{Thermal}$ is the total thermal (coal, oil and gas) power capacity addition.

[6] The “*2014 Baseline Emission Factors for Regional Power Grids in China”,* which has been published by the Chinese DNA (Director Office of National Climate Change Coordination of NDRC) on May 11, 2015.

As mentioned above, the build margin emission factor of the baseline is calculated ex-ante and will not be renewed in the second crediting period of the project activity. The Build Margin Emission Factor is **0.4737**tCO_2e/MWh.

The data resources for calculating $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are:

- Installed capacity, power generation and the rate of internal electricity consumption of thermal power plants

Source: *China Electric Power Yearbook* (2009-2013); *Compilation of China Electric Power Industry Statistic 2010-2012.*

- Fuel consumption and the net caloric value of thermal power plants

Source: *China Energy Statistical Yearbook* (2011-2013);

- Carbon oxidation factor of each fuel

Source: *2006 IPCC Guidelines for default values, Table 1.4 of Page 1.23-1.24 in Chapter one, Volume 2 Energy*.

STEP 6. Calculate the combined margin emission factor

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

(a) Weighted average CM; or
(b) Simplified CM.

The weighted average CM method (option A) should be used as the preferred option.
The simplified CM method (option b) can only be used if:

- The project activity is located in (i) a Least Developed Country (LDC) or (ii) in a country with less than 10 registered projects at the starting date of validation or (iii) a Small Island Developing States (SIDS); and
- The data requirements for the application of step 5 above cannot be met.

The PDD will choose option A.

The Baseline Emission Factor is calculated as follow:

$$EF_{grid,CM,y} = w_{OM} \times EF_{grid,OM,y} + w_{BM} \times EF_{grid,BM,y} \qquad \text{(Equation B.16)}$$

Where:

$EF_{grid,BM,y}$: Build margin CO_2 emission factor in year *y* (tCO_2e/MWh);

$EF_{grid,OM,y}$: Operating margin CO_2 emission factor in year *y* (tCO_2e/MWh);

w_{OM} : Weighting of operating margin emissions factor (%);

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

The data resources for calculating $EF_{grid,OM,y}$ and $EF_{grid,BM,y}$ are:

According to the calculation, the operating margin emission factor **(**$EF_{grid,OM,y}$**)** of the CCPG is **0.9724**$\mathbf{tCO_2e}$**/MWh** and the build margin emission factor **(**$EF_{grid,BM,y}$**)** is **0.4737**$\mathbf{tCO_2e}$**/MWh.** The defaults weights for hydro projects during the subsequent crediting periods are used as specified in the "*Tool to calculate the emission factor for an electricity system* (Version 04.0)".

$$w_{OM} = 0.25; w_{BM} = 0.75$$

Using above mentioned values the Combined Baseline Emission Factor of the CCPG corresponds to 0.598375$\mathbf{tCO_2e}$**/MWh.**

Leakage

According to the methodology ACM0002, the leakage is not considered.

Emission Reductions ER_y

$$ER_y = BE_y - PE_y$$ (Equation B.17)

Where

ER_y =Emission reductions in year *y*.

Based on calculation above,

$$ER_y = BE_y - PE_y$$

$$= EG_{facility,y} \times EF_{grid,CM,y} - (FC_{diesel} \times NCV_{diesel} \times EF_{CO_2,diesel} \times 850kg / m^3 + \frac{EF_{Res} \times EG_{hydro,y}}{1000})$$

(Equation B.18)

B.6.2. Data and parameters fixed ex ante

Data / Parameter	$EGP_{y,j}$
Unit	MWh
Description	The Power Generation of Sources j in the year y (2008-2012, including Hunan, Hubei, Jiangxi, Sichuan, Chongqing and Henan)
Source of data	*China Electric Power Yearbook 2009-2013*
Value(s) applied	Provided in Appendix 4
Choice of data or Measurement methods and procedures	The data obtained from the official publication China electric power yearbook, satisfying the requirement of latest version of Tool to calculate the emission factor for an electricity system.
Purpose of data	To calculate OM
Additional comment	/

Data / Parameter	$GEN_{import,y}$
Unit	MWh
Description	The Power import from NCPG and NWCPG to the CCPG in the year of *y* (2010-2012)
Source of data	*Compilation of China Electric Power Industry Statistic 2010-2012*
Value(s) applied	Provided in Appendix 4
Choice of data or Measurement methods and procedures	The data obtained from the official publication Compilation of China Electric Power Industry Statistic, satisfying the requirement of latest version of Tool to calculate the emission factor for an electricity system.
Purpose of data	To calculate the OM

Additional comment	/

Data / Parameter	PR_y
Unit	%
Description	The rate of electricity consumption of thermal power plants in the years y (2010-2012 including Hunan, Hubei, Jiangxi, Sichuan, Chongqing and Henan)
Source of data	*China Electric Power Yearbook 2011-2013*
Value(s) applied	Provided in Appendix 4
Choice of data or Measurement methods and procedures	The data obtained from the official publication China electric power yearbook, satisfying the requirement of latest version of Tool to calculate the emission factor for an electricity system.
Purpose of data	To calculate the power delivered to the grid
Additional comment	/

Data / Parameter	EG_y
Unit	MWh
Description	Net electricity generated by thermal power plants in the project electricity system in the years y (2010-2012 including Hunan, Hubei, Jiangxi, Sichuan, Chongqing and Henan)
Source of data	*Calculated based on* $EGP_{y,j}$ and PR_y above in the *China Electric Power Yearbook 2011-2013*
Value(s) applied	Provided in Appendix 4
Choice of data or Measurement methods and procedures	The data calculated based on the official publication China electric power yearbook, satisfying the requirement of latest version of Tool to calculate the emission factor for an electricity system.
Purpose of data	To calculate the OM
Additional comment	/

Data / Parameter	$FC_{i,m,y}$
Unit	10^4t/10^8m^3
Description	The Fuel *i* Consumption in the years y (2010-2012, including Hunan, Hubei, Jiangxi, Sichuan, Chongqing and Henan)
Source of data	*China Energy Statistical Yearbook 2011-2013*
Value(s) applied	Provided in Appendix 4

Choice of data or Measurement methods and procedures	The data obtained from the official publication China energy statistics yearbook, satisfying the requirement of latest version of Tool to calculate the emission factor for an electricity system.
Purpose of data	To calculate OM and BM
Additional comment	/

Data / Parameter	$NCV_{i,y}$
Unit	TJ/ fuel in a mass or volume unit
Description	The NCV_i of Fuel i in a mass or volume unit
Source of data	*China Energy Statistical Yearbook 2013*
Value(s) applied	Provided in Appendix 4
Choice of data or Measurement methods and procedures	The data obtained from the official publication China energy statistics yearbook, satisfying the requirement of latest version of Tool to calculate the emission factor for an electricity system.
Purpose of data	To calculate OM and BM
Additional comment	/

Data / Parameter	$EF_{CO_2,i,y}$
Unit	$kgCO_2/TJ$
Description	The Emission Factor of Fuel i in a mass or volume unit in year y
Source of data	*2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy*
Value(s) applied	Provided in Appendix 4
Choice of data or Measurement methods and procedures	Regional or national average default values are unavailable, so IPCC default values at the lower limit of the uncertainty at a 95% confidence interval are used, satisfying the requirement of *Tool to calculate the emission factor for an electricity system*.
Purpose of data	To calculate OM and BM
Additional comment	/

Data / Parameter	$\eta_{best,coal}$
Unit	%
Description	Commercially available coal-fired power plant corresponding to the best practice in terms of efficiency
Source of data	*Chinese DNA: 2014 Baseline Emission Factors for Regional Power Grids in China -the calculation of baseline Build Margin emission factor for the China Regional Grids*
Value(s) applied	40.03%

Choice of data or Measurement methods and procedures	The data obtained from the Chinese DNA, satisfying the requirement of *Tool to calculate the emission factor for an electricity system*
Purpose of data	To calculate OM
Additional comment	/

Data / Parameter	$\eta_{best,oil,gas}$
Unit	%
Description	Commercially available oil and gas power plant corresponding to the best practice in terms of efficiency
Source of data	*Chinese DNA: 2014 Baseline Emission Factors of the China Regional Grids -the calculation of baseline Build Margin emission factor for the China Regional Grids*
Value(s) applied	52.9%
Choice of data or Measurement methods and procedures	The data obtained from the Chinese DNA, satisfying the requirement of *Tool to calculate the emission factor for an electricity system*
Purpose of data	To calculate OM
Additional comment	/

