# Project design document form for CDM project activities

**(Version 08.0)**

*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** | 75MW Yunnan Nuozu Hydropower Project |
| **Version number of the PDD** | 03.0 |
| **Completion date of the PDD** | 04/02/2017 |
| **Project participant(s)** | Yunnan Nanpan River Nuozu Electric Development Co., Ltd (Project Owner)<br>Citigroup Global Markets Ltd. |
| **Host Party** | P.R. of China |
| **Applied methodology(ies) and, where applicable, applied standardized baseline(s)** | ACM0002"Consolidated baseline methodology for grid-connected electricity generation from renewable sources"(version 12.3.0) |
| **Sectoral scope(s) linked to the applied methodology(ies)** | Scope 1: Energy industries (Renewable sources) |
| **Estimated amount of annual average GHG emission reductions** | 206,173 $tCO_2e$ |

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

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75MW Yunnan Nuozu Hydropower Project (hereafter referred to as “the proposed project” or “the project activity”) is a new-built hydropower station, located on the middle reach of Nanpan River, between Huaning County Yuxi City and Mile County Honghe Prefecture, Yunnan Province, China. The proposed project is developed by Yunnan Nanpan River Nuozu Electric Development Co., Ltd. (hereafter referred to as “project owner”).

The purpose of the proposed project is to utilize the hydrological resources of the Nanpan River in a hydropower facility that will generate low emissions electricity. The proposed project involves installation of 3 turbines, each of which has a rated output of 25MW, providing total capacity of 75MW. The annual utilization time will be 4,889 h, the expected annual electricity generated by the project activity is 366,700MWh, the expected annual electricity delivered to the South China Power Grid (SCPG) is 326,069.64MWh[1], and the load factor is 55.8%[2].

The existing scenario prior to the start of the implementation of the proposed project is: electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and addition of new generation sources on China Southern Power Grid (SCPG), which is same as the baseline scenario of the proposed project.

After completion of the proposed project, electricity generated by the proposed project will effectively displace part of the electricity generated by the SCPG which is dominated by fossil fuel power plants. Thus greenhouse gas (GHG) emission reductions can be achieved. It is estimated that the proposed project can reduce 206,173 tonnes GHG emissions annually.

As a renewable energy project, the project activity will promote sustainable economic and industrial growth in the long run, help to conserve natural resources, and consequently contribute to a cleaner and healthier environment.

As illustrated below, the project activity will generate multiple benefits:

- The electricity generated by the project activity will displace the equivalent amount of electricity supplied from the China Southern Power Grid, thereby reducing emissions of $CO_2$, $SO_2$ and $NO_x$ from burning of fossil fuels at thermal power plants supplying power to the grid;
- The project activity will satisfy increasing electricity demand of Yuxi City, bring in related economic benefits for the local community and lead to sustainable economic and industrial growth in the region;
- The project activity will contribute to conservation of natural resources, such as coal, diesel and gas, by utilizing renewable sources of energy;

[1] FSR,P14-3
The effective power coefficient of the project is 90% while the total self-use rate is 1.2%. Besides, the monitoring meters have been installed in the substation. The net power delivery by the project to the grid is 366,700*90%*(1-1.2%)=326,069.64MWh.

[2] According to the FSR, the annual power generation is 366,700 MWh, and correspondingly, the PLF is calculated at 55.8% (4,889/8760). The PLF is taken from FSR which was carried out by a qualified third party, and finally approved by local DRC. It can be proved that the annual utilization hours were determined by a third party contracted with the project owner, and is the same one provided in the FSR which was provided to government while applying the approval, thus comply with the *Guidelines for the Reporting and Validation of Plant Load Factors* (version 01).

The project activity will provide 77 employment positions for professionals, workers and residents in the region;

The project activity will build about 60 km road to improve the local traffic condition; and
A bridge will be built convenient for the people who live in Mile County and Huaning County to exchange their farm produce and promote local economic development.

## A.2. Location of project activity

### A.2.1. Host Party

>>
People's Republic of China

### A.2.2. Region/State/Province etc.

>>
Yunnan Province

### A.2.3. City/Town/Community etc.

>>
Between Huaning County Yuxi City and Mile County Honghe Prefecture

### A.2.4. Physical/Geographical location

>>
The project activity is on the middle of Nanpan River, between Huaning County, Yuxi City and Mile County, Honghe Prefecture, Yunnan Province, China. The geographical coordinates of the dam is north latitude 24.4749° and east longitude 103.1048°, while the power house is north latitude 24.4673° and east longitude 103.1009°. The position of the project activity is shown in Figure A2-1.


**Figure A2-1 Geographic Location of the Project**

## A.3. Technologies and/or measures

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The purpose of the proposed project is to use well established hydropower generation technology for electricity generation. Low emissions electricity will be delivered to SCPG thereby displacing electricity from the Grid. The baseline scenario is the same as the scenario existing prior to the start of the implementation of the project activity; namely, electricity delivered to the grid by the proposed project would have otherwise been generated by the operation of grid connected power plants and by addition of new generation sources.

The proposed project mainly consists of a reservoir, a dam, step-up station, power house transformers and transmission line. The total installed capacity of 75 MW and the surface

area of the reservoir is 0.576km$^2$ at the full reservoir level according to FSR[3] so the power density is 130.21W/m$^2$. The lifetime of the proposed project is 25 years. The load factor is 55.8%[4], determined in the FSR by an independent qualified design institute.

Three sets of water-turbine generators with unit capacity 25MW will be installed in the power generation plant. The technology used in the proposed project, which has been used worldwide, is safe for the environment. Characteristics of the proposed project and construction methods will not permit negative impacts on the ecosystem. The major facilities which will be employed in the project activity are listed in table A3-1.

**Table A3-1 General Information of Major Facilities Selected in the Project**

| Main Technical Parameters | | Value |
|---|---|---|
| **Generators** | Quantity | 3 |
| | Type | SF25-16/4250 |
| | Rated Power | 25MW |
| | Rated Voltage | 10,500V |
| | Rated Speed | 763.2r/min |
| | Rated Power Factor | 0.85 |
| | Rated Frequency | 50Hz |
| | Life Time | 25 years |
| | Manufactory | Kunming Electrical Co., Ltd. |
| **Water Turbine** | Quantity | 3 |
| | Type | HLA743-LJ-190 |
| | Rated Head | 88.50m |
| | Rated Flux | 31.62m$^3$/s |
| | Rated Power | 25,620kW |
| | Life Time | 25 years |
| | Manufactory | Kunming Electrical Co., Ltd. |

The electricity generated by the project activity is connected via the Qinglong substation and Xiyi substation to SCPG with 2 connection lines. There are 2 monitoring meters installed in the 2 substation. Both meters are bidirectional meter and will record both the electricity imported and exported from and to the grid.

The electricity generated by the project activity is connected via the Qinglong transformer substation and Xiyi transformer substation to SCPG. The SCPG is comprised of Guangdong Power Grid, Guangxi Power Grid, Yunnan Power Grid, Guizhou Power Grid, and Hainan Power Grid.

The turbines and generators employed in the proposed project are domestic, no technology will be transferred.

[3] FSR P1

[4] Document from design institute: Kunming Hydropower Investigation, Design and Research Institute

### 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) |
|---|---|---|
| People's Republic of China (host) | Yunnan Nanpan River Nuozu Electric Development Co., Ltd | No |
| The Kingdom of Sweden | Citigroup Global Markets Ltd | No |

### A.5. Public funding of project activity

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No public funding from any Annex I parties are involved in the project activity.

## 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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The proposed project adopts the approved consolidated baseline and monitoring methodology ACM0002:
"*Consolidated baseline methodology for grid-connected electricity generation from renewable sources*"
(Version 12.3.0)
http://cdm.unfccc.int/methodologies/DB/C505BVV9P8VSNNV3LTK1BP3OR24Y5L
This methodology refers to the following tools:
"*Tool for the demonstration and assessment of additionality*" (Version 06.1.0)
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-01-v6.1.0.pdf

"*Tool to calculate the emission factor for an electricity system*" (Version 02.2.1)
http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf

### B.2. Applicability of methodology and standardized baseline

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Hydropower generation technology is one kind of renewable electricity generation technologies which
displaces fossil fuel-fired power generation technology to supply electricity to the grid. The proposed
project applies the consolidated methodology ACM0002 approved by CDM EB to determine the baseline
and to calculate GHG emission reductions achieved by hydropower generation. The following table
explains why the methodology ACM0002 is applicable to the project activity:

| Applicability Explanation | Explanation |
|---|---|
| This methodology is applicable to grid-connected renewable power generation project activities that | The project activity belongs to (a) install a new power plant at a site where no renewable power |

| | |
|---|---|
| (a) install a new power plant at a site where no renewable power plant was operated prior to the implementation of the project activity (greenfield plant); (b) involve a capacity addition; (c) involve a retrofit of (an) existing plant(s); or (d) involve a replacement of (an) existing plant(s). | plant was operated prior to the implementation of the project activity (Greenfield plant). |
| The project activity is the installation, capacity addition, retrofit or replacement of a power plant/unit of one of the following types: hydropower plant/unit (either with a run-of-river reservoir or an accumulation reservoir), wind power plant/unit, geothermal power plant/unit, solar power plant/unit, wave power plant/unit or tidal power plant/unit; | The project activity is the installation of a new hydropower plant with a run-of-river reservoir. |
| In the case of capacity additions, retrofits or replacements (except for capacity addition projects for which the electricity generation of the existing power plant(s) or unit(s) is not affected): the existing plant started commercial operation prior to the start of a minimum historical reference period of five years, used for the calculation of baseline emissions and defined in the baseline emission section, and no capacity addition or retrofit of the plant has been undertaken between the start of this minimum historical reference period and the implementation of the project activity; | The project activity is not a capacity addition, modification or retrofit; hence this condition is not relevant. |
| In case of hydropower plants:<br>• At least one of the following conditions must apply:<br>The project activity is implemented in an existing single or multiple reservoirs, with no change in the volume of any of the reservoirs; or<br>The project activity is implemented in an existing single or multiple reservoirs, where the volume of any of reservoirs is increased and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 $W/m^2$ after the implementation of the project activity; or<br>The project activity results in new single or multiple reservoirs and the power density of each reservoir, as per the definitions given in the Project Emissions section, is greater than 4 $W/m^2$ after the implementation of the project activity.<br>In case of hydropower plants using multiple reservoirs where the power density of any of the reservoirs is lower than 4 $W/m^2$ after the implementation of the project activity all of the | The project activity results in new single reservoir and the power density of the reservoir, as per the definitions given in the Project Emissions section, is 130.21$W/m^2$, which is greater than 4 $W/m^2$ after the implementation of the project activity. |

| | |
|---|---|
| following conditions must apply:<br>• The power density calculated for the entire project activity using equation 5 is greater than 4 $W/m^2$;<br>• All reservoirs and hydropower plants are located at the same river and were designed together to function as an integrated project that collectively constitutes the generation capacity of the combined<br>power plant;<br>• The water flow between the multiple reservoirs is not used by any other hydropower unit which is not<br>a part of the project activity;<br>• The total installed capacity of the power units, which are driven using water from the reservoirs with a power density lower than 4 $W/m^2$, is lower than 15 MW;<br>• The total installed capacity of the power units, which are driven using water from reservoirs with a<br>power density lower than 4 $W/m^2$, is less than 10% of the total installed capacity of the project activity from multiple reservoirs. | |
| The methodology is not applicable to the following:<br>• Project activities that involve switching from fossil fuels to renewable energy sources at the site of the project activity, since in this case the baseline may be the continued use of fossil fuels at<br>the site;<br>• Biomass fired power plants;<br>• A hydropower plant that results in the creation of a new single reservoir or in the increase in an existing single reservoir where the power density of<br>the reservoir is less than 4 $W/m^2$. | The project activity is to establish one new hydropower plant, therefore:<br>• The project activity doesn't involve switching from fossil fuels to renewable energy sources at the<br>site of the project activity;<br>• The project activity isn't a biomass fired power plant;<br>• The project activity results in new single reservoir and the power density of the reservoir according to<br>the definition given in the Project Emissions section, is 130.21$W/m^2$, which is greater than 4 $W/m^2$ after the implementation of the project activity. |
| In the case of retrofits, replacements, or capacity additions, this methodology is only applicable if the most plausible baseline scenario, as a result of the identification of baseline scenario, is "the continuation of the current situation, i.e. to use the power generation equipment that was already in use prior to the implementation of the project activity and undertaking business as usual maintenance". | The project activity is not a capacity addition, modification or retrofit; hence this condition is not relevant. |

### B.3. Project boundary

| Source | | GHGs | Included? | Justification/Explanation |
|---|---|---|---|---|
| Baseline scenario | $CO_2$ emissions from the fossil fuel fired power station of SCPG 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 hydropower plants, emissions of $CH_4$ from the reservoir. | $CO_2$ | No | Minor emission source |
| | | $CH_4$ | No | As the power density of the proposed project is 130.21W/m$^2$, greater than 10 W/m$^2$, the emission source is neglected |
| | | $N_2O$ | No | Minor emission source |

The electricity generated by the proposed project will be delivered to the SCPG via Yunnan Power Grid.