Data / Parameter	$CAP_{y,i}$
Unit	MW
Description	The Installed Capacity of Power Sources j in the years y (2010-2012, including Hunan, Hubei, Jiangxi, Sichuan, Chongqing and Henan)
Source of data	*China Electricity Power Yearbook 2011-2013*
Value(s) applied	Provided in Appendix 4
Choice of data or Measurement methods and procedures	The data obtained from the official publication China electric power yearbook, satisfying the requirement of latest version of Tool to calculate the emission factor for an electricity system.
Purpose of data	To calculate BM
Additional comment	/

Data / Parameter	EF_{Res}
Unit	$kgCO_2e/MWh$
Description	Default emission factor for emissions from reservoirs
Source of data	Decision at EB 23
Value(s) applied	90

Choice of data or Measurement methods and procedures	Decision at EB 23
Purpose of data	To calculate project emission
Additional comment	/

Data / Parameter	Cap_{BL}
Unit	W
Description	Installed capacity of the hydro power plant before the implementation of the project activity.
Source of data	The methodology ACM0002
Value(s) applied	0
Choice of data or Measurement methods and procedures	For new hydro power plants, this value is zero
Purpose of data	To calculate power density
Additional comment	/

Data / Parameter	A_{BL}
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.
Source of data	The methodology ACM0002
Value(s) applied	0
Choice of data or Measurement methods and procedures	For new hydro power plants, this value is zero
Purpose of data	To calculate power density
Additional comment	/

B.6.3. Ex ante calculation of emission reductions

>>

The annual net power supply to the CCPG is estimated to be 750,760MWh at full load.

Application of the formula presented in Section B.6.1 and the baseline data presented in Annex 3 yields the following results:

$EF_{grid,OM,y}$ = 0.9724 t CO_2/MWh

$EF_{grid,BM,y}$ = 0.4737 t CO_2/MWh

$EF_{grid,CM,y}$ = 0.25*0.9724 + 0.75*0.4737 = 0.598375 tCO_2/MWh

The BE_y is thus calculated in Table B.6.

Table B.6 The estimation of the baseline emission reductions in second crediting period

Year	Year	Annual net power supply to the grid (EGy) (MWh)	Baseline emission factor (tCO_2/MWh)	Baseline emissions (tCO_2e)
1	10/03/2016-09/03/2017	750,760	0.598375	449,236
2	10/03/2017-09/03/2018	750,760	0.598375	449,236
3	10/03/2018-09/03/2019	750,760	0.598375	449,236
4	10/03/2019-09/03/2020	750,760	0.598375	449,236
5	10/03/2020-09/03/2021	750,760	0.598375	449,236
6	10/03/2021-09/03/2022	750,760	0.598375	449,236
7	10/03/2022-09/03/2023	750,760	0.598375	449,236
	Total	5,255,320	/	3,144,652
	Average	750,760	/	449,236

The total electricity produced by the project, including the electricity supplied to the grid and the electricity supplied to internal loads, is 806,400MWh. The default emission factor for emissions from reservoirs is 90 $kgCO_2e$/MWh.

The quantity of the diesel oil used for the emergency backup diesel generator is 77.65L/h under full load according to the generator manufacturer. It is expected to be operated 3 hours in one year. Therefore, the quantity of the diesel oil is 233L. It is estimated to be 0.233m^3 consumed by the project.

The PE_y are thus calculated in Table B.7.

Table B.7 The estimation of the project emission reductions in second crediting period

Year	Year	The total electricity produced by the project (EGy) (MWh)	Default emission factor for emissions from reservoirs (tCO_2/MWh)	The quantity of the diesel oil(m^3)	emission factor for diesel oil (tCO_2e/m^3, 43.3/1000000* 74800*0.85)	Project emissions (tCO_2e)
1	10/03/2016-09/03/2017	806,400	0.09	0.233	2.753014	72,577
2	10/03/2017-09/03/2018	806,400	0.09	0.233	2.753014	72,577
3	10/03/2018-09/03/2019	806,400	0.09	0.233	2.753014	72,577
4	10/03/2019-09/03/2020	806,400	0.09	0.233	2.753014	72,577
5	10/03/2020-09/03/2021	806,400	0.09	0.233	2.753014	72,577
6	10/03/2021-09/03/2022	806,400	0.09	0.233	2.753014	72,577
7	10/03/2022-09/03/2023	806,400	0.09	0.233	2.753014	72,577
	Total	5,644,800	/	1.631	/	508,039
	Average	806,400	/	0.233	2.753014	72,577

B.6.4. Summary of ex ante estimates of emission reductions

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
10/03/2016-09/03/2017	449,236	72,577	0	376,659
10/03/2017-09/03/2018	449,236	72,577	0	376,659
10/03/2018-09/03/2019	449,236	72,577	0	376,659
10/03/2019-09/03/2020	449,236	72,577	0	376,659
10/03/2020-09/03/2021	449,236	72,577	0	376,659
10/03/2021-09/03/2022	449,236	72,577	0	376,659
10/03/2022-09/03/2023	449,236	72,577	0	376,659
Total	3,144,652	508,039	0	2,636,613
Total number of crediting years	7			
Annual average over the crediting period	449,236	72,577	0	376,659

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data / Parameter	**$EG_{facility,y}$**
Unit	MWh
Description	The Net electricity supplied to the grid by the project
Source of data	Directly measured and calculated
Value(s) applied	750,760MWh
Measurement methods and procedures	Measured continuously (M1, M2, M3) and recorded on a monthly basis. ✧ The M1, M2, M3 (main meters, bi-direction, Accuracy Class 0.2S) are located at the outlet of on site transformers at the project site, continuously measure the electricity supplied to the grid (M1a, M2a, M3a) and the electricity imported from the grid to the project (M1b, M2b, M3b). The meter M4, M5, M6 (backup meters, bi-direction, Accuracy Class 0.2S) are installed at the same site with M1, M2, and M3 respectively, and used as the backup meters for M1, M2, M3. Therefore, the net electricity supplied to the grid is M1a+M2a+M3a-M1b-M2b-M3b. ✧ Recorded monthly When the main meters are in trouble, the project entity employs the data monitored by the backup meters.
Monitoring frequency	Measured continuously and recorded monthly
QA/QC procedures	✧ The all meters are calibrated annually by the qualified third party according to relevant national standards, such as *"Technical administrative code of electric energy metering (DL/T448－2000)".* ✧ The net electricity supplied to the grid is measured and double checked by sales receipts. Data record and relevant documents will be archived for a period of 2 years after the crediting period.

Purpose of data	To calculate baseline emission
Additional comment	The measured data will be double checked by sales receipts.

Data / Parameter	**TEG_y**
Unit	MWh
Description	The total electricity produced by the project, including the electricity supplied to the grid and the electricity supplied to internal loads
Source of data	Directly measured
Value(s) applied	806,400MWh
Measurement methods and procedures	Measured continuously (M7, M8, M9, M10, M11) and recorded on a monthly basis ✧ The M7, M8, M9, M10, M11 (Accuracy Class 0.5) is located at the outlet of the 5 generators at the project site, continuously measure the electricity produced by each generators (EGM7, EGM8, EGM9, EGM10, EGM11) respectively. Therefore, the total electricity produced by the project is EGM7+EGM8+EGM9+EGM10+EGM11. ✧ Recorded monthly
Monitoring frequency	Measured continuously and recorded monthly
QA/QC procedures	The all meters are calibrated annually by the qualified third party.
Purpose of data	To calculate project emission
Additional comment	Applicable to hydro power project activities with a power density of the project (PD) greater than 4 W/m^2 and less than or equal to 10 W/m^2

Data / Parameter	Cap_{PJ}
Unit	W
Description	Installed capacity of the project after the implementation of the project activity.
Source of data	Project site
Value(s) applied	200,000,000W
Measurement methods and procedures	Check the Generator's nameplates
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	-
Purpose of data	To calculate project emissions if necessary
Additional comment	-

Data / Parameter	A_{PJ}
Unit	m^2
Description	Surface area of the reservoir at full level
Source of data	Measured
Value(s) applied	24,500,000 m^2

Measurement methods and procedures	The surface area has been calculated using the design schematics and area maps by the design institute at start of the project.
Monitoring frequency	Once at the beginning of each crediting period
QA/QC procedures	/
Purpose of data	To calculate project emissions if necessary
Additional comment	/