According to ACM0002 (Version 12.3.0) and the delineation of project electricity system and connected electricity systems published by Chinese DNA, the spatial extent of the proposed project boundary includes the proposed project site and all power plants connected physically to the SCPG that the proposed project will be connected to. The area covered by SCPG includes Guangdong, Guangxi, Yunnan, Guizhou, and Hainan Provinces.

The flow diagram of the proposed project boundary is shown as follows:

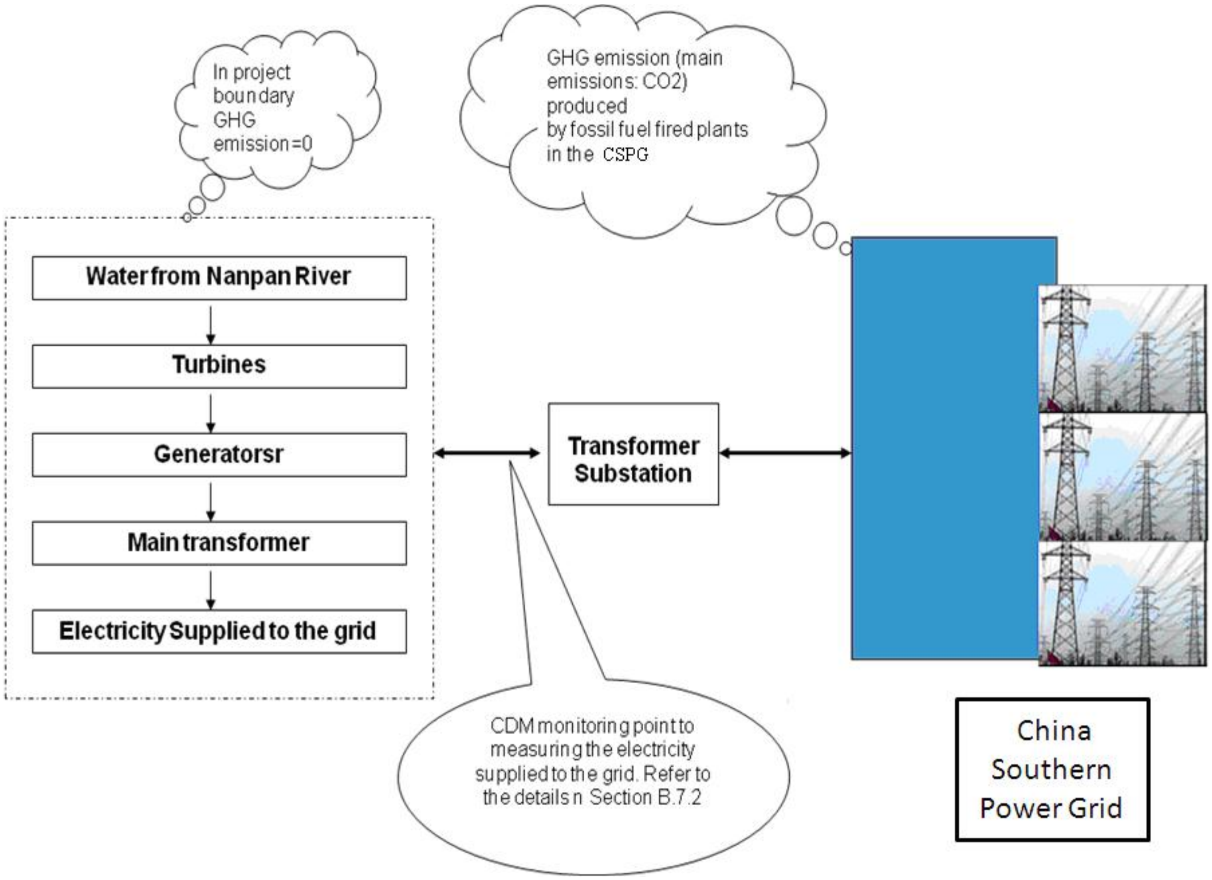


**Figure B3-1 Flow Diagram of the Proposed Project Boundary**

## B.4. Establishment and description of baseline scenario

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According to identification of the baseline scenario in ACM0002 (Version 12.3.0), the baseline scenario for a new grid-connected renewable power plant is as follows:

Electricity delivered to the grid by the project activity would have otherwise been generated by the
operation of grid-connected power plants and by the addition of new generation sources of SCPG, as reflected in the combined margin (CM) calculation described in the "*Tool to calculate the emission factor for an electricity system* (Version 02.2.1)".

According to the "*Tool to calculate the emission factor for an electricity system* (Version 02.2.1)", if the DNA of the host country has published delineation for the project electricity system and connected
electricity systems, these delineations should be used. Electricity generated by the proposed project will
be delivered to SCPG. Therefore, in accordance with the "*Tool to calculate the emission factor for an electricity system* (Version 02.2.1)" and the delineation given by Chinese DNA, SCPG is defined as the project electricity system as well as the project boundary of the proposed project. The proposed project is the installation of a new grid-connected renewable energy power plant, thus the baseline scenario in accordance with ACM0002 (Version 12.3.0) of the proposed project is as follows:
Electricity delivered to the grid by the proposed project would have otherwise been generated by the

operation of power plants connected to SCPG and by addition of new generation sources of SCPG.
The scenario is in compliance with national law "Renewable Energy Law of P.R. China".

## B.5. Demonstration of additionality

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**CDM consideration**

The project owner was aware of the positive impact of CDM revenue on implementation of the proposed project at an early stage. Knowledge that potential CDM revenue can improve the financial status of the proposed project was a key factor driving the project entity to make the investment decision. The following Table B5-1 presents the timeline of the proposed project.

**Table B5-1 Timeline of the Proposed Project**

| Time | Project Implementation | CDM Event | Description |
| --- | --- | --- | --- |
| May 2004 | FSR completed | | |
| 12/11/2004 | Approval of EIA | | |
| 06/02/2005 | Approval of FSR | | |
| 07/05/2005 | | Meeting with Huarui Investment Group Co., Ltd | Huarui Investment Group Co., Ltd introduce CDM to PO |
| 07/06/2005 | | Shareholders meeting[5] | Decided to carry out the CDM project in work plan |
| 15/07/2005 | | Huaning and Mile local DRC letter about CDM[6] | The two letters expressed support for the project development as CDM. |
| 28/07/2005 | | CDM Stakeholder Consultation Meeting | the stakeholders support the construction of the project |
| 15/10/2005 | | Letter from the Bank of China[7] | The bank suggested the project entity introducing the |

[5] CDM stratagem decision of company

[6] Supporting Letters from Huaning and Mile county

[7] Letter from the Bank of China to Yunnan Nuozu Hydropower Project

| | | | |
|---|---|---|---|
| | | | CDM in<br>order to get loan<br>successfully. |
| 15/12/2005 | Contract of the Project Construction was signed[8]. | | Starting date of proposed project. |
| 10/01/2006 | Turbines and Generators Purchase Agreement Singed (the second contract signed) | | |
| 21/03/2006 | | Signature of agreement on<br>CDM development between PO and Huarui Investment Group Co., Ltd[9] | |
| Mar,2006 to Dec,2006 | | The PO pushed the CDM<br>agent for CER buyer scouting and CDM project development[10] | |
| 14/12/2006 | Construction Starting Order issued by Supervision Party | | |
| 11/01/2007 | | Shareholders meeting taking decision on replacement of CDM agent[11] | Huarui Investment Group Co.,<br>Ltd showed no CDM competence and the CDM<br>development of the project did<br>not progress. The PO decided to<br>look for a new CDM consultant. |
| 10/12/2007 | | CDM development agreement between Shanghai Jingyi Investment | |

[8] Contract of Project Construction

[9] Agreement on CDM Development

[10] E-mail exchange between the owner and Huarui Investment Group Co., Ltd

[11] The Second Shareholder Meeting Based on the CDM

| | | | |
|---|---|---|---|
| | | Management Co., Ltd and the PO[12]. | |
| Feb 2008 | | Negotiate the CER transaction with Marubeni Corporation[13]. | |
| 20/06/2008 | | Signed the LOI with Sumitomo Corporation[14] | |
| 29/08/2008 | | Confirmation letter for termination of LOI by Sumitomo Corporation[15] | |
| 03/09/2008 | | Framework Agreement on Development Cooperation for CDM Projects in China between Enecore Carbon and Shanghai Jingyi | Enecore was consigned to find a buyer for the project. |
| 28/10/2008 | | Issuance of Host Country LOA | |
| 19/01/2009 | Yunnan Province Environmental Protection Bureau agreed the commissioning of the proposed project[16] | | |
| 11/02/2009 | | ERPA between PO and Citigroup | |
| 08/04/2009 | | Start of first GSC period | |
| 27/11/2009 | | MoC between PO and | |

[12] Agreement on CDM Development between the owner and Shanghai Jingyi Investment Management Co., Ltd

[13] E-mail exchange between Marubeni Corporation and Shanghai Jingyi Investment Management Co., Ltd

[14] LOI signed between the owner and the Sumitomo Corporation

[15] Termination Letter signed by Sumitomo Corporation

[16] Letter from Yunnan Province Environmental Protection Bureau

| | | | |
|---|---|---|---|
| | | Citigroup | |
| 20/07/2010 | | Termination of the first validation service | |
| 11/05/2012 | | Contract with DOE for new validation service | |

As shown in the above Table B5-1, the Construction Contract was signed on 15/12/2005, construction started in April 2006 and after that the Turbines and Generators Purchase Agreement was signed on 10/01/2006. The date of the Construction Contract, 15/12/2005, is the starting date of the project activity in accordance with the CDM Glossary of Terms (Ver.6). The timeline of the proposed project demonstrates that the incentive of CDM was seriously considered from the outset of the project planning cycle.

According to the ACM00002 (Version 12.3.0), the following steps are used to demonstrate the additionality of the proposed project according to the “Tool for the demonstration and assessment of additionality (Version 06.1.0)” agreed by the Executive Board.

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

According to methodology ACM0002 (Version 12.3.0), the realistic and credible baseline scenario is “electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation source of SCPG”.

**Step 2: Investment analysis**

The purpose of this step is to determine whether the project activity is economically or financially more attractive for the project participant than other alternatives without additional revenue/funding, possibly from the sale of emission reductions (CERs). The investment analysis was conducted according to Guidance on the assessment of investment analysis (Version 05) through the following sub-steps:

***Sub-step 2a: Determine appropriate analysis method***

The “Tool for the demonstration and assessment of additionality” (Version 06.1.0) suggests three analysis methods including simple cost analysis (option I), investment comparison analysis (option II) and benchmark analysis (option III). Since the proposed project will earn the revenues not only from the CDM but also from electricity sales, the option I is not an appropriate method. Investment comparison analysis method is applicable to projects whose alternatives are similar investment projects. The alternative baseline scenario of the proposed project is provision of equivalent amount of annual power output by SCPG rather than new investment projects therefore option II is not an appropriate method. The proposed project will use benchmark analysis method based on the consideration that benchmark IRR of the hydropower sector is available.

***Sub-step 2b: Benchmark Analysis Method (Option III)***

With reference to “Interim Rules on Economic Assessment of Electric Engineering Retrofit Projects”[17], the benchmark IRR of Chinese power industry is 8% of the total investment, which

[17] “Interim Rules on Economic Assessment of Electrical Engineering Retrofit Projects”, State Power Corporation of China. Beijing: China Electric Power press, 2003

has been used widely for Feasibility Studies of power project investments including hydropower projects in China.