Data / Parameter	FC_{diesel}
Unit	m^3
Description	The quantity of the diesel oil used for the emergency backup diesel generator
Source of data	Measured and recorded
Value(s) applied	The quantity of the diesel oil used for the emergency backup diesel generator is estimated about $0.233m^3$ (0.233L, estimated maximum value and the actual monitoring data will be employed)
Measurement methods and procedures	A ruler gauge will be employed to measure the diesel consumption of the emergency backup diesel generator. The project owner records the quantity of the diesel oil used for the Diesel Generator in the operation logs
Monitoring frequency	Recorded after each use
QA/QC procedures	The ruler gauge will be calibrated annually by a third qualified party. The quantity of the diesel oil used for the Diesel Generator and double checked according to diesel oil purchase invoices.
Purpose of data	To calculate project emissions
Additional comment	/

B.7.2. Sampling plan

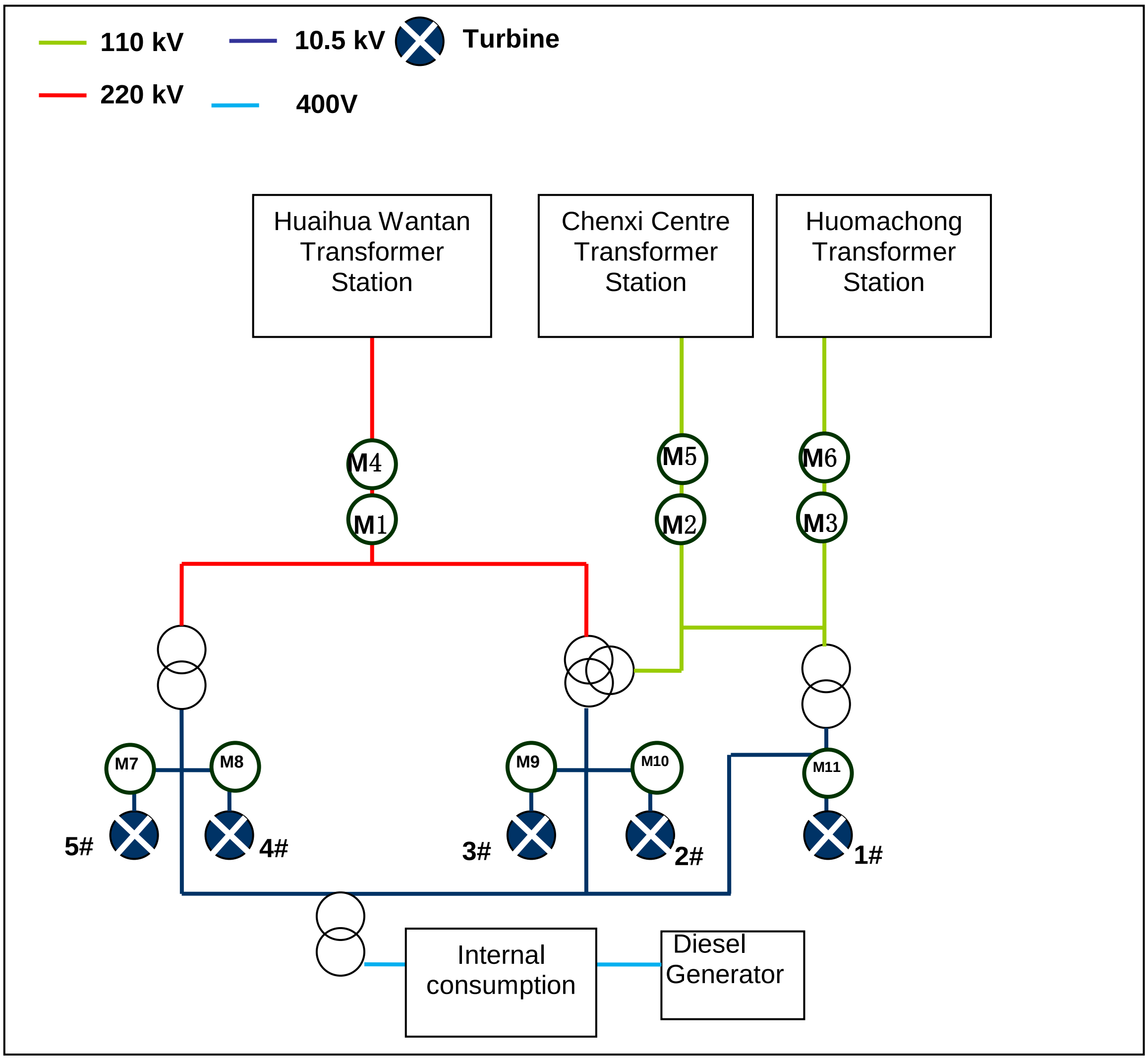
>>
Not applicable

B.7.3. Other elements of monitoring plan

>>
The objective of the monitoring plan is to insure the complete, consistent, clear, and accurate monitoring and calculation of the emissions reductions during the whole crediting period. The project entity is mainly responsible for the implementation of the monitoring plan, and the Grid Company cooperates with the project entity.

The project produces electricity employing five generators in the power house. The total electricity produced by the project is metered at outlets of the generators on the project site (see Figure B.3). The project is connected to the grid through three on-site transformers that increase the voltage from 10.5kV to 110kV or 220kV. The project is then connected to the Huaihua Wantan Transformer Substation via a 220kV power line, and to the Chenxi Centre Transformer Substation and the Huomachong Transformer Substation through two 110kV power lines respectively. All these transformer substations belong to the grid company. The electricity supplied to the grid is metered at the high voltage site of on-site transformers on the project site (see Figure B.3). Therefore, no further transformer losses will occur before the project is connected to the grid. The project will in principle make use of its own electricity for auxiliary power consumption, but can also import power from the grid in case its own power supply fails. The electricity imported from the grid to the project by the grid will be metered and deducted from electricity supplied to the grid by the project.

Figure B.2. Simplified electrical grid connection diagram



The total electricity produced by the project is metered with meters M7, M8, M9, M10 and M11, which are located at the outlet of the 5#, 4#, 3#, 2# and 1# generator respectively. The net electricity supplied to the grid by the project are metered/recorded by the project entity and the grid company with meters M1, M2 and M3, which are located on the project site at the high-voltage side of the on-site transformers to Huaihua Wantan Transformer Substation, Chenxi Centre Transformer Substation, and Huomachong Transformer Substation respectively. Meters M4, M5 and M6, installed at high voltage sides of the three on-site transformers at the project site will be employed as the backup meters of M1, M2 and M3. The accuracy of meters M1, M2, M3, M4, M5 and M6 is 0.2S. The accuracy of meters M7, M8, M9, M10 and M11 is 0.5. The metering instruments M1, M2, M3, M4, M5 and M6 will records two readings, i.e. electricity supplied to the grid by the project and electricity imported from the grid to the project. The project entity and the grid company will log the readings monthly and the differences, i.e. electricity supplied to the grid by the project minus electricity imported from the grid to the project , will be taken as net electricity supplied to the grid by the project (note that for the calculation of emission reductions).

An overview of the recording frequency, calibration procedures and available documentation is provided in Table B.7. The numbering of the metering equipment refers to Figure B.2 which shows the location of each meter.

Table B.7 Details of metering instruments

Meter	Operated by	Recording	Calibration	Accuracy	Documentation
M1	Project entity and Grid company	Monthly	Qualified third party (Annually)	Accuracy Class 0.2S	Monthly sales receipts
M2	Project entity and Grid company	Monthly	Qualified third party (Annually)	Accuracy Class 0.2S	Monthly sales receipts
M3	Project entity and Grid company	Monthly	Qualified third party (Annually)	Accuracy Class 0.2S	Monthly sales receipts
M4	Project entity and Grid company	Monthly	Qualified third party (Annually)	Accuracy Class 0.2S	If M1 is in trouble, print out optional paper log. Data will consist of two readings, i.e. electricity supplied to the grid and the electricity imported from the grid to the project.
M5	Project entity and Grid company	Monthly	Qualified third party (Annually)	Accuracy Class 0.2S	If M2 is in trouble, print out optional paper log. Data will consist of two readings, i.e. electricity supplied to the grid and the electricity imported from the grid to the project.
M6	Project entity and Grid company	Monthly	Qualified third party (Annually)	Accuracy Class 0.2S	If M3 is in trouble, print out optional paper log. Data will consist of two readings, i.e. electricity supplied to the grid and the electricity imported from the grid to the project.
M7	Project entity	Monthly	Qualified third party (Annually)	Accuracy Class 0.5	Print out optional paper log with electricity produced by 5# generator
M8	Project entity	Monthly	Qualified third party (Annually)	Accuracy Class 0.5	Print out optional paper log with electricity produced by 4# generator
M9	Project entity	Monthly	Qualified third party (Annually)	Accuracy Class 0.5	Print out optional paper log with electricity produced by 3# generator
M10	Project entity	Monthly	Qualified third party (Annually)	Accuracy Class 0.5	Print out optional paper log with electricity produced by 2# generator
M11	Project entity	Monthly	Qualified third party (Annually)	Accuracy Class 0.5	Print out optional paper log with electricity produced by 1# generator

In addition to the monitoring of net power supplied to the grid by the project, project entity will also monitor the use of an emergency back-up diesel generator by the ruler gauge and log its actual diesel consumption in operation logs.