***Sub-step 2c: Calculation and comparison of financial indicators***

(1) Basic parameters from the feasibility study report

Based on the feasibility study report of the proposed project, basic parameters for calculation of financial indicators are shown in table B5-2 (below):

**Table B5-2 Basic Parameters for IRR Calculation**

| No. | Parameter | Value | Sources |
|---|---|---|---|
| 1 | Installed capacity | 75MW | FSR(P14-1) |
| 2 | Estimated annual delivered to grid electricity | 326,069.64MWh | FSR(P14-3) |
| 3 | Project lifetime | 25 years | FSR(P14-3) |
| 4 | Static investment | RMB 514,176,500 | FSR(P14-2) |
| 5 | "Electricity Tariff | 0.1838 RMB/KWh(exclude VAT) | FSR(P14-1) |
| 6 | Residual value | 0 | FSR(P14-17) |
| 7 | Rate of Depreciation | 5% | FSR(P14-3) |
| 8 | Depreciation period | 20 | FSR(P14-12) |
| 9 | Average annual operating cost | RMB 9,523,100 | Calculated based on the basic parameter in FSR |
| | In 3rd year | RMB 1,273,700 | |
| | In 4th year | RMB 9,243,400 | |
| | In 5th year to 12th year | RMB 9,956,500 | |
| | In 13th year to 29th year | RMB 9,820,900 | FSR(P14-4) |
| 10 | Value added tax | 17% | FSR(P14-4) |
| | Income tax | 33% | FSR(P14-4) |
| | City building surtax | 5% | FSR(P14-4) |
| | Education additional surtax | 3% | |
| 11 | Crediting period | 7×3 years | |
| 12 | Expected CERs price | 8.6Euro/t$CO_2$e | ERPA |

*The tariff is in line with the "*Information note on the highest tariffs applied by the EB in its decisions on registration of projects in the People's Republic of China"* version 02*;*

(2) Comparison of the IRR of the proposed project and the financial benchmark

In accordance with benchmark analysis (Option III), if the financial indicators (such as IRR) of the proposed project are lower than the benchmark, the proposed project is considered as financially unattractive.

**Table B 5-3 Financial Indicators of the Project**

| Financial Indicators | IRR of Total Investment (Benchmark=8%) |
|---|---|
| Without CDM revenues | 6.87% |
| With CDM revenues | 9.05% |

Table B 5-3 shows the IRR of the proposed project, with and without CDM revenues. Without support of CDM, the IRR of total investment is lower than the benchmark 8%. Therefore, the proposed project is not financially attractive. With support of CDM, CERs revenue will significantly improve IRR of total investment, which exceed the benchmarks. Therefore, with support of CDM revenue, the proposed project can be considered financially attractive to investors.

**Sub-step 2d. Sensitivity analysis**

The objective of sensitivity analysis is to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions. The investment analysis provides a valid argument in support of additionality only if it consistently supports (for a realistic range
of assumptions) the conclusion that the project activity is unlikely to be the most financially attractive or is unlikely to be financially attractive.

For the proposed project, the following financial parameters were taken as uncertain factors for sensitive analysis of financial attractiveness:

(1) Electricity Tariff
(2) Electricity Generation
(3) Fixed Asset Investment
(4) Operating Cost

When the above three financial indicators fluctuate within the range of -10% to +10%, the IRR of the proposed project varies to different extents. The impacts on IRR of total investment by fluctuation of the above parameters (not considering CERs income) can be seen in table B5-4.

**Table B5-4 Results of the Sensitivity Analysis for Project IRR**

| Fluctuation Range of Parameters | -10% | -5% | 0 | 5% | 10% |
|---|---|---|---|---|---|
| Electricity Tariff | 5.88% | 6.38% | 6.87% | 7.33% | 7.79% |
| Electricity Generation | 5.88% | 6.38% | 6.87% | 7.33% | 7.79% |
| Static Investment | 7.79% | 7.31% | 6.87% | 6.45% | 6.06% |
| Operating Cost | 7.03% | 6.95% | 6.87% | 6.79% | 6.70% |

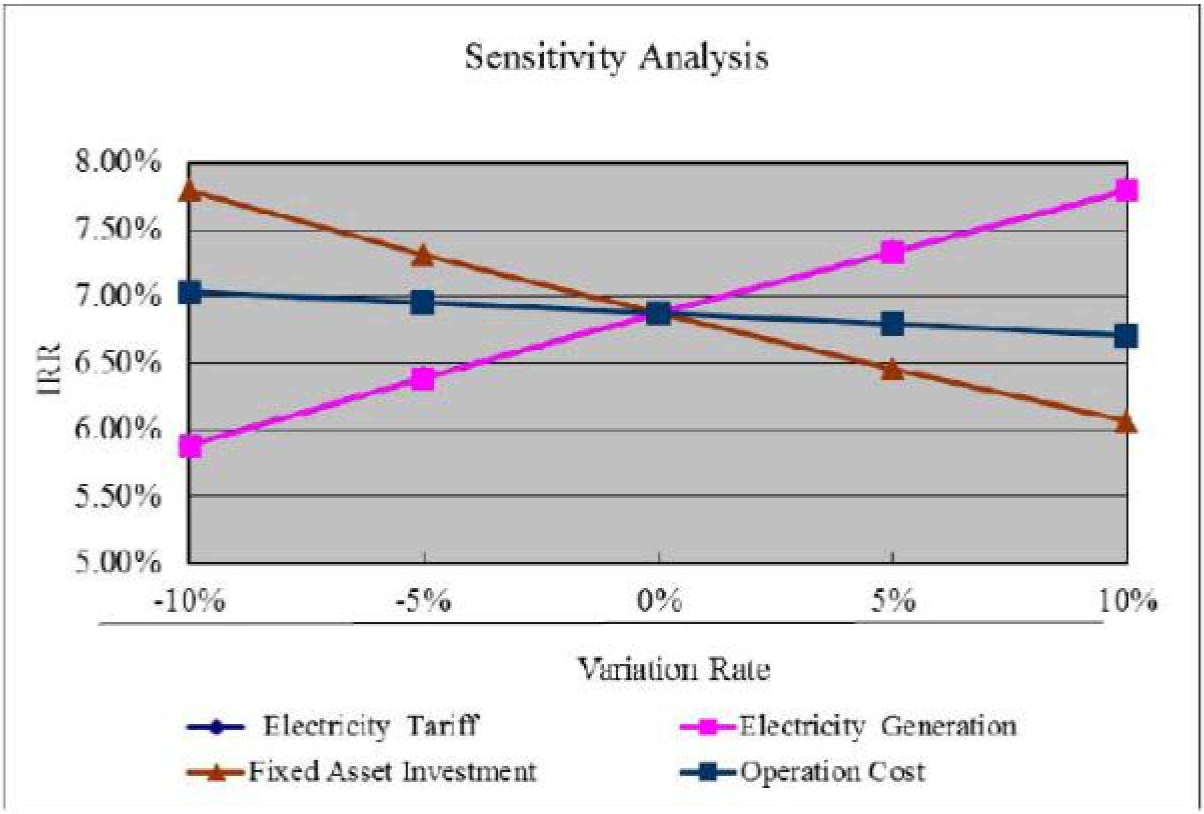


**Figure B5-1 Results of Sensitivity Analysis for IRR**

The table B5-4 and Figure B5-1 shows that the IRR will decrease with increase of total investment or operating cost, and it will increase with decrease of total investment or operating cost. When the total investment or annual operating cost decreases by 10%, the IRR is still lower than 8%.

Meanwhile, in order for the IRR to reach the benchmark, the parameters must change as summarised in Table B5-5:

**Table B5-5 Results of the Sensitivity Analysis for the Project IRR (Total Investment)**

| Parameter | Scope of Change | IRR |
|---|---|---|
| Electricity Tariff | 12.35% | 8% |
| Electricity Generation | 12.35% | 8% |
| Static Investment | -12.08% | 8% |
| Operating Cost | -73.13% | 8% |

The electricity tariff (excluding VAT) is an important factor affecting the financial attractiveness of the proposed project. When the tariff increases by 12.35%, the IRR of the proposed project would reach the benchmark. But according to the PPA of the proposed project, the actual grid price is 0.215Yuan/kWh (incl.VAT) and 0.1838 (excl.VAT). Therefore, it is unlikely that the grid price will be increased and as a result, it is not possible to improve the economic revenue through an increase in the grid price. Besides, according to *the INFORMATION NOTE ON THE HIGHEST TARIFFS APPLIED BY THE EXECUTIVE BOARD IN ITS DECISIONS ON REGISTRATION OF PROJECTS IN THE PEOPLE'S REPUBLIC OF CHINA* (version 02) issued by EB61, Para 78, 03 June 2011, the highest tariff of Hydropower project in Yunnan province is 0.215Yuan/kWh which is same as the proposed project.

When the estimated annual power delivered to the grid increases by about 12.35%, the IRR of the proposed project would exceed the benchmark. The value of annual power delivered to the grid is sourced from the FSR, which reflects a representative year value based on the water resource of the river over the past 48 years. Therefore, it is unlikely that an increase of electricity delivered to the grid will raise the IRR to meet the benchmark.

If 12.08% of the Static investment could be saved, the IRR of the proposed project could reach the benchmark IRR. However, the actual contract value of the main contracts (i.e. main equipment and key construction works) of the proposed project is close to the Static investment estimated in the FSR. Therefore, this assumption is unrealistic.

Annual operating cost should decrease 73.13% when IRR reach the benchmark, which is impossible in practice because the price of materials and wage standard is rising in China[18].

**Step 3: Barrier analysis**

Not applied. Since it is demonstrated in Step 2 above that the proposed CDM project activity is not financially attractive, we proceed to Step 4.

**Step 4: Common practice analysis**

The common practice of the project activity is demonstrated by applying the "*Tool for the demonstration and assessment of additionality*" (Version 06.1.0).

***Sub-step 1: Calculate applicable output range as +/-50% of the design output or capacity of the proposed project activity.***

The total installed capacity of proposed project is 75MW, thus the output ranged as +/-50% of the design output will be included in the following analysis, i.e., power projects with installed capacity from 37.5MW to 112.5MW.

***Sub-step 2: In the applicable geographical area, identify all plants that deliver the same output or capacity, within the applicable output range calculated in Sub-step 1, as the proposed project activity and have started commercial operation before the start date of the project. Note their number $N_{all}$. Registered CDM project activities and projects activities undergoing validation shall not be included in this step.***

Applicable geographic area: The developments of hydropower technology vary considerably across China as it is a resource-based clean technology. In addition, because of the geographical differences (e.g access to natural resources, the climate, the terrain), and social and significant economic differences among the provinces (e.g. regulatory framework, infrastructure, level of economic development economic structure, access to technology, access to financing, tariff levels), therefore, the common practice analysis is limited to the Yunnan Province.

Applicable project size: Identify all plants which deliver an output of 37.5~112.5MW electricity in Yunnan Province and started commercial operation before 15th Dec, 2005 (the start date of the proposed project activity), excluding registered CDM projects.

If the project activities are classified in terms of energy resources, the project activities could be classified into hydro power projects and other projects, which could be expressed in the following equation:

$N_{all}=N_{all,\ hydro}+N_{all,\ others.}$

[18] http://finance.sina.com.cn/g/20080124/10024447240.shtml

The table below shows that all hydropower projects which deliver an output of 37.5~112.5MW electricity in Yunnan Province and started commercial operation before 15th Dec, 2005 (the start date of the proposed project activity), excluding registered CDM projects

| No | Project name | Installed capacity (MW) | Operation year | CDM project |
|---|---|---|---|---|
| 1 | Gaoqiao hydro power project[19] | 90 | 2004 | No |
| 2 | Malutang hydro power project[20] | 100 | 2005 | No |
| 3 | Dayingjiang hydro power project[21] | 98 | 2005 | No |
| 4 | A'jiutan hydro power project[22] | 105 | 2005 | No |
| 5 | Chaishitan hydro power project[23] | 60 | 2000 | No |
| 6 | Yunguixiang hydro power project[24] | 100 | 1999 | No |
| 7 | Lazhuang hydro power project[25] | 60 | 1992 | No |
| 8 | Xucun hydro power project[26] | 78 | 2000 | No |
| 9 | Husonghe hydro power project[27] | 63 | 1997 | No |
| 10 | Luosiwan hydro power project[28] | 60 | 1999 | No |
| | The proposed Project | 75 | 2005 | |

*Data source: China water resource yearbook 2005, 2006, 2007.*

Therefore, $N_{all}$=10+$N_{all,others}$

***Sub-step 3: Within plants identified in Sub-step 2, identify those that apply technologies different that the technology applied in the proposed project activity. Note their number $N_{diff}$.***

According to the "Tool for the Demonstration and Assessment of Additionality" (version 06.1.0), different technologies are technologies that deliver the same output and differ by at least one of the following (as appropriate in the context of the measure applied in the proposed CDM project and applicable geographical area):

(a) Energy source/fuel;
(b) Feed stock;

(c) Size of installation (power capacity):
- (i) Micro;
- (ii) Small;
- (iii) Large;

(d) Investment climate in the date of the investment decision, inter alia:
- (i) Access to technology;
- (ii) Subsidies or other financial flows;

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[19] http://www.chinabidding.com/zxzx-detail-192276.html

[20] http://news.sina.com.cn/s/2002-10-10/1523762304.html

[21] http://www.dh.gov.cn/dhzrmzfgzxxw/3974147408102686720/20060921/67281.html

[22] http://www.ynsph.com.cn/column/466.whtml

[23] http://baike.baidu.com/view/4081675.htm

[24] http://www.cnki.com.cn/Article/CJFDTOTAL-ZJXD200001025.htm

[25] http://baike.baidu.com/view/4883417.htm

[26] http://www.ynf.gov.cn/newsview.aspx?id=69480

[27] http://baike.baidu.com/view/4418057.htm

[28] http://baike.baidu.com/view/4391176.htm

(iii) Promotional policies;
(iv) Legal regulations;
(e) Other features, inter alia:
(i) Unit cost of output (unit costs are considered different if they differ by at least 20%);

Since projects with different energy source/fuel are considered as different technologies, $N_{all,others}$ are considered as different technologies with the project.