Procedures in case of damaged metering equipment / Emergencies

Damages to metering equipment:

In case metering equipment is damaged and no reliable readings can be recorded, the project entity will estimate net electricity supplied to the grid by the project according to the following procedure:

1, In case main metering equipment is damaged only:
The backup metering data logged by the project entity, evidenced by sales receipts will be used as record of the net electricity supplied to the grid when the main metering equipment is damaged.
2, In case both backup and main metering equipment are damaged:
The project entity and the grid company will jointly calculate a conservative estimate of net electricity supplied to the grid. A statement will be prepared indicating
► the background to the damage to metering equipment
► the assumptions used to estimate net electricity supplied to the grid when the metering equipments are damaged
► the estimation of net electricity supplied to the grid
The statement will be signed by both a representative of the project entity as well as a representative of the grid company.
The project entity will furthermore document all efforts taken to restore normal monitoring procedures.
3, In case the metering equipments at outlet of the generators are damaged:
The electricity produced by the project will be conservatively estimated as per the maximum output of the generator in that period.

Emergencies:

In case of emergencies, the project entity will not claim emission reductions due to the project activity for the duration of the emergency. The project entity will follow the following procedure for declaring the emergency period to be over:

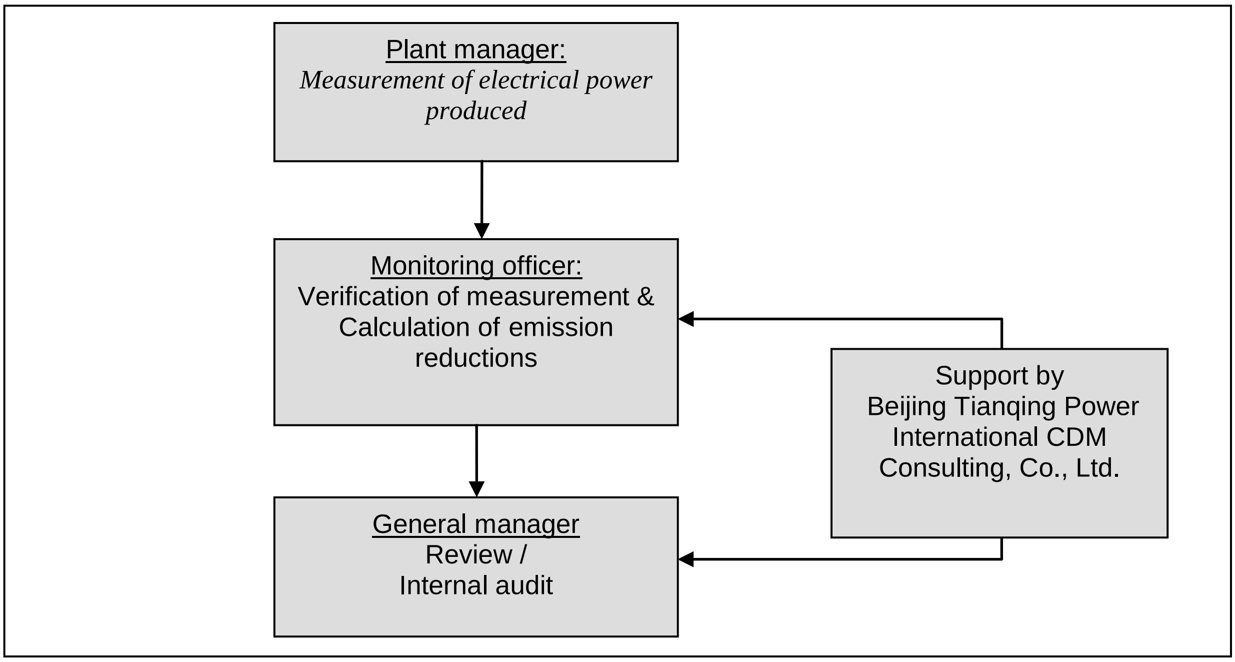
1. The project entity will ensure that all requirements for monitoring of emission reductions have been re-established.
2. The monitoring officer and the head of operations of the hydropower station will both sign a statement declaring the emergency situation to have ended and normal operations to have resumed.

Operational and management structure for monitoring

The monitoring of the emission reductions will be carried out according to the scheme shown in Figure B.3. The general manager will hold the overall responsibility for the monitoring process, but as indicated below parts of the process are delegated. The first step is the measurement of the net electricity supplied to the grid by the project and reporting of daily operations, which will be carried out by the plant manager.

The project entity appoints a monitoring officer who will be responsible for verification of the measurement, collection of sales receipts, and the calculation of the emissions reductions. The monitoring officer will prepare operational reports of the project activity, recording the daily operation of the hydropower station including operating periods, electricity supplied to the grid by the project, electricity imported from the grid to the project, equipment defects, diesel consumption of the diesel generator, etc. The selection procedure, tasks and responsibilities of the monitoring officer are described in detail in Annex 4. Finally, the monitoring reports will be reviewed by the General Manager of Hunan Chenxi Dafutan Hydropower Co., Ltd.

Figure B.3. Management structure in order to monitor emission reductions



B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>

Date of completion: 23/11/2015

Name of persons determining the baseline:

Xiujuan(Tracy) Yuan, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-62199416
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Guihong(Grace) Guan, Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Tel: +86-10-62199416
Fax: +86-10-62166196
Email: graceguan@tqpower.net

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
11/04/2005 (this day market the start of construction activities)

C.1.2. Expected operational lifetime of project activity

>>
30 years 0 month

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Renewable crediting period
The second crediting period

C.2.2. Start date of crediting period

>>
10/03/2016

C.2.3. Length of crediting period

7 years 0 month

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
An Environmental Impact Assessment (EIA) was carried out and was accepted by the Hunan Province Environment Protection Bureau on July 6th, 2004. A summary of the main findings of the EIA is provided below.

SUMMARY OF ENVIRONMENTAL IMPACT ASSESSMENT

Impact on the Air quality
During the construction period, transportation, mixing, and some other activities will cause some negative effects on the local air environment. This is temporary and will disappear once construction of the project is finished. Therefore, the construction will not cause much negative impact on the local air environment. Furthermore, the project will employ some measures to minimize the negative effect. Among the measures are spraying water to reduce the generation of dust, improving maintenance of equipment to reduce the emissions of waste gas, and maintaining the construction activities within a closed area.

Impact on water environment
The maximum production of wastewater due to sand washing during the construction period is 3000-5000m^3/d. The main pollutants of this waste water are suspension and basic materials.

The waste water will be drained into the Yuanshui River after deposition and neutralisation treatment. Wastewater generated during construction activities will be collected and treated to remove the oil. The domestic wastewater will be treated in a Cesspool treatment system.

Noise impact on environment

Noise will be generated by machine equipment and transporting vehicles during the construction period. The project owner will aim to avoid high noise equipment were possible and avoid generating excess noise during abnormal hours of the day. There are no villages, towns or schools which need special protection. Construction workers will be impacted by the noise during construction, but they will be equipped with protection equipment.

Impact of solid waste on environment

During the construction period, the project will generate around 2,263,000 m^3 waste slag. This waste slag will be disposed of on a designated waste disposal site. The waste disposal site will be recovered and greened in order to conserve water and soil quality.

Impact on water and soil loss

This impact will appear mostly during digging for main construction, discarding waste slag, and removing plants. In order to reduce the negative environmental impacts, the following measures will be taken: keeping construction activities within area limited space, employing engineering or replanting measures in the area of main construction, discarding all waste slag, cleaning up the construction site, and recover the original vegetation when the construction is finished.