*Investment climate in the date of the investment decision: projects after 2002*
There was reform of unbundling power plants and power grids in 2002, namely "Reforming of Electric Power System"[29]. Before the reform, all power projects were constructed and operated by the national or provincial electric power companies. The government provided loan guarantees for those companies at that time and the developers did not have to overcome investment or financing barriers. There were also changes to the electricity tariff mechanisms under the reform, and as a result the investment environment of power production projects in China changed significantly in 2002. Therefore, only projects developed after reform can be considered similar to the proposed project. Project 5 to project 10 are considered as different technologies with the project.

According to "*Tool for the demonstration and assessment of additionality*" (Version 06.1.0), the technology could be concluded different if the unit cost of output differ by at least 20 %. The unit cost of output of the project is 7,241.1RMB/kW, and the operating hours of the project is 4,889 hours.

Project 1, Gaoqiao was developed by Dianneng (Group) Zhaotong Gaoqiao Power Limited Company with total investment of 442,000,000 RMB and with annual operational hour of 5,067 hours. Furthermore, the project is a key project included in the Yunnan 10$^{th}$ Five-Year Plan[30] and did not face the same difficulties in securing the financing for the project[31]. Gaoqiao plant is different form the proposed project, since the unit cost of output (4,911.1 RMB/kW) is 32% lower and at the same time operating hours (5,067 hours) are 3.6% higher than the proposed project.

Project 2, Malutang hydropower station was developed by Yunnan Wenshan Malutang Generation Co., Ltd., with total investment of 447,000,000 RMB with an annual operational hour of 6,970 hours. These two parameters are much higher than the ones of the proposed project (unit cost of output (4,470.0 RMB/kW) is 38% lower, while operating hours (6,970 hours) is 42.6% higher).

Project 3, Dayingjiang hydropower station was developed by Dehong Kairui Dayingjiang Development Co., Ltd., with total investment of 500,000,000 RMB. The annual operational hour of Dayingjiang is 7,388: this shows that the Dayingjiang project is different form the proposed project activity (unit cost of output (5,102.0 RMB/kW) is 30% lower while the operating hours (7,388 hours) is 51.1% higher).

Project 4, Ajiutian Hydropower Station is developed by Yunnan Baoshan Supa River Hydro Development Limited Company. Ajiutian Hydropower Station is located on the Supahe River in Baoshan City, the annual operational hour is 5,670 hours while the total investment of is 492,800,000 RMB. Ajiutian plant shows a unit cost of output (4,693.3 RMB/kW) lower by 35% and operating hour (5670 hours) is higher by 16% compared to the proposed project. Besides, the company is the subsidy company of Yunnan Domestic Electric Power Investment Co. Ltd

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[29] See http://www.ndrc.gov.cn/xwfb/t20050708_28096.htm

[30] http://news.sina.com.cn/c/2004-07-08/11543027389s.shtml

[31] http://zt.gog.com.cn/system/2009/06/25/010592245.shtml

and Baoshan Electric Power Limited Company[32] Ajiutian project is a key construction project in Yunnan, therefore this project did face investment barrier[33].

Therefore, project 1 to project 4 are considered as different technologies with the project.

| Name of the project | Unit cost of output (RMB/kW) | Variation | Operating Hours | Variation |
|---|---|---|---|---|
| Proposed Project | 7,241.1 | | 4,889 | |
| Gaoqiao Hydropower Station | 4,911.1 | -32% | 5,067 | 3.6% |
| Malutang Hydropower Station | 4,470.0 | -38% | 6,970 | 42.6% |
| Dayingjiang Hydropower Station | 5,102.0 | -30% | 7,388 | 51.1% |
| Ajiutian Hydropower Station | 4,693.3 | -35% | 5670 | 16.0% |

From the analysis of Sub-step 2 and Sub-step 3, it can be seen that $N_{all,hydro}$= 10+$N_{all,others}$ = $N_{diff}$

Step 4: Calculate factor F=1-$N_{diff}$/$N_{all}$ representing the share of plants using technology similar to the technology used in the proposed project in all plants that deliver the same output or capacity as the proposed project.

According to publicly available information from UNFCCC[34], "The proposed project activity is a "common practice" within a sector in the applicable geographical area if both the following conditions are fulfilled:

(a) the factor F is greater than 0.2, and
(b) $N_{all}$-$N_{diff}$ is greater than 3."

From the above analysis, $N_{diff}$ is same as $N_{all}$, and F=0. Therefore, the project is additional as per the "*Tool for the demonstration and assessment of additionality*" (Version 06.1.0).

In conclusion, similar hydropower projects in Yunnan Province have only been developed as CDM projects to improve their financial status and decrease risks. The proposed project without support of CDM is not common practice in Yunnan Province.

## B.6. Emission reductions

### B.6.1. Explanation of methodological choices

>>

**Project Emissions**

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

Where:

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

$PE_{FF,y}$ = Project emissions from fossil fuel consumption in year *y*

32 http://www.ynsph.com.cn/column/430.whtml

33 http://news.sina.com.cn/c/2002-08-08/1402664780.html

34 *http://cdm.unfccc.int*

(t$CO_2$/yr)

$PE_{GP,y}$ = Project emissions from the operation of geothermal power plants due to the release of non-condensable gases in year *y* (t$CO_2$e/yr)

$PE_{HP,y}$ = Project emissions from water reservoirs of hydropower plants in year *y* (t$CO_2$e/yr)

The proposed project is a hydro project, so $PE_{GP,y}$=0;

The proposed project does not involve any fossil fuel consumption hence $PE_{FF,y}$=0;

For hydropower project that result in a new reservoir, if the power density (PD) of the power plant is greater than 10W/m$^2$, $PE_{HP,y}$=0.

The power density of the project activity is calculated as:

$$PD = \frac{Cap_{PJ} - Cap_{BL}}{A_{PJ} - A_{BL}}$$ (*Equation B. 2*)

Where:

$PD$ = Power density of the project activity, in W/m$^2$.

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

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

$A_{PL}$ = Area of the reservoir measured in the surface of the water, after the implementation of the project activity, when reservoir is full(m$^2$)

$A_{BL}$ = Area of the reservoir measured in the surface of the water, before the implementation of the project activity, when the reservoir is full (m$^2$).For new reservoirs, this value is zero.

For the proposed project, it is a new hydropower plant, so$PD = \frac{75MW - 0MW}{576000m^2 - 0m^2} = 130.21W/m^2$.

Thus, the project emission $PE_y$ = 0.

**Baseline emissions (*$BE_y$*)**

Baseline emissions include only $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity, calculated as follows:

$BE_y = EG_{PJ,y} \times EF_{grid,CM,y}$ (*Equation B.3*)

Where:

$BE_y$ = Baseline emissions in year *y* (t$CO_2$/year)

$EG_{PJ,y}$ = 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*

Since the proposed project is the installation of a new grid-connected renewable power plant at a site where no renewable power plant was operated prior to the implementation of the project, the $EG_{PJ,y}$ are calculated according to the following equation:

$$EG_{PJ,y} = EG_{facility,y} \quad (Equation\ B.4)$$

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) |

**Calculation of $EG_{facility,y}$**

$$EG_{facility,y} = EG_{out,y} - EG_{in,y} \quad (Equation\ B.5)$$

Where:

| | | |
|---|---|---|
| $EG_{out,y}$ | = | Electricity delivered to power grid by the Project in year $y$ (MWh) |
| $EG_{in,y}$ | = | Electricity import from SCPG by the Project in year $y$ ($tCO_2$/year) |

**Calculation of $EF_{grid,CM,y}$**

The calculation can be conducted according to "*Tool to calculate the emission factor for an electricity system*" (Version 02.2.1). It also refers to "*Bulletin on Baseline Emission Factor of China Region Grid*" as published by the Office of National Coordination Committee on Climate Change (i.e. the national DNA), which calculate the Operating Margin (OM) Emission Factor and the Build Margin (BM) Emission Factor for the Chinese regional power grids.

The full process for the calculation of the emission factors and all underlying data are presented in Annex 4 to this PDD.

**Step 1. Identify the relevant electric power system**

The delineation of the proposed project electricity system and the connected electricity system as defined by the Host Country DNA has been used to identify the relevant electric power system. The power generated by the project activity will be transferred to the SCPG, comprising the provincial electric systems of Guangdong, Guangxi, Yunnan, Guizhou, and Hainan Provinces. Therefore the SCPG is identified as the proposed project electric power system. The SCPG imports some electricity from Central China Power Grid (CCPG) therefore the connected electricity system is identified as CCPG. Electricity transfers from CCPG to SCPG are defined as electricity imports. For the purpose of determining the operating margin emission factor, option (b) is used to determine the $CO_2$ emission factor(s) for net electricity imports.

***Step 2. Choose whether to include off-grid power plants in the project electricity system***

In accordance with the "*Tool to Calculate the Emission Factor for an Electricity System"* (Version 02.2.1), project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

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

The project participants choose **Option I:** Only grid power plants are included in the calculation as the way to calculate the operating margin and build margin emission factors

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

According to the "*Tool to calculate the emission factor for an electricity system* (Version 02.2.1)", one of the following options can be applied for the $EF_{OM}$ calculation:

(a) Simple OM;
(b) Simple adjusted OM;
(c) Dispatch data analysis OM;
(d) Average OM.

The simple OM method (option a) can only be used if low-cost/must-run resources constitute less than 50% of total grid generation in: 1) average of the five most recent years, or 2) based on long-term averages for hydroelectricity production. The low-cost/must-run resources only constitute 30.42%, 28.43%, 29.28%, 36.07% and 32.36% of total generation of SCPG from the year 2005 to 2009, respectively, which are far less than 50% of total grid generation in the five most recent years. Therefore, the simple OM method (option a) is used to calculate OM emission factor for the proposed project.

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

> Ex-ante option: A 3-year generation-weighted average, based on the most recent data available (i.e. 2007, 2008 and 2009) at the time of submission of the CDM-PDD to the DOE for validation ,without requirement to monitor and recalculate the emission factor during the crediting period, or
>
> Ex-post option: The year, in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year *y* is usually only available later than six months after the end of year *y*, alternatively the emission factor of the previous year (*y-1*) may be used. If the data is usually only available 18 months after the end of year *y*, the emission factor of the year proceeding the previous year(*y-2*) may be used. The same data vintage (*y*, *y-1*or *y-2*) should be used throughout all crediting periods.

For the proposed project, *ex-ante* option is applied to calculate the emission factor for simple OM and it will not be updated during the first crediting period.

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

According to "*Tool to calculate the emission factor for an electricity system* (Version 02.2.1) ", the Simple OM emission factor is calculated as the generation-weighted average $CO_2$ emissions per unit net electricity generation ($tCO_2$/MWh) of all generating power plants serving the system, not including low-cost / must-run power plants / units. It may be calculated:

**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.

The proposed project selected Option B for the following 3 reasons:

1. Data on net electricity generation and a $CO_2$ emission factor of each power unit in the SCPG are not available;
2. 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;;
3. Off-grid power plants are not included in the calculation.

According to Option B, the calculation follows the following formula:

$$EF_{grid,OMsimple,y} = \frac{\sum_i FC_{i,y} \cdot NCV_{i,y} \cdot EF_{co_2,i,y}}{EG_y} \quad \text{(Equation B.6)}$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin $CO_2$ emission factor in year *y* ($tCO_2/MWh$)

$FC_{i,y}$ = Amount of fossil fuel type *i* consumed in the project electricity system in year *y* (mass or volume unit)

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

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

$EG_y$ = Net electricity generated and delivered to the grid by all power sources serving the system, not including low-cost/must-run power plants/units, in year *y* (MWh)

*i* = All fossil fuel types combusted in power sources in the project electricity system in year *y*

*y* = The relevant year as per the data vintage chosen in Step 3

In accordance with the "*Tool to calculate the emission factor for an electricity system* (Version 02.2.1)", the Ex-ante option is selected to calculate the OM emission factor, Therefore, equation B.3 is applied to the three latest years for which data are available, and a 3-year generation-weighted average value is taken for the OM Emission Factor.

The published OM emission factor calculates the emission factor directly from published aggregated data on fuel consumption, net calorific values, and power supply to the grid and IPCC default values for the $CO_2$ emission factor and the oxidation rate. Aggregated generation and fuel consumption data have been used for the calculation of the emission factors since more disaggregated data is not publicly available in China.

On the basis of this data, the Operating Margin emission factors for 2007, 2008 and 2009 are calculated. The three-year average is calculated as a full-generation-weighted average of the emission factors. For details we refer to the publications cited above and the detailed explanations and demonstration of the calculation of the OM emission factor provided in Annex 4. We calculate the Operation Margin Emission Factor as:

$EF_{gird,OMsimple,y}$ =0.9489 $tCO_2/MWh$.

The operating margin emission factor of the baseline is calculated ex-ante and will not be updated in the first crediting period of the project activity.

**Step 5. Calculate the build margin emission factor(s) (*$EF_{BM}$*)**

In terms of the data vintage, the "*Tool to calculate the emission factor for an electricity system* (Version 02.2.1)" indicates two options for the calculation of $EF_{BM,y}$.

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 the emission factor during the crediting period.

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

The proposed project selected Option 1: In the first crediting period, calculate the build margin emission factor $EF_{BM,y}$ ex-ante based on the most recent information available on plants already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

The Build Margin Emission Factor is calculated as the generation-weighted average emission factor ($tCO_2e/MWh$) of all power unites *m* during the most recent year *y* for which power generation data is available, calculated as follows;

$$EF_{gird,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

(*Equation B.7*)

Where:

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

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

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

*m* = Power units included in the build margin

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

However, a direct application of this approach is difficult in China, as data on either the five power plants that have been built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation are classified as business confidential and are not publicly available. As the data required cannot be obtained in China, the EB has provided guidance and allowed for deviation[35]. The following deviation has been indicated by the EB:

a. Use of capacity addition from one year to another as basis for determining the build margin, i.e. the capacity addition over five years, whichever results in a capacity addition that is closest to 20% of total installed capacity.
b. Use proportional weights that correlate to the distribution of installed capacity in place during the selected period above instead of power generation, using plant efficiencies and emission factors of commercially available best practice technology.

Executive Board (EB) also suggests using the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin.

The calculations of build margin emission factor are derived from the "*Bulletin on the Baseline Emission Factor of the China's Regional Grids*", which was updated and published by the DNA in China on 20th October 2011.

***Sub-step 1. Calculation the weights of $CO_2$ emissions of solid, liquid and gas fuel in total emissions for power generation***

The weights of $CO_2$ emissions from solid, liquid and gas fuels in the total emissions in SCPG are calculated by the formulae as follows:

$$\lambda_{Coal,y} = \frac{\sum_{i \in COAL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}$$ (*Equation B.8*)

$$\lambda_{Oil,y} = \frac{\sum_{i \in OIL,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}$$ (*Equation B.9*)

$$\lambda_{Gas,y} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,y} \times EF_{CO_2,i,j,y}}$$ (*Equation B.10*)

[35] "Request for guidance: Application of AM0005 and AMS-I.D in China", a letter from DNV to the Executive Board, dated 07/10/2005, http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM

Where:

$F_{i,j,y}$ = Amount of fuel *i* consumed in province *j* in year *y*(tce)

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

$EF_{co2,i,j,y}$ = $CO_2$ emission factor of fossil fuel type *i* in year *y* ($tCO_2$/GJ)

$\lambda_{Coal}$, $\lambda_{liquid}$, $\lambda_{gas}$ = Weights of $CO_2$ emissions of solid, liquid and gas fuel in total emissions respectively

For the detailed information, please see the Annex 4.

***Sub-step 2. Calculate the emission factor of relevant thermal power***

The emission factor of thermal power is then calculated by using a formula as follows:

$$EF_{Thermal,y} = \lambda_{Coal,y} \times EF_{Coal,Adv,y} + \lambda_{Oil,y} \times EF_{Oil,Adv,y} + \lambda_{Gasl,y} \times EF_{Oil,Adv,y} \quad (Equation\ B.11)$$

Where:

$EF_{Coal,Adv,y}$, $EF_{Oil,Adv,y}$, $EF_{Gas,Adv,y}$ = Emission factor representing best technology commercially available for fuel of coal, oil or gas fired power plants respectively.

According to the statistical analysis of newly-built coal-fired 600MW power plants which is promulgated by China Electricity Council, the weighted average value of the former 30 generators with the lowest power supply coal consumption is confirmed the best commercialized technology of the most optimal efficiency level, and the coal consumption is 311.5gce/kWh, while the power supply efficiency is corresponding to 39.45%.

The combined cycle technology of 200 MW level is confirmed to have the highest optimal efficiency of all technologies that are commercially available (including gas- fired and oil-fired power plants). According to data in 2009, coal consumption of the gas turbine power plant with highest optimal efficiency is 237.4gce/kWh (calculating according to calorie value), while the power supply efficiency is corresponding to 51.77%[36].

***Sub-step 3. Calculate the BM of the grid***

Based on the result above and the share of thermal power of recent 20% capacity additions, build margin emission factor can be calculated by:

$$EF_{grid,BM,y} = \frac{CAP_{Thermal,y}}{CAP_{Total,y}} \times EF_{Thermal,y} \quad (Equation\ B.12)$$

Where:

$CAP_{Total,y}$ = Total of new capacity additions(MW)

$CAP_{Thermal,y}$= New capacity addition of thermal power(MW)

The calculation result of the Building Margin emission factor is $EF_{grid,BM,y}$ **=** 0.3157 $tCO_2$/MWh. For the detailed information, please see the Annex 4.

The build margin emission factor of the baseline is calculated ex-ante and will not be updated in the first crediting period of the project activity.

[36] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2551.doc

**Step 6. Calculate the combined margin emissions factor ($EF_y$)**

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 proposed project selected weighted average CM methodology.

**Weighted average CM**

The combined margin emission factor is calculated as weighted average of the operating margin and build margin.

$$EF_{gird,CM,y} = EF_{grid,OM,y} \times w_{OM} + EF_{grid,BM,y} \times w_{BM} \quad \text{(Equation B.13)}$$

Where:
$EF_{gird,CM,y}$ = Combined margin $CO_2$ emission factor in year $y$ ($tCO_2e/MWh$)
$EF_{grid,BM,y}$ = 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, which is 0.5 by default
$w_{BM}$ = Weighting of build margin emissions factor, which is 0.5 by default

According to steps above and the *Bulletin on Baseline Emission Factor of China Region Grid* published by the Office of National Coordination Committee on Climate Change on 20th October 2011, the operating margin emission factor ($EF_{grid,OM,y}$ ) of the SCPG is $EF_{grid,OM,y}$ =0.9489 $tCO_2e/MWh$ and the build margin emission factor ($EF_{grid,BM,y}$) is $EF_{grid,BM,y}$ =0.3157$tCO_2$ e/MWh. The value of the default weights of the operating margin ($w_{OM}$) and building margin ($w_{BM}$) as specified in the "*Tool to calculate the emission factor of an electricity system*" are $w_{OM}$= 0.5 and $w_{BM}$ = 0.5.

Applying above values the combined baseline emission factor of the SCPG is:
$EF_{gird,CM,y}$ =0.6323 $tCO_2e/MWh$.

The combined emission factor of the baseline is calculated ex-ante and will not be updated in the first crediting period of the project activity.

**Leakage**

As per ACM0002 (Version 12.3.0), no leakage emissions are considered. The main emissions potentially giving rise to leakage in the context of electric sector projects are emissions arising due to activities such as power plant construction and upstream emissions from fossil fuel use (e.g. extraction, processing, and transport). These emissions sources are negligible. Therefore, $LE_y$=0 $tCO_2e$.

**Emission reductions**

Emission reductions are calculated as follows:

$$ER_y = BE_y - PE_y \quad \text{(Equation B.14)}$$

Where
$ER_y$ = Emission reduction in year $y$ ($tCO_2e/yr$)
$BE_y$ = Baseline emission in year $y$ ($tCO_2e/yr$)

$PE_y$ = Project emission in year $y$ ($tCO_2e/yr$)

### B.6.2. Data and parameters fixed ex ante

| | |
|---|---|
| **Data / Parameter** | $FC_{i,y}$ |
| **Unit** | mass or volume unit |
| **Description** | Amount of fossil fuel type *i* consumed in the SCPG in year *y*. |
| **Source of data** | *China Energy Statistical Yearbooks,2008-2010* |
| **Value(s) applied** | See Annex 4 for details |
| **Choice of data or Measurement methods and procedures** | The data obtained from the official publication "*China Energy StatisticalYearbook*", satisfying the requirement of latest version of "*Tool to calculate the emission factor for an electricity system*". |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation |

| | |
|---|---|
| **Data / Parameter** | $NCV_{i,y}$ |
| **Unit** | GJ/mass or volume unit |
| **Description** | Net calorific value (energy content) of fossil fuel type *i* in year *y*. |
| **Source of data** | *China Energy Statistical Yearbook,2008-2010* |
| **Value(s) applied** | See Annex 4 for details |
| **Choice of data or Measurement methods and procedures** | The data obtained from the official publication "*China Energy Statistical Yearbook*", satisfying the requirement of latest version of "*Tool to calculate the emission factor for an electricity system*". |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $NCV_{i,y}$ |
| **Unit** | GJ/mass or volume unit |
| **Description** | Net calorific value (energy content) of fossil fuel type *i* in year *y*. |
| **Source of data** | *China Energy Statistical Yearbook,2008-2010* |
| **Value(s) applied** | See Annex 4 for details |
| **Choice of data or Measurement methods and procedures** | The data obtained from the official publication "*China Energy Statistical Yearbook*", satisfying the requirement of latest version of "*Tool to calculate the emission factor for an electricity system*". |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $EF_{CO2,i,y}$ |

| | |
|---|---|
| **Unit** | $tCO_2/GJ$ |
| **Description** | $CO_2$ Emission Factor of fossil fuel type *i* in year *y*. |
| **Source of data** | The IPCC default values of uncertainty at the 95% confidence interval in *2006 IPCC Guideline for National Greenhouse Gas Inventories, Volume 2 Energy, table2.2-table 2.5* |
| **Value(s) applied** | See Annex 4 for details |
| **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 latest version of "*Tool to calculate the emission factor for an electricity system*". |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $GEN_y$ |
| **Unit** | kWh |
| **Description** | Electricity generated by all power sources serving the SCPG, not including low-cost/must-run power plants/units, in year *y*. |
| **Source of data** | *China Electric Power Yearbook 2008-2010* |
| **Value(s) applied** | See Annex 4 for details |
| **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** | Calculation of baseline emissions |
| **Additional comment** | The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation |

| | |
|---|---|
| **Data / Parameter** | $AER_y$ |
| **Unit** | % |
| **Description** | The auxiliary electricity consumption rate of all power sources serving the SCPG. |
| **Source of data** | *China Electric Power Yearbook, 2008-2010* |
| **Value(s) applied** | See Annex 4 for details |
| **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** | Calculation of baseline emissions |
| **Additional comment** | The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation |

| | |
|---|---|
| **Data / Parameter** | $F_{i,j,y}$ |
| **Unit** | tCe |
| **Description** | The consumption of fuel *i* in province *j* in year *y*. |