Impact on migration and Land Requisition

A total of 2,978 individuals will be displaced due to the project. The construction of the project will 7 seven towns, covering 43 villages. All dislocated residents will be resettled nearby and will be compensated according to the national standard. The permanent occupied land is 116ha and the temporary occupied land is 299ha. The project owner will compensate the residents for the occupied land. Additional to the compensation, the project owner will employ some methods to improve the productivity of the land and raise land above the water level and consolidate the land for local residents. Around 181,353ha of tilled land will be protected against floods.

Impact on ecological environment

The project will have some negative impact on local animal and plant life. Because human activity was plentiful in the construction area and the to be flooded reservoir area, few rare species, animals and plants are present. So there is no threat of extinction or significant reduction of rare animals or plants. Additionally, the project will include a sluicing structure to provide a passage to boats on the river. This sluicing structure has the additional advantage of providing a passage to fish, who are able to swim from one side of the dam to the other via this sluice.

In conclusion, during the construction period, the land requisition, noise, wastewater, waste slag and the dust will have some negative impact on the environment. This impact is limited, since measures will be employed to reduce the negative impacts and the negative impacts are temporary. From the perspective of saving coal resources, the construction of the project will bring environmental benefits.

D.2. Environmental impact assessment

>>

The environmental impacts of the project are not considered significant by the Chinese government and the project participants. The Environmental Impact Assessment Form (EIA) was accepted by the Hunan Province Environment Protection Bureau in July 6th, 2004.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

A special stakeholder consultation meeting for the project relating to CDM was organized from 15:00 to 17:00 on October 13th, 2006 in Huaihua City, Hunan Province, China, to collect opinions of all the potential stakeholders, such as local residents and so on. The aim of this meeting was to collect opinions concerning the influence the project would have on the local society, economy, and daily life. To ensure all potential stakeholders received the information concerning the meeting, the project owner published a bulletin for the stakeholders' meeting on the public announcement board of the affected County and the website of www.tqcdmchina.com on October 10th, 2006, and made an announcement in the *Huaihua Daily* newspaper on October 13th, 2006. Furthermore, questionnaires were distributed to residents who may be impacted by the project and 32 investigation questionnaires have been returned. At the meeting, the project owner and consultant invited the participants to comment and express their concerns concerning the project and CDM. The representatives asked the following questions:

1. Whether local residents experience a lack of electricity?
2. Will the project cause noise, drinking water pollution or other environment impacts? How far is the project location away from the nearest local resident?
3. How do local residents earn a living? Will construction of the project have a positive impact on the local residents' incomes? If increase, how will incomes increase?
4. What was the project site used for before the construction of the project?
5. Whether the local residents have additional questions, such as tilled land reduction? And if yes, have they been resolved? Does the compensation comply with national policies and regulations?
6. How much residents will migrate? Are the migrants satisfied with the allocation and compensation?
7. Will infrastructure, such as traffic and transportation conditions, be improved?
8. Will the project impact cultural relics and historic sites?
9. Will the project have a negative impact on the local ecological environment, such as local animals, fish, and plants? Also, is the water quality affected? If yes, how significant is this effect?
10. Do you approve of CDM and do you support the construction of the project?

E.2. Summary of comments received

>>

We investigated some residents who might be impacted by the project using investigation questionnaires. A total of 120 questionnaires have been distributed, covering over 40 villages. Of these questionnaires, a total of 107 were returned, all by individuals over twenty years old. 40% of them were women and 30% of them were junior high school graduates or lower educated. We obtained the following results:

- 90% of the investigated residents use coal or gas for heating and cooking.
- 97% of the investigated residents think the hydropower station will bring benefits to their live.
- 91% of the investigated residents think the hydropower station will not have a negative impact on the environment; the remaining 9% think the hydropower station will have some negative impact on the environment, but consider this impact small.

- 100% of the investigated residents agree with the construction of the project.

Summary of main comments received:

The project will have some negative impact on the local environment, but this impact is minimized due to measures taken as described in the EIA. All stakeholders recognize that hydropower is a renewable energy source which will have little negative impact on the environment. The project entity will compensate migrants and all migrants are migrating voluntary and are satisfied with the compensation. The project owner will provide a yearly compensation of 600 Yuan RMB to all dislocated residents for a minimum of 20 years. Additionally, the project will improve the structure of local resources and the capacity of adjusting to peak, increase local transportation conditions and reduce the cost of transportation, and build a new school for the dislocated residents. The project will also help to increase local employment opportunities by employing local people. Furthermore, the hydropower station will increase humidity and improve the ecological environment. The project's impact is negligible. All stakeholders were pleased with the development of the project and support the construction of the station.

E.3. Report on consideration of comments received

>>
Necessary measures, as described in the previous sections (See D.1 and E.2), have been taken and given the generally positive (or neutral) nature of the comments received, no additional action has been taken to address the comments received.

SECTION F. Approval and authorization

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The Letter of Approval is issued by Chinese DNA on March 5, 2007

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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 application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Hunan Chenxi Dafutan Hydropower Co., Ltd.
Street/P.O. Box	Chenxi County, Huaihua City
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City	Huaihua City
State/Region	Hunan Province
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Country	People's Republic of China
Telephone	+86-745-5452493
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E-mail	janyangtq@163.com
Website	/
Contact person	Cai Rongfei
Title	Director
Salutation	Mr.
Last name	Cai
Middle name	/
First name	Rongfei
Department	/
Mobile	+86-18666615370
Direct fax	+86-0751-8153019
Direct tel.	+86-0751-8153019
Personal e-mail	342833957@qq.com

Project participant and/or responsible person/ entity	☐ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Beijing Tianqing Power International CDM Consulting, Co., Ltd.
Street/P.O. Box	No.18A, Zhoangguancun South SStreet, Haidian District
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State/Region	/
Postcode	100081
Country	People's Republic of China
Telephone	+86-10-62199416
Fax	+86-10-62166196
E-mail	graceguan@tqpower.net
Website	/
Contact person	Guan Guihong
Title	Project Manager
Salutation	Ms.
Last name	Guan
Middle name	/
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Appendix 2. Affirmation regarding public funding

The Project does not receive any public funding from Annex I countries.

Appendix 3. Applicability of methodology and standardized baseline

Not applicable.

Appendix 4. Further background information on ex ante calculation of emission reductions

Table 1 The ratio of power generated by hydro-power and other low cost/compulsory resources for the CCPG, 2008-2012

	2008	2009	2010	2011	2012
Thermal Power Generation (MWh)	407,200,000	450,400,000	512,700,000	597,800,000	562,300,000
Other Power Generation (MWh)	263,500,000	271,700,000	309,310,000	305,810,000	386,900,000
Total Electricity Generation of the CCPG (MWh)	670,700,000	722,100,000	822,010,000	903,610,000	949,200,000
The ratio of power generated by hydropower and other low cost/compulsory resources of total grid generation	39.29%	37.63%	37.63%	33.84%	40.76%

Data Source: China Electric Power Yearbook, 2009-2013. China Energy Statistical Yearbook 2008-2012.

Table 2 Calculation of Thermal Power supplied to the CCPG in 2010

Province	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan
Thermal power Generation (MWh)	53,700,000	219,800,000	77,100,000	72,500,000	33,100,000	56,500,000
Rate of Electricity Consumption of Power Plant (%)	6.00	6.23	6.30	6.27	0.00	7.52
Thermal power Supplied (MWh)	50,478,000	206,106,460	72,242,700	67,954,250	33,100,000	52,251,200
Total Thermal Power Supplied to Central China Power Grid (MWh)	482,132,610					
Net import Power from the NWCPG (MWh)	12,386,810					
Net import Power from the NCPG (MWh)	2,684,680					
The total thermal power consumed by the CCPG (MWh)	497,204,100					

Data Source: China Electric Power Yearbook 2011, Compilation of Electric Power Industry Statistics 2010.

Table 3 Calculation of Thermal Power supplied to the CCPG in 2011

Province	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan
Thermal power Generation (MWh)	66,500,000	249,800,000	93,300,000	89,900,000	38,700,000	59,600,000
Rate of Electricity Consumption of Power Plant (%)	5.60	5.90	5.80	6.00	0.00	7.30
Thermal power Supplied (MWh)	62,776,000	235,061,800	87,888,600	84,506,000	38,700,000	55,249,200
Total Thermal Power Supplied to Central China Power Grid (MWh)	564,181,600					
Net import Power from the NWCPG (MWh)	15,526,260					

Net import Power from the NCPG (MWh)	4,154,580
The total thermal power consumed by the CCPG (MWh)	583,862,440

Data Source: China Electric Power Yearbook 2012, Compilation of Electric Power Industry Statistics 2011.