| | |
|---|---|
| **Source of data** | *China Energy Statistical Yearbook, 2008-2010* |
| **Value(s) applied** | See Annex 4 for details |
| **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** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $EF_{Coal,Adv,y}$ |
| **Unit** | % |
| **Description** | Electricity supply efficiency of the best efficiency commercial coal-fired generation technology. |
| **Source of data** | *2011 Baseline Emission Factors for Regional Power Grids in China published by* China DNA |
| **Value(s) applied** | 39.45 |
| **Choice of data or Measurement methods and procedures** | The data obtained from the China DNA, satisfying the requirement of latest version of "*Tool to calculate the emission factor for an electricity system*". |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $EF_{Oil,Adv,y}$ |
| **Unit** | % |
| **Description** | Electricity supply efficiency of the best efficiency commercial oil-fired generation technology. |
| **Source of data** | *2011 Baseline Emission Factors for Regional Power Grids in China published by* China DNA |
| **Value(s) applied** | 51.77 |
| **Choice of data or Measurement methods and procedures** | The data obtained from the China DNA, satisfying the requirement of latest version of "*Tool to calculate the emission factor for an electricity system*". |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $EF_{Gas,Adv,y}$ |
| **Unit** | % |
| **Description** | Electricity supply efficiency of the best efficiency commercial gas-fired generation technology. |
| **Source of data** | *2011 Baseline Emission Factors for Regional Power Grids in China published by* China DNA |
| **Value(s) applied** | 51.77 |

| | |
|---|---|
| **Choice of data or Measurement methods and procedures** | The data obtained from the China DNA, satisfying the requirement of latest version of "*Tool to calculate the emission factor for an electricity system*". |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $CAP_{Total,y}$ |
| **Unit** | MW |
| **Description** | The total installed capacity in the SCPG in year *y*. |
| **Source of data** | *China Electric Power Yearbook, 2008-2010* |
| **Value(s) applied** | See Annex 4 for details |
| **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** | Calculation of baseline emissions |
| **Additional comment** | For calculating the added capacity comprised 20% of the SCPG |

| | |
|---|---|
| **Data / Parameter** | $CAP_{Thermal,y}$ |
| **Unit** | MW |
| **Description** | The total installed capacity of thermal power in the SCPG in year *y*. |
| **Source of data** | *China Electric Power Yearbook, 2008-2010* |
| **Value(s) applied** | See Annex 4 for details |
| **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** | Calculation of baseline emissions |
| **Additional comment** | For calculating the added capacity comprised 20% of the SCPG. |

| | |
|---|---|
| **Data / Parameter** | $CAP_{BL}$ |
| **Unit** | W |
| **Description** | Installed capacity of the hydro power plant before the implementation of the project activity. For new hydro power plants, this value is zero |
| **Source of data** | *Project site* |
| **Value(s) applied** | *0* |
| **Choice of data or Measurement methods and procedures** | Default value |
| **Purpose of data** | |
| **Additional comment** | |

| **Data / Parameter** | $A_{BL}$ |
|---|---|
| **Unit** | $m^2$ |
| **Description** | Area of the single or multiple reservoirs measured in the surface of the water, before the implementation of the project activity, when the reservoir is full ($m^2$). For new reservoirs, this value is zero |
| **Source of data** | *Project site* |
| **Value(s) applied** | *0* |
| **Choice of data or Measurement methods and procedures** | Default value |
| **Purpose of data** | |
| **Additional comment** | |

### B.6.3. Ex ante calculation of emission reductions

>>

According to the "*2011 Baseline Emission Factors for Regional Power Grids in China*" published by Chinese DNA[37] (details could be seen in Annex 4), the weighted average *OM* emission factors of SCPG from year 2007 to 2009 is:

$EF_{grid,OM,y}$ =0.9489t$CO_2$/MWh

The calculated Build Margin emission factor of SCPG is:

$EF_{grid,BM,y}$ = 0.3157 t$CO_2$/MWh

Hence, $EF_{grid,CM,y} = 0.5 \times EF_{grid,OM,y} + 0.5 \times EF_{grid,BM,y\ y}$

$EF_{grid,CM,y} = 0.5 \times 0.9489 + 0.5 \times 0.3157$

$= 0.6323$ t$CO_2$/MWh

The amount of net electricity to be delivered to the grid from the proposed project according to FSR is

$EG_{facility} = EG_{out,y}$=326,069.64 MWh.

So the annual baseline emissions ($BE_y$) is: $BE_y = EG_{facility} \times EF_{grid,CM,y}$ = 206,173 (t$CO_2$).

According to formula (B.14), the annual emission reductions due to the proposed project are:

$ER_y = BE_y - PE_y = (EG_{out,,y} - EG_{in,y}).\ EF_{grid,CM,y} = EG_{out,,y} \times EF_{grid,CM,y}$ = 206,173 (t$CO_2$)

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

| Year | Baseline emissions (t $CO_2$e) | Project emissions (t $CO_2$e) | Leakage (t $CO_2$e) | Emission reductions (t $CO_2$e) |
|---|---|---|---|---|
| 2013 | 206,173 | 0 | 0 | 206,173 |

[37] http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File2720.pdf

| | | | | |
|---|---|---|---|---|
| 2014 | 206,173 | 0 | 0 | 206,173 |
| 2015 | 206,173 | 0 | 0 | 206,173 |
| 2016 | 206,173 | 0 | 0 | 206,173 |
| 2017 | 206,173 | 0 | 0 | 206,173 |
| 2018 | 206,173 | 0 | 0 | 206,173 |
| 2019 | 206,173 | 0 | 0 | 206,173 |
| **Total** | 1,443,211 | 0 | 0 | 1,443,211 |
| **Total number of crediting years** | 7 | | | |
| **Annual average over the crediting period** | 206,173 | 0 | 0 | 206,173 |

### B.7. Monitoring plan

#### B.7.1. Data and parameters to be monitored

| | |
|---|---|
| **Data / Parameter** | $EG_{out,y}$ |
| **Unit** | MWh |
| **Description** | Electricity supplied to the SCPG by the proposed project in year *y*. |
| **Source of data** | The value in the PDD from the FSR, the real value will be measured by electricity meters. |
| **Value(s) applied** | 326,069.64 |
| **Measurement methods and procedures** | Directly measured by electricity meters with 0.2s accuracy. The reading of the meter would be continuously measured; the project owner and the grid company will record the readings at least once a month. The proportion of data to be monitored is 100% and the data will be archived and kept for 2 years after the end of the crediting period or the last issuance of CERs,whichever is later. There are two lines to transfer electricity,but only the line to Qinglong Substaton is used, the other line has not been connected so far.Thus, the measuring meter was installed in the Qinglong Substation. |
| **Monitoring frequency** | Continuously |
| **QA/QC procedures** | Sales receipts will be used to double check and ensure consistency. Meter(s) will be installed according to National standard DL/T448-2000 and will be calibrated according to the National standard JJG 596-1999 by a qualified organization to ensure accuracy. |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $EG_{in,y}$ |
| **Unit** | MWh |
| **Description** | Electricity imported from the SCPG by the proposed project in year *y*. |
| **Source of data** | The value is assumed as zero and will be monitored ex-post by electricity meters. |
| **Value(s) applied** | 0 |

| | |
|---|---|
| **Measurement methods and procedures** | Directly measured by electricity meters with 0.2s accuracy . The reading of the meter would be continuously measured; the project owner and the grid company will record the readings at least once a month. The proportion of data to be monitored is 100% and the data will be archived and kept for 2 years after the end of the crediting period or the last issuance of CERs,whichever is later.There are two lines to transfer electricity,but only the line to Qinglong Substaton is used, the other line has not been connected so far.Thus, the measuring meter was installed in the Qinglong Substation. |
| **Monitoring frequency** | continuously |
| **QA/QC procedures** | Sales receipts will be used to double check and ensure consistency.Meter(s) will be installed according to National standard DL/T448-2000 and will be calibrated according to the National standard JJG 596-1999 by a qualified organization to ensure accuracy. |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $EG_{facility,y}$ |
| **Unit** | MWh |
| **Description** | Quantity of net electricity generation supplied by the project plant/unit to the grid in year y The value in the PDD is from the FSR, the real value will be calculated as $EG_{facility,y} = EG_{out,y} - EG_{in,y}$ |
| **Source of data** | 326,069.64 |
| **Value(s) applied** | Calculated using $EG_{out,y}$ and $EG_{in,y}$ . |
| **Measurement methods and procedures** | The result of data will be archived and kept for 2 years after the end of the crediting period or the last issuance of CERs, whichever is later. |
| **Monitoring frequency** | continuously |
| **QA/QC procedures** | Sales receipts will be used to double check and ensure consistency.Meter(s) will be installed according to National standard DL/T448-2000 and will be calibrated according to the National standard JJG 596-1999 by a qualified organization to ensure accuracy. |
| **Purpose of data** | Calculation of baseline emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $A_{PJ}$ |
| **Unit** | $km^2$ |
| **Description** | Area of the single or multiple reservoirs measured in the surface of the water, after the implementation of the project activity, when the reservoir is full |
| **Source of data** | The value in the PDD from the FSR, the real value will be determined from topographical surveys, maps, satellite pictures, etc. |
| **Value(s) applied** | 0.576 |
| **Measurement methods and procedures** | Measured from topographical surveys, maps, satellite pictures, etc |
| **Monitoring frequency** | yearly |

| | |
|---|---|
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of project emissions |
| **Additional comment** | - |

| | |
|---|---|
| **Data / Parameter** | $Cap_{PJ}$ |
| **Unit** | MW |
| **Description** | Installed capacity of the hydropower plant after the implementation of the project activity. |
| **Source of data** | The value in the PDD from the FSR, the real value will be determined by equipment contract and nameplate. |
| **Value(s) applied** | 75 |
| **Measurement methods and procedures** | Determine the installed capacity based on equipment contract and nameplate. |
| **Monitoring frequency** | yearly |
| **QA/QC procedures** | - |
| **Purpose of data** | Calculation of project emissions |
| **Additional comment** | - |

### B.7.2. Sampling plan

>>

Not applicable.

### B.7.3. Other elements of monitoring plan

>>

The monitoring plan for this project activity will ensure monitoring and calculation of the project emission reductions is accurate, consistent, clear and complete during the whole crediting period. The details of the monitoring plan are summarized as follows:

**1. Monitoring Organization**

Prior to the start of the crediting period, a monitoring team will be organized and established by the project owner. Clear roles and responsibilities will be assigned to the team members. A CDM Manager will be appointed by the project owner, who will be in charge of issues related to CDM project. The operation and management structure is shown in Figure B.2.

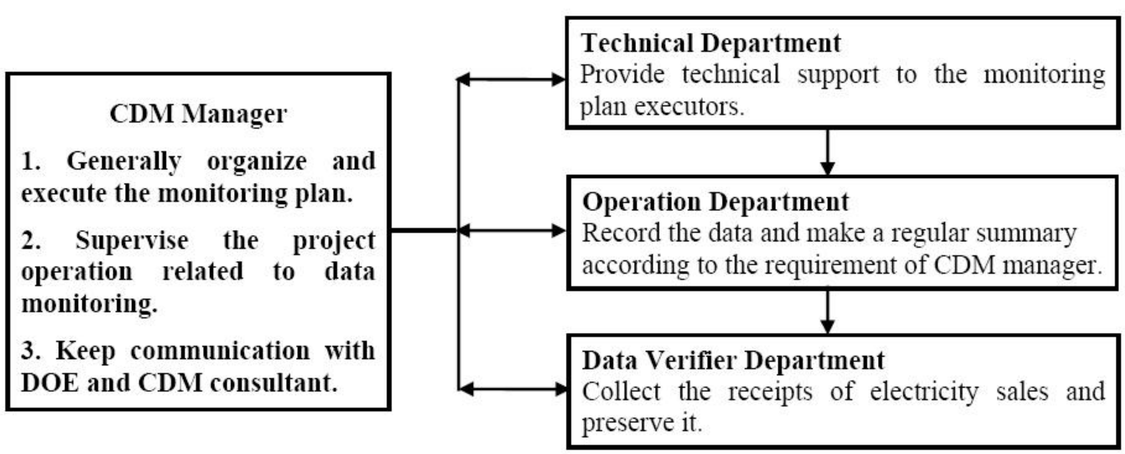

**Figure B.2 Monitoring Organization of the Project**

**2. Data to be monitored**

The data to be monitored for the proposed project is the electricity delivered to the grid ($EG_{out, y}$) and the electricity consumed by the proposed project which is imported from SCPG ($EG_{in, y}$).

According to ACM0002 (Version12.3.0), the area of the reservoir measured in the surface of the water ($A_{PJ}$) and installed capacity of the project ($Cap_{PJ}$) also should be monitored. All data should be documented (electronic and paper) and stored for two years after the end of the crediting period.