Table 4 Calculation of Thermal Power supplied to the CCPG in 2012

Province	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan
Thermal power Generation (MWh)	61,000,000	246,500,000	86,300,000	76,500,000	33,600,000	58,400,000
Rate of Electricity Consumption of Power Plant (%)	5.4	6	5.4	6	8	6
Thermal power Supplied (MWh)	57,706,000	231,710,000	81,639,800	71,910,000	30,912,000	54,896,000
Total Thermal Power Supplied to Central China Power Grid (MWh)	528,773,800					
Net import Power from the NWCPG (MWh)	15,965,910					
Net import Power from the NCPG (MWh)	5,673,710					
The total thermal power consumed by the CCPG (MWh)	550,413,420					

Data Source: China Electric Power Yearbook 2013, Compilation of Electric Power Industry Statistics 2012.

Table 5 Emission Factor of NWCPG in 2010-2012

Year	Total CO_2 Emission (tCO_2e)	Total electricity supplied to Grid (MWh)	Emission Factor (tCO_2e/ MWh)
2010	256,755,243	260,589,710	0.98529
2011	321,335,334	341,716,600	0.9404
2012	350,313,673	366,981,300	0.9546

Table 6 Emission Factor of NCPG in 2010-2012

Year	Total CO_2 Emission (tCO_2e)	Total electricity supplied to Grid (MWh)	Emission Factor (tCO_2e/ MWh)
2010	1,007,173,290	974,757,190	1.03326
2011	1,174,992,213	1,088,194,790	1.0798
2012	1,202,212,118	1,136,033,150	1.0583

Table 7 Energy Consumption Statistics of Power Generation of the CCPG in 2010

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	The CCPG G=A+B+C+D+E+F
Raw coal	10^4 Tons	2,648.31	9,925.73	3,474.75	3,318.57	1,542.19	2,667.82	23,577.37
Clean coal	10^4 Tons	0.00	331.40	0.00	0.00	0.000.00		331.40
Other washed coal	10^4 Tons	0.00	205.66	0.00	0.00	145.37	116.96	467.99
Briquettes	10^4 Tons	0.00	0.00	0.00	1.82	0.00	0.00	1.82
Coke	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal gangue	10^4 Tons	48.80	256.37	78.86	36.85	237.58	0.00	658.46
Coke oven gas	10^8 m^3	0.30	3.76	0.07	0.19	1.12	0.00	5.44
Blast furnace gas	10^8 m^3	45.81	61.58	131.21	46.32	7.19	0.00	292.11
Converter gas	10^8 m^3	1.49	0.00	0.00	4.42	0.18	0.00	6.09
Other gas	10^8 m^3	0.00	0.02	0.00	0.13	0.00	0.00	0.15
Crude oil	10^4 Tons	0.00	0.08	0.00	0.00	0.00	0.00	0.08
Gasoline	10^4 Tons	0.00	0.00	0.00	0.00	0.01	0.00	0.01
Diesel oil	10^4 Tons	0.65	31.41	1.20	0.91	1.12	0.00	35.29
Fuel oil	10^4 Tons	0.06	1.14	0.27	1.86	0.05	1.51	4.89
Petroleum coke	10^4 Tons	0.00	5.82	0.00	0.00	0.00	0.00	5.82
LPG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Refinery gas	10^4 Tons	0.15	1.45	1.05	1.11	0.00	0.00	3.76
Natural gas	10^8 m^3	0.00	13.76	0.15	0.00	0.05	11.97	25.93
Other petroleum products	10^4 Tons	0.00	0.00	0.00	2.75	0.00	0.00	2.75
Other coking products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Energy	10^4 Tons	41.43	266.07	0.00	8.12	2.40	0.00	318.02

Data sources: China Energy Statistical Yearbook 2011

Table 8 Energy Consumption Statistics of Power Generation of the CCPG in 2011

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	The CCPG G=A+B+C+D+E+F
Raw coal	10^4 Tons	3,080.51	12,081.67	4,076.95	4,204.70	1,780.22	2,783.89	28,007.94
Clean coal	10^4 Tons	0.00	30.51	0.00	0.00	0.00	0.00	30.51
Other washed coal	10^4 Tons	0.00	129.50	0.00	0.00	154.05	118.68	402.23
Briquettes	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coke	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal gangue	10^4 Tons	40.79	299.59	54.56	57.15	255.32	79.66	787.07
Coke oven gas	10^8 m^3	0.55	6.08	0.02	0.15	1.38	5.11	13.29
Blast furnace gas	10^8 m^3	11.89	29.60	147.59	53.35	42.53	50.76	335.72
Converter gas	10^8 m^3	1.82	0.00	0.00	2.98	0.33	6.85	11.98
Other gas	10^8 m^3	0.00	0.06	0.00	0.00	0.00	0.00	0.06
Crude oil	10^4 Tons	0.00	0.04	0.00	0.00	0.00	0.00	0.04
Gasoline	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel oil	10^4 Tons	0.50	1.67	1.04	0.78	0.69	1.01	5.69
Fuel oil	10^4 Tons	0.00	1.82	0.22	0.91	0.00	0.00	2.95
Petroleum coke	10^4 Tons	0.00	5.58	0.00	0.00	0.00	0.00	5.58
LPG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Refinery gas	10^4 Tons	0.00	1.15	0.88	0.77	0.00	0.00	2.80
Natural gas	10^8 m^3	0.38	13.93	1.75	0.00	0.02	0.71	16.79
Other petroleum products	10^4 Tons	0.00	0.00	0.00	5.01	0.00	0.00	5.01
Other coking products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Energy	10^4 Tons	0.00	69.79	0.00	47.07	16.14	2.08	135.08

Data sources: China Energy Statistical Yearbook 2012

Table 9 Energy Consumption Statistics of Power Generation of the CCPG in 2012

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	The CCPG G=A+B+C+D+E+F
Raw coal	10^4 Tons	2,649.47	11,393.35	3,454.97	3,233.93	1,408.27	2,549.04	24,689.03
Clean coal	10^4 Tons	0.00	22.71	0.00	0.00	0.00	0.00	22.71
Other washed coal	10^4 Tons	0.00	126.8	0.00	0.00	138.05	93.58	358.43
Briquettes	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Coal gangue	10^4 Tons	66.29	234.49	60.51	85.62	215.65	207.23	869.79
Coke	10^4 Tons	0.00	0.00	0.49	0.00	0.00	0.00	0.49
Coke oven gas	$10^8 m^3$	0.37	4.23	0.03	0.15	1.59	4.57	10.94
Blast furnace gas	$10^8 m^3$	17.39	72.19	124.33	65.88	61.12	52.07	392.98
Converter gas	$10^8 m^3$	2.58	1.51	0.00	3.19	0.71	8.38	16.37
Other gas	$10^8 m^3$	0.00	0.11	0.00	0.00	0.32	0.00	0.43
Other coking products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crude oil	10^4 Tons	0.00	0.03	0.00	0.00	0.00	0.00	0.03
Gasoline	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kerosene	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diesel oil	10^4 Tons	0.33	1.35	0.85	0.63	0.85	1.59	5.6
Fuel oil	10^4 Tons	0.00	0.82	0.25	1.03	0.00	0.00	2.1
Naphtha	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lubricants	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Parraffin waxes	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
White spirit	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
bitumen asphalt	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Petroleum coke	10^4 Tons	0.00	5.71	0.00	2.22	0.00	0.00	7.93
LPG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Refinery gas	10^4 Tons	0.00	0.74	0.85	0.34	0.00	0.00	1.93
Other petroleum products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Natural gas	10^8 m^3	0.11	10.01	1.71	0.00	0.05	0.21	12.09
LNG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Other Energy	10^4 Tons	0.00	135.21	182.66	0.17	26.28	0.00	344.32

Data sources: China Energy Statistical Yearbook 2013

Table 10 The Operation Margin Emission Factor Calculation of the CCPG in 2010

Fuel	Unit	Fuel Consumption of the CCPG in 2005 G	Emission Factor H （tc/TJ）	Oxidation Rate I (%)	Emission Factor J ($kgCO_2$/TJ)	Average NCV K (MJ/t,km^3)	CO_2 Emission(tCO_2e) L=G*I*J*K/100000 (in quality unit) L=G*I*J*K/10000 (in volume unit)
Raw coal	10^4 Tons	23,577.37	25.8	100	87,300	20,908	430,350,284
Clean coal	10^4 Tons	331.40	25.8	100	87,300	26,344	7,621,641
Other washed coal	10^4 Tons	467.99	25.8	100	87,300	8,363	3,416,748
Briquettes	10^4 Tons	1.82	26.6	100	87,300	20,908	33,220
Coke	10^4 Tons	0.00	29.2	100	95,700	28,435	0
Coal gangue	10^4 Tons	658.46	25.8	100	87,300	8,363	4,807,350
Coke oven gas	10^8 m^3	5.44	12.1	100	37,300	16,726	339,391
Blast furnace gas	10^8 m^3	292.11	70.8	100	219,000	3,763	24,072,697
Converter gas	10^8 m^3	6.09	46.9	100	145,000	7,945	701,583
Other gas	10^8 m^3	0.15	12.1	100	37,300	5,227	2,925
Crude oil	10^4 Tons	0.08	20.0	100	71,100	41,816	2,378
Gasoline	10^4 Tons	0.01	18.9	100	67,500	43,070	291
Diesel oil	10^4 Tons	35.29	20.2	100	72,600	42,652	1,092,767
Fuel oil	10^4 Tons	4.89	21.1	100	75,500	41,816	154,383
Petroleum coke	10^4 Tons	5.82	26.6	100	82,900	31,947	154,137
LPG	10^4 Tons	0.00	17.2	100	61,600	50,179	0
Refinery gas	10^4 Tons	3.76	15.7	100	48,200	46,055	83,466
Natural gas	10^8 m^3	25.93	15.3	100	54,300	38,931	5,481,481

Other petroleum products	10^4 Tons	2.75	20.0	100	72,200	41,816	83,026
Other coking products	10^4 Tons	0.00	25.8	100	95,700	28,435	0
Other Energy	10^4 Tons	318.02	0.0	0	0	0	0
CO_2 emission of net power import from the NWCPG		0.9853×12,386,810=12,204,543tCO_2e					
CO_2 emission of net power import from the NCPG		1.0333×2,684,680=2,773,961CO_2e					
Total Emission (Q)		493,376,271tCO_2					
Thermal Power supplied to the CCPG (P)		497,204,100MWh					
OM Emission Factor in 2010 [＝Q/P]		0.9923CO_2e/MWh					

Data sources: China Energy Statistical Yearbook 2011, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Table 1.4 of P1.23-1.24 in Chapter one.

Table 11 The Operation Margin Emission Factor Calculation of the CCPG in 2011

Fuel	Unit	Fuel Consumption of the CCPG in 2005 G	Emission Factor H （tc/TJ）	Oxidation Rate I (%)	Emission Factor J (kgCO_2/TJ)	Average NCV K (MJ/t,km^3)	CO_2 Emission(tCO_2e) L=G*I*J*K/100000 (in quality unit) L=G*I*J*K/10000 (in volume unit)
Raw coal	10^4 Tons	28,007.94	25.8	100	87,300	20,908	511,220,078
Clean coal	10^4 Tons	30.51	25.8	100	87,300	26,344	701,678
Other washed coal	10^4 Tons	402.23	25.8	100	87,300	8,363	2,936,641
Briquettes	10^4 Tons	0.00	26.6	100	87,300	20,908	0
Coke	10^4 Tons	0.00	29.2	100	95,700	28,435	0
Coal gangue	10^4 Tons	787.07	25.8	100	87,300	8,363	5,746,319
Coke oven gas	10^8 m^3	13.29	12.1	100	37,300	16,726	829,136
Blast furnace gas	10^8 m^3	335.72	70.8	100	219,000	3,763	27,666,584
Converter gas	10^8 m^3	11.98	46.9	100	145,000	7,945	1,380,126
Other gas	10^8 m^3	0.06	12.1	100	37,300	5,227	1,170
Crude oil	10^4 Tons	0.04	20.0	100	71,100	41,816	1,189
Gasoline	10^4 Tons	0.00	18.9	100	67,500	43,070	0
Diesel oil	10^4 Tons	5.69	20.2	100	72,600	42,652	176,193
Fuel oil	10^4 Tons	2.95	21.1	100	75,500	41,816	93,135
Petroleum coke	10^4 Tons	5.58	26.6	100	82,900	31,947	147,781
LPG	10^4 Tons	0.00	17.2	100	61,600	50,179	0
Refinery gas	10^4 Tons	2.80	15.7	100	48,200	46,055	62,156
Natural gas	10^8 m^3	16.79	15.3	100	54,300	38,931	3,549,328
Other petroleum products	10^4 Tons	5.01	20.0	100	72,200	41,816	151,258
Other coking products	10^4 Tons	0.00	25.8	100	95,700	28,435	0
Other Energy	10^4 Tons	135.08	0.0	0	0	0	0

CO_2 emission of net power import from the NWCPG	0.9404×15,526,260=14,600,215tCO_2e
CO_2 emission of net power import from the NCPG	1.0798×4,154,580=4,485,961tCO_2e
Total Emission (Q)	573,748,948tCO_2
Thermal Power supplied to the CCPG (P)	583,862,440MWh
OM Emission Factor in 2011 [＝Q/P]	0.9827CO_2e/MWh

Data sources: China Energy Statistical Yearbook 2012, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Table 1.4 of P1.23-1.24 in Chapter one

Table 12 The Operation Margin Emission Factor Calculation of the CCPG in 2012

Fuel	Unit	Fuel Consumption of the CCPG in 2005 G	Emission Factor H （tc/TJ）	Oxidation Rate I (%)	Emission Factor J ($kgCO_2/TJ$)	Average NCV K ($MJ/t,km^3$)	CO_2 Emission(tCO_2e) L=G*I*J*K/100000 (in quality unit) L=G*I*J*K/10000 (in volume unit)
Raw coal	10^4 Tons	24,689.03	25.8	100	87,300	20,908	450,641,063
Clean coal	10^4 Tons	22.71	25.8	100	87,300	26,344	522,292
Other washed coal	10^4 Tons	358.43	25.8	100	87,300	8,363	2,616,861
Briquettes	10^4 Tons	0.00	26.6	100	87,300	20,908	0,
Coal gangue	10^4 Tons	869.79	25.8	100	87,300	8,363	6,350,249
Coke	10^4 Tons	0.49	29.2	100	95,700	28,435	13,334
Coke oven gas	10^8 m^3	10.94	12.1	100	37,300	16,726	682,525
Blast furnace gas	10^8 m^3	392.98	70.8	100	219,000	3,763	32,385,364
Converter gas	10^8 m^3	16.37	46.9	100	145,000	7,945	1,885,865
Other gas	10^8 m^3	0.43	12.1	100	37,300	5,227	8,384
Other coking products	10^4 Tons	0.00	25.8	100	95,700	28,435	0
Crude oil	10^4 Tons	0.03	20.0	100	71,100	41,816	892
Gasoline	10^4 Tons	0.00	18.9	100	67,500	43,070	0
Kerosene	10^4 Tons	0.00	19.6	100	71,900	43,070	0
Diesel oil	10^4 Tons	5.6	20.2	100	72,600	42,652	173,406
Fuel oil	10^4 Tons	2.1	21.1	100	75,500	41,816	66,299
Naphtha	10^4 Tons	0.00	20.2	100	72,600	43,906	0
Lubricants	10^4 Tons	0.00	20	100	71,900	41,398	0
Parraffin waxes	10^4 Tons	0.00	20	100	72,200	39,934	0
White spirit	10^4 Tons	0.00	20	100	72,200	42,945	0
bitumen asphalt	10^4 Tons	0.00	21	100	69,300	38,931	0
Petroleum coke	10^4 Tons	7.93	26.6	100	82,900	31,947	210,019
LPG	10^4 Tons	0.00	17.2	100	61,600	50,179	0

Refinery gas	10^4 Tons	1.93	15.7	100	48,200	46,055	42,843
Other petroleum products	10^4 Tons	0.00	20	100	72,200	41,816	0
Natural gas	10^4 Tons	12.09	15.3	100	54,300	38,931	2,555,770
LNG	$10^8 m^3$	0.00	15.3	100	54,300	51,434	0
Other Energy	10^4 Tons	344.32	0.0	0	0	0	0
CO_2 emission of net power import from the NWCPG		0.9546×15,965,910=15,241,058tCO_2e					
CO_2 emission of net power import from the NCPG		1.0583×5,673,710=6,004,487tCO_2e					
Total Emission (Q)		519,400,160tCO_2					
Thermal Power supplied to the CCPG (P)		550,413,420MWh					
OM Emission Factor in 2012 [＝Q/P]		0.9437CO_2e/MWh					