**3. Monitoring device and its installation**

The electricity delivered to the grid by the project activity and the power consumed by the proposed project will be monitored by bidirectional electricity meters. The Xiyi Substation has not been used so far since the relative line is not connected. All elcetricity delivered to the grid through 110KV line to Qinglong Substation and the meters are located in the Qinglong substation and 24 o'clock on the last day of each month is the settlement time.The power purchaser and the power seller(project owner) common confirmed the power data, after that the power purchaser gives power seller the settlement, the power seller according to the settlement to record and calculate the emission reduction.All electricity meters should match the technical requirement of "Technical Management Rules of Electricity Measurement Device" (DL/T448-2000) and have an accuracy of 0.2S to measure the electricity which will be delivered to grid and imported form the grid for internal use. Before operation of the project activity, all electricity meters will be jointly checked and accepted by the project entity and SCPG company according to the technical requirement of DL/T448-2000.

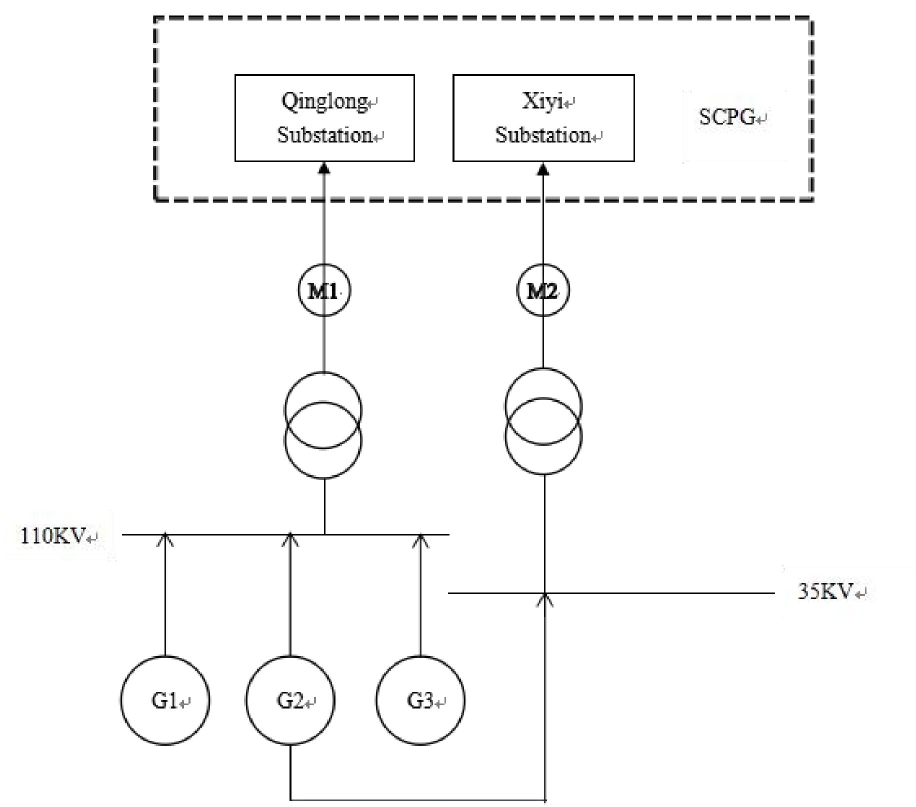


**Figure B7-1 Layout of the Monitoring Facility**

The electricity generated by the project activity is connected via the Qinglong substation and Xiyi substation to SCPG with 2 connection lines. There are 2 monitoring meters installed in the 2 substation. Both meters are bidirectional meter and will record both the electricity imported and exported from and to the grid.The line to Qinglong Substation is 110KV line and the line to Xiyi Substation is 35KV.

**4. Data collection and QA/QC**

Detailed monitoring arrangements of the amount of electricity delivered by the proposed project ($EG_{out,\ y}$) and the electricity imported from the grid to the proposed project ($EG_{in,\ y}$) are as follows:

1) The representatives from the project owner and the grid company will read the meter and record the readings regularly. The records of $EG_{out,\ y}$ and $EG_{in,\ y}$ will be readily accessible for verification by the DOE.

2) The net amount of power delivered of the proposed project will be recorded by the project owner,

$EG_y = EG_{out,y} - EG_{in,y}$

Ten days after the occurrence of the conditions below, the Meters shall be tested by the designated institute commissioned by the project owner and the power grid company together:

a. the error of the meter is out of the permissible limits;

b. repair the malfunctioning meter.

1) The processes of maintenance and calibration of the meters could also follow the power purchase agreement between project owner and power grid.
2) The invoice value from the grid company would be applied for ER calculation during the malfunction period.

**5. Calibration**

The project owner will sign an agreement with third party possessing state qualifications in order to regulate the measurement and adjustment processes of quality control for ensuring reliability of the system. Meters must be regularly verified according to the "Verification Regulation of Electrical Energy Meters with Electronics (JJG 596-1999)". Meters must be sealed after verification and must not be dismantled and changed by the project owner unless in the presence of a quality monitoring institution.

All meters must be tested by the qualified institute consigned by the project owner within 10 days after the following events:

1) Metering error for the checking meters and gateway meter is beyond the acceptable accuracy range;
2) Meters are repaired owing to problems of the meters' components.

The processes of maintenance and calibration of the meters could also follow the power purchase agreement between project owner and power grid. The meters will be calibrated annually according to the "Verification Regulation of Electrical Energy Meters with Electronics (JJG 596-1999)"

**6. Data management**

At the end of each month, the monitoring data should be archived electronically, back up in disk and printed out. The project owner should keep a copy of electricity sale/purchase receipts. Other documents such as maps, diagrams and environmental assessments should be also be archived. In order to facilitate ease of reference, monitoring data should be indexed. All paper-based information and data shall have copies for backup and all data will be archived for 2 years after the end of the crediting period or latest issuance of CERs whichever is later.

**7. Monitoring report**

All the related records of calibration, reading and invoices will be readily accessible for verification by the DOE. The monitoring report shall include all information used to calculate the emission reductions of the proposed project.

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

>>

| | |
|---|---|
| Date of completion of application of methodology | 02/03/2012 |
| Contact information of responsible persons/ entities | Wanchuang Wu |

## SECTION C. Duration and crediting period

### C.1. Duration of project activity

#### C.1.1. Start date of project activity

>>

15/12/2005 (As described in the Table B5 -1 in part B.5, the day when the Contract of the Project Construction was signed is considered as the starting date because it was the earliest date of real action.)

#### C.1.2. Expected operational lifetime of project activity

>>
25yrs, 0months (not including construction period).

### C.2. Crediting period of project activity

#### C.2.1. Type of crediting period

>>
The proposed project applies renewable crediting period.

#### C.2.2. Start date of crediting period

>>
01/01/2013

#### C.2.3. Length of crediting period

7yrs, 0months

## SECTION D. Environmental impacts

### D.1. Analysis of environmental impacts

>>
The Environmental Impact Assessment (EIA) report for this project activity has been approved by Yunnan Province Environmental Protection Bureau on 12$^{th}$ November, 2004. The environmental impacts arising from the project activity are summarized as follows:

**Ecological environment impact**

The area to be submerged is limited and no human inhabitants, rare animals or rare plants will be impacted. Although submergence of land will lead to changes of land utility, the impact is not significant and will be mitigated by expiation measures. Extension of the water surface will contribute to higher humidity in the area surrounding the project activity, which is expected to encourage survival of bird species, and re-growth of vegetation. Generally speaking, the impact on the ecological environment from the proposed project is not big.

**Wastewater impact on environment**

The duration of construction is 42 months, so the impact of wastewater is temporary, reversible, and can be reduced by environment protection measures.

**Noise impact on environment**

During construction, noise will be generated by machinery. As there are no residents living in the area around the project site only workers will be impacted. Suitable measures, such as management of the construction schedule, controlling the quality of machinery used at the project site and maintaining good standard of project facilities will be taken by the project owner to reduce the impact of noise on the workers.

**Air pollution**

Digging, blasting and transportation of building materials during construction will have a temporary impact on local air quality. The project owner will adopt mitigation measures to reduce the adverse impacts, for example, straw bags will be used to cover blasting surfaces and the concrete stirring machinery will be equipped with dust removing equipment.

During construction, use of oil and dynamite will produce some noxious fumes; however the average wind speed at the project site is above 1.2m/s so fumes will be quickly dispersed and the impact on air quality will be minimal.

**Solid waste management**

The project activity will produce some solid waste during the construction period. Workers will also produce domestic garbage during the construction and operational phases. Construction waste will be recycled where possible. Residual construction waste which cannot be reused will be transported to a waste disposal site. Domestic garbage will be collected in garbage bins at the project site and will be sent to landfill to avoid pollution of the local environment.

## D.2. Environmental impact assessment

>>

Taking into consideration the contribution made by the proposed project to sustainable development for the local area and nation, the proposed project will have an overall positive impact on the local and national environment. Any negative environmental impacts will be subject to effective mitigation measures as described above.

# SECTION E. Local stakeholder consultation

## E.1. Solicitation of comments from local stakeholders

>>

Before construction of the proposed project, the project owner held a stakeholders' conference facilitated by local village councils on 25 July 2005. During the stakeholders' conference, the project owner collected opinions from the stakeholders by questionnaire. 70 questionnaires were sent, of which 64 were returned (91.43% participation rate.)

Information about the stakeholders who returned the questionnaire is summarized as follows:

**Table E-1 Background Information of the Residences**

| Participant | | Number of People | Percentage (%) |
|---|---|---|---|
| District | Xi er town in Mile county | 64 | 100.00 |
| Sex | Male | 56 | 87.50 |
| | Female | 8 | 12.50 |
| Age | 20~30 | 18 | 28.13 |
| | 31~40 | 23 | 35.94 |
| | 41~50 | 18 | 28.13 |
| | 50 above | 4 | 6.25 |
| | Unselected | 1 | 1.56 |
| Vocation | Cadre | 19 | 29.69 |
| | Farmer | 20 | 31.25 |
| | Teacher | 2 | 3.13 |
| | Worker | 3 | 4.69 |
| | Unselected | 20 | 31.25 |
| Education | Primary school and below | 10 | 15.63 |
| | High school | 35 | 54.69 |
| | Undergraduate and above | 19 | 29.69 |

The questionnaire included the following questions:
(1) What's your opinion of the project activity's construction?
(2) What's your opinion of the project activity's positive impact on your life?
(3) What's your opinion of the project activity's negative impact on your life?
(4) What measures in your opinion can be taken to reduce the negative impact above mentioned?
(5) If your land and house are occupied, which compensation measures are the best for you?
(6) Any other opinions or advice?

## E.2. Summary of comments received

>>
Total 70 questionnaires were distributed, and 64 had been returned. All of the opinions from the local stakeholders had been collected and considered. Comments from these questionnaires for local people are summarized below.

1. All persons were in support of this project.

2. All positive impacts pointed out by people investigated were as follows：

   Increase in electricity supply (11 persons, 17.19%)
   Reduce electricity price (5 persons, 7.8%)
   Increase in revenue (51 persons, 79.69%)
   Increase in employment opportunities (58 persons, 90.63%)
   Improve living standards (52 persons, 81.25%)
   Others (11 persons, 17.19%)

3. All negative impacts pointed out by people investigated were as follows：

   Noise (50 persons, 78.13%)
   Occupation of land (1 person, 1.6%)
   Reduced water quantity (12 persons, 18.75%)
   Destruction of the local ecology (1 person, 1.6%)

Interfere with traffic (42 people, 65.63%)

4. Measures which people considered can reduce the negative impacts were as follows:

Build new transport infrastructure, and complete construct work rapidly and normatively
Enhance construction control, stipulate work time and appoint a specialist to undertake dredging
Ensure minimal disruption to local water supply

5. Affected persons should be compensated in accordance with national compensation policy.

Generally speaking, the stakeholders held a generally positive attitude towards construction of the proposed project.

## E.3. Report on consideration of comments received

>>

**Table E-2 Questions of the Questionnaires**

| No | Comments | Measures |
|---|---|---|
| 1 | The proposed project must take into account interests of stakeholders whose land is occupied. | The owner has planned a resettlement program in accordance with the national compensation policy. |
| 2 | The proposed project needs to enhance construction control. | During the construction period, the project owner enhanced construction control and reduced work time thereby keeping negative impacts to a minimum. |
| 3 | The proposed project should reduce negative impacts on the local ecology. | The project owner will restore the local environment after construction. |
| 4 | The proposed project should minimize disruption to traffic. | The project activity built about 60 km of new road and a bridge for people in Mile county and Huaning county to exchange farm produce, promote economic development and enhance the living conditions of people nearby. |
| 5 | The local environment is hard to restore once destroyed. | The project owner will implement appropriate mitigation measures to minimize impact on the local environment. |
| 6 | The project should not reduce the water quantity available for local residents. | The project is hydropower project, which just takes water from river and feed back to river. Therefore, the water quantity will not reduce. |

These suggestions from the public will be seriously considered by the project owner.