Data sources: China Energy Statistical Yearbook 2013, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Table 1.4 of P1.23-1.24 in Chapter one

According to electricity supplied to the grid of thermal power, the OM of latest three years should be weighted average, so the weighted average OM is:

Table 13 Full-weighted Ave. OM three years of the CCPG

Year	2010	2011	2012
Total CO_2 Emission(tCO_2e)	493,376,271	573,748,948	519,400,160
Thermal Power supplied to the CCPG (MWh)	497,204,100	583,862,440	550,413,420
Full-weighted average OM(tCO2e/MWh)	0.9724		

Table 14 Calculation of CO_2 Emission of Solid, Liquid and Gas Fuel for Power Generation in 2012

Fuel	Unit	Jiangxi A	Henan B	Hubei C	Hunan D	Chongqing E	Sichuan F	Total G=A+B+C+D+E+F	NCV kJ/kg kJ/m^3 H	Emission Factor kgCO_2/TJ I	CO_2 emission (tCO_2e)
Raw coal	10^4 Tons	2,649.47	11,393.35	3,454.97	3,233.93	1,408.27	2,549.04	24,689.03	20,908	87,300	450,641,063
Clean coal	10^4 Tons	0.00	22.71	0.00	0.00	0.00	0.00	22.71	26,344	87,300	522,292
Other washed coal	10^4 Tons	0.00	126.8	0.00	0.00	138.05	93.58	358.43	8,363	87,300	2,616,861
Briquettes	10^4Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20,908	87,300	0,
Coal gangue	10^4 Tons	66.29	234.49	60.51	85.62	215.65	207.23	869.79	8,363	95,700	6,350,249
Coke	10^4Tons	0.00	0.00	0.49	0.00	0.00	0.00	0.49	28,435	87,300	13,334
Other Coke Products	10^4 Tons	0	0	0	0	0	0	0	28,435	95,700	0
Coal Fuel Subtotal											460,143,799
Crude oil	10^4 Tons	0.00	0.03	0.00	0.00	0.00	0.00	0.03	41,816	71,100	892
Gasoline	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	43,070	67,500	0
Kerosene	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71,900	43,070	0
Diesel oil	10^4 Tons	0.33	1.35	0.85	0.63	0.85	1.59	5.6	42,652	72,600	173,406
Fuel oil	10^4 Tons	0.00	0.82	0.25	1.03	0.00	0.00	2.1	41,816	75,500	66,299
Petroleum coke	10^4 Tons	0.00	5.71	0.00	2.22	0.00	0.00	7.93	41,816	75,500	210,019
Other petroleum products	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	41,816	72,200	0
Oil Fuel Subtotal											450,616
Natural gas	10^8 m^3	0.11	10.01	1.71	0.00	0.05	0.21	12.09	38,931	54,300	2,555,770
LNG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	54,300	51,434	0
Coke oven gas	10^8 m^3	0.37	4.23	0.03	0.15	1.59	4.57	10.94	16,726	37,300	682,525
Blast furnace gas	10^8 m^3	17.39	72.19	124.33	65.88	61.12	52.07	392.98	3,763	219,000	32,385,364
Convert gas	10^8 m^3	2.58	1.51	0.00	3.19	0.71	8.38	16.37	7,945	145,000	1,885,865
Other gas	10^8 m^3	0.00	0.11	0.00	0.00	0.32	0.00	0.43	5,227	37,300	8,384
LPG	10^4 Tons	0.00	0.00	0.00	0.00	0.00	0.00	0.00	50,179	61,600	0
Refinery gas	10^4 Tons	0.00	0.74	0.85	0.34	0.00	0.00	1.93	46,055	48,200	42,843

Gas Fuel Subtotal	-	37,560,750
Total	-	**498,155,164**

Calculated: $\lambda_{Coal,y}$ =92.37%，$\lambda_{Oil,y}$ =0.09%，$\lambda_{Gas,y}$ =7.54%

Table 15 Calculating of Emission Factor for Various Power Plant

	Variable	Power Supply Efficiency L	Emission Factor ($kgCO_2$/TJ) I	Emission Factor (tCO_2e/MWh) O=3.6/L/10000*I
Coal-fired Power Plant	$EF_{Coal,Adv}$	40.03	87,300	0.7851
Oil-fired Power Plant	$EF_{Oil,Adv}$	52.90	75,500	0.5138
Gas-fired Power Plant	$EF_{Gas,Adv}$	52.90	54,300	0.3695

Therefore, the emission factor of thermal power is:

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gas,y} \times EF_{Gas,Adv,y} = 0.75353 tCO_2/MWh$$

Table 16 Installed Capacity of the CCPG in 2009

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal Power	MW	11,500	43,100	15,670	15,900	6,800	12,270	105,240
Hydro Power	MW	3,770	3,650	30,010	11,460	4,530	25,810	79,230
Nuclear Power	MW	0	0	0	0	0	0	0
Wind Power and others	MW	60	50	10	2	10	0	132
Total	MW	15,330	46,800	45,690	27,362	11,340	38,080	184,602

Data Source: China Electric Power Yearbook 2010.

Table 17 Installed Capacity of the CCPG in 2010

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal Power	MW	12,940	46,870	18,150	16,090	6,740	12,580	113,370
Hydro Power	MW	4,040	3,650	30,850	12,990	4,880	30,700	87,110
Nuclear Power	MW	0	0	0	0	0	0	0
Wind Power and others	MW	82	50	63	38	50	0	283
Total	MW	17,062	50,570	49,063	29,118	11,670	43,280	200,763

Data Source: China Electric Power Yearbook 2011.

Table 18 Installed Capacity of the CCPG in 2011

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal Power	MW	13,820	49,190	19,180	17,650	6,940	14,440	121,220
Hydro Power	MW	4,110	3,950	33,860	13,370	5,980	33,420	94,690
Nuclear Power	MW	0	0	0	0	0	0	0
Wind Power and others	MW	137	110	103	106	50	20	526
Total	MW	18,067	53,250	53,143	31,126	12,970	47,880	216,436

Data Source: China Electric Power Yearbook 2012.

Table 19 Installed Capacity of the CCPG in 2012

Installed Capacity	Unit	Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total
Thermal Power	MW	15,050	53,550	21,740	19,060	7,240	14,930	131,570
Hydro Power	MW	4,200	3,950	35,950	13,720	6,110	39,640	103,570
Nuclear Power	MW	0	0	0	0	0	0	0
Wind Power and others	MW	216	150	182	190	50	20	808
Total	MW	19,466	57,650	57,872	32,970	13,400	54,590	235,948

Data Source: China Electric Power Yearbook 2013.

Table 20 The BM Calculation of the CCPG

	Installed Capacity in 2009	Installed Capacity in 2010	Installed Capacity in 2011	Installed Capacity in 2012	Capacity Addition Of 2009-2012	Capacity Addition Of 2010-2012	Capacity Addition Of 2011-2012	Ratio of Capacity Addition
Thermal Power(MW)	105,240	113,370	121,220	131,570	34,725	22,612	10,350	62.86%
Hydro Power(MW)	79,230	87,110	94,690	103,570	19,840	16,160	8,880	35.92%

Nuclear Power(MW)	0	0	0	0	0	0	0	0.00%
Wind Power(MW)	132	283	526	808	675	524	282	1.22%
Total(MW)	184,602	200,763	216,436	235,948	55,240	39,296	19,512	100.00%
Percent of Installed Capacity in 2009					23.41%	16.65%	8.27%	

Therefore, the BM was calculated as EF_{BM},y=0.75353×62.86%=0.4737tCO_2/MWh.

The baseline emission factor was calculated as the weighted average of the OM Emission Factor (0.9724tCO_2e/MWh) and the BM Emission Factor (0.4737tCO_2e/MWh). The defaults weights value for the second crediting period and for subsequent crediting periods are used as specified in the "Tool to calculate the emission factor for an electricity system (Version 04.0) ($w_{OM} = 0.25; w_{BM} = 0.75$).

Using above mentioned values the Combined Baseline Emission Factor ($EF_{grid,CM,y}$) of the CCPG in the second crediting period corresponds to **0.598375tCO_2e/MWh.**

Appendix 5. Further background information on monitoring plan

See detailed information in section B7.2.

Appendix 6. Summary of post registration changes

The revision of the monitoring plan was approved on 28/05/2010.

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