## SECTION F. Approval and authorization

>>

The letter of approval from the host country is proved by China National Development and Reform Committee on 28th Oct 2008, and the letter of approval from the Annex 1 country is proved by Swedish Energy Agency on 5th Nov 2012.

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

| | |
|---|---|
| **Project participant and/or responsible person/ entity** | ☒ Project participant<br>☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity |
| **Organization name** | Yunnan Nanpan River Nuozu Electric Development Co., Ltd. |
| **Street/P.O. Box** | Taoyuan Road 36th |
| **Building** | Taoyuan Road 36th, Miyang Town, Mile county |
| **City** | Mile county, Yunnan Province |
| **State/Region** | Yunnan Province |
| **Postcode** | 652300 |
| **Country** | China |
| **Telephone** | +86-871-6134742 |
| **Fax** | |
| **E-mail** | |
| **Website** | |
| **Contact person** | Wanchuang Wu |
| **Title** | Engineer |
| **Salutation** | |
| **Last name** | Wu |
| **Middle name** | |
| **First name** | Wanchuang |
| **Department** | |
| **Mobile** | +86-13708848638 |
| **Direct fax** | |
| **Direct tel.** | +86-873-6134742 |
| **Personal e-mail** | |

| | |
|---|---|
| **Project participant and/or responsible person/ entity** | ☒ Project participant<br>☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity |
| **Organization name** | Citigroup Global Markets Ltd. |
| **Street/P.O. Box** | Canada Square, Canary Wharf |
| **Building** | Citigroup Centre |
| **City** | London |

| | |
|---|---|
| **State/Region** | |
| **Postcode** | E14 5LB |
| **Country** | United Kingdom |
| **Telephone** | +44 20 7986 9325 |
| **Fax** | +44 20 7192 0014 |
| **E-mail** | |
| **Website** | www.citi.com |
| **Contact person** | Van Dijk Jaap |
| **Title** | Vice President |
| **Salutation** | Mr |
| **Last name** | Van Dijk |
| **Middle name** | |
| **First name** | Jaap |
| **Department** | Environmental Products - Commodities |
| **Mobile** | +44 77898676702 |
| **Direct fax** | +44 20 7986 3149 |
| **Direct tel.** | +44 20 7986 2151 |
| **Personal e-mail** | jaap.vandijk@citi.com |

# Appendix 2. Affirmation regarding public funding

No public funding from any Annex I parties are involved in the project activity.

# Appendix 3. Applicability of methodology and standardized baseline

The Project is a newly built hydro power project with capacity more than 15MW, which is applicable to ACM0002, please refer to Section B of this PDD for detail.

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

Table A3-1 Operating Margin Emission Factor of SCPG in 2007

| Fuel | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Total | Carbon Content of the Fuels | Emission Factor of the Fuels | NCV | $CO_2$ Emission ($tCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | $tCO_2e/TJ$ | $kgCO_2/TJ$ | MJ/t,MJ/$10^3$ $m^3$ | I=E*G*H/100000 (for mass unit) |
| | | A | B | C | D | E=A+B+C+D | F | G | H | I=E*G*H/10000 (for volume unit) |
| Raw Coal | $10^4$ t | 8214.78 | 1750.63 | 4298.8 | 3170.79 | **17435** | 25.8 | 87,300 | 20,908 | 318,235,546 |
| Cleaned Coal | $10^4$ t | 3.46 | | | | **3.46** | 25.8 | 87,300 | 26,344 | 79,574 |
| Other Washed Coal | $10^4$ t | | 0.65 | 21.58 | 14.64 | **36.87** | 25.8 | 87,300 | 8,363 | 269,184 |
| Briquette | $10^4$ t | 271.25 | | | | **271.25** | 26.6 | 87,300 | 20,908 | 4,951,041 |
| Coke | $10^4$ t | 0.04 | 1.69 | | 2.15 | **3.88** | 29.2 | 95,700 | 28,435 | 105,584 |
| Coke Oven Gas | $10^8$ $m^3$ | | 0.96 | 3.19 | 1.8 | **5.95** | 12.1 | 37,300 | 16,726 | 371,208 |
| Other Gas | $10^8$ $m^3$ | | 30.77 | | 21.63 | **52.4** | 12.1 | 37,300 | 5,227 | 1,021,628 |
| Crude Oil | $10^4$ t | | | | | **0** | 20 | 71,100 | 41,816 | 0 |
| Gasoline | $10^4$ t | | | | | **0** | 18.9 | 67,500 | 43,070 | 0 |
| Diesel Oil | $10^4$ t | 21.37 | 2.13 | | 2.29 | **25.79** | 20.2 | 72,600 | 42,652 | 798,596 |
| Fuel Oil | $10^4$ t | 467.97 | 0.41 | | | **468.38** | 21.1 | 75,500 | 41,816 | 14,787,262 |
| LPG | $10^4$ t | | | | | **0** | 17.2 | 61,600 | 50,179 | 0 |
| Refinery Dry Gas | $10^4$ t | 0.37 | | | | **0.37** | 15.7 | 48,200 | 46,055 | 8,213 |
| Natural Gas | $10^8$ $m^3$ | 32.17 | | | | **32.17** | 15.3 | 54,300 | 38,931 | 6,800,588 |
| Other petroleum produce | $10^4$ t | 8.47 | | | | **8.47** | 20 | 72,200 | 41,816 | 255,719 |
| Other coking produce | $10^4$ t bc | | | | | **0** | 25.8 | 95,700 | 28,435 | 0 |
| Other energy | | 118.04 | 81.89 | 44.1 | 50.3 | **294.33** | 0 | 0 | 0 | 0 |
| | | | | | | | | | Subtotal | 347,684,143 |

Data Source: China Energy Statistics Yearbook 2008

Table A3-2 Fuel-fired Electricity Generation of SCPG for Year 2007

| Province | Electricity Generation ($10^8$ kWh) | Electricity Generation (MWh) | Internal Power Consumption Rate (%) | Supplied Electricity (MWh) |
|---|---|---|---|---|
| Guangdong | 2,157 | 215,700,000 | 6.01 | 202,736,430 |
| Guangxi | 361 | 36,100,000 | 7.42 | 33,421,380 |
| Guizhou | 843 | 84,300,000 | 6.62 | 78,719,340 |
| Yunnan | 474 | 47,400,000 | 7.23 | 43,972,980 |
| Total | | | | 358,850,130 |
| Net import electricity from CCPG (MWh) | | 24,237,240 | | |
| Simple OM of CCPG in 2007 | | 1.10197 | | |
| Total emission of $CO_2$ in 2007 | | 374,392,940 | | |
| Electricity delivered to grid generate in 2007 | | 383,087,370 | | |
| 2007 Emission factor of SCPG | | 0.97730 | | |

Data Source: China Electric Power Yearbook 2008

Table A3-3 Operating Margin Emission Factor of SCPG in 2008

| Fuel | Unit $10^4$ | Guangdong | Guangxi | Guizhou | Yunnan | Total | Carbon Content of the Fuels | Emission Factor of the Fuels | NCV | $CO_2$ Emission ($tCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | $tCO_2e/TJ$ | $kgCO_2/TJ$ | MJ/t,MJ/$10^3m^3$ | I=E*G*H/100000 (for mass unit) |
| | | A | B | C | D | E=A+B+C+D | F | G | H | I=E*G*H/10000 (for volume unit) |
| Raw Coal | $10^4$t | 8001.54 | 1513.1 | 4117.45 | 2766.85 | **16398.94** | 25.8 | 87,300 | 20,908 | 299,324,670 |
| Cleaned Coal | $10^4$t | 2.31 | | | | **2.31** | 25.8 | 87,300 | 26,344 | 53,126 |
| Other Washed Coal | $10^4$t | | 0.08 | 13.38 | 57.11 | **70.57** | 25.8 | 87,300 | 8,363 | 515,224 |
| Briquette | $10^4$t | 297.43 | | | | **297.43** | 26.6 | 87,300 | 20,908 | 5,428,896 |
| Coke | $10^4$t | 3.24 | 1.73 | | 2.74 | **7.71** | 29.2 | 95,700 | 28,435 | 209,807 |
| Coke Oven Gas | $10^8$ $m^3$ | | 1.55 | 3.92 | 2.17 | **7.64** | 12.1 | 37,300 | 16,726 | 476,644 |
| Other Gas | $10^8$ $m^3$ | 1.09 | 29.6 | | 35.71 | **66.4** | 12.1 | 37,300 | 5,227 | 1,294,582 |
| Crude Oil | $10^4$t | | | | | **0** | 20 | 71,100 | 41,816 | 0 |
| Gasoline | $10^4$t | 0.01 | | | | **0.01** | 18.9 | 67,500 | 43,070 | 291 |
| Diesel Oil | $10^4$t | 10.46 | 0.97 | | 2.28 | **13.71** | 20.2 | 72,600 | 42,652 | 424,535 |
| Fuel Oil | $10^4$t | 344.59 | 0.24 | | | **344.83** | 21.1 | 75,500 | 41,816 | 10,886,656 |
| LPG | $10^4$t | | | | | **0** | 17.2 | 61,600 | 50,179 | 0 |
| Refinery Dry Gas | $10^4$t | 0.76 | | | | **0.76** | 15.7 | 48,200 | 46,055 | 16,871 |
| Natural Gas | $10^8$ $m^3$ | 35.6 | | | | **35.6** | 15.3 | 54,300 | 38,931 | 7,525,674 |
| Other petroleum produce | $10^4$t | 7.3 | | | | **7.3** | 20 | 72,200 | 41,816 | 220,395 |
| Other coking produce | $10^4$ t bc | | | | | **0** | 25.8 | 95,700 | 28,435 | 0 |
| Other energy | | 120.17 | 103.26 | 89.44 | 42.63 | **355.5** | 0 | 0 | 0 | 0 |
| | | | | | | | | | Subtotal | 326,377,370 |

Table A3-4 Fuel-fired Electricity Generation of SCPG for Year 2008

| Province | Electricity Generation ($10^8$ kWh) | Electricity Generation (MWh) | Internal Power Consumption Rate (%) | Supplied Electricity (MWh) |
|---|---|---|---|---|
| Guangdong | 2,107 | 210,700,000 | 6.18 | 197,678,740 |
| Guangxi | 342 | 34,200,000 | 7.14 | 31,758,120 |
| Guizhou | 813 | 81,300,000 | 7.04 | 75,576,480 |
| Yunnan | 418 | 41,800,000 | 7.29 | 38,752,780 |
| Total | | | | 343,766,120 |
| Net import electricity from CCPG (MWh) | 22,342,090 | | | |
| Simple OM of CCPG in 2008 | 1.04205 | | | |
| Total emission of $CO_2$ in 2008 | 349,658,904 | | | |
| Electricity delivered to grid generate in 2008 | 366,108,210 | | | |
| 2008 Emission factor of SCPG | 0.95507 | | | |

Data Source: China Electric Power Yearbook 2009

Table A3-5 Operating Margin Emission Factor of SCPG in 2009

| Fuel | Unit $10^4$ | Guangdong | Guangxi | Guizhou | Yunnan | Hainan | Total | Carbon Content of the Fuels | Emission Factor of the Fuels | NCV MJ/t,MJ/$10^3$ | $CO_2$ Emission ($tCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | $tCO_2e$/TJ | $kgCO_2$/TJ | MJ/t,MJ/$10^3$ $m^3$ | J=F*H*I/100000 (for mass unit) |
| | | A | B | C | D | E | F=A+B+C+D+E | G | H | I | J=F*H*I/10000 (for volume unit) |
| Raw Coal | | 8011.98 | 1815.41 | 4925.23 | 3311.44 | 376.59 | **18440.65** | 25.8 | 87,300 | 20,908 | 336,591,357 |
| Cleaned Coal | $10^4$t | 1.8 | | | | | **1.8** | 25.8 | 87,300 | 26,344 | 41,397 |
| Other Washed Coal | $10^4$t | | | 11.67 | 44.92 | | **56.59** | 25.8 | 87,300 | 8,363 | 413,158 |
| Briquette | $10^4$t | 195.86 | | | | | **195.86** | 26.6 | 87,300 | 20,908 | 3,574,971 |
| Coke | $10^4$t | 4.9 | 1.6 | | 1.63 | | **8.13** | 29.2 | 95,700 | 28,435 | 221,236 |
| Coke Oven Gas | $10^8$ $m^3$ | | 2.89 | 2.02 | 2.48 | | **7.39** | 12.1 | 37,300 | 16,726 | 461,047 |
| Other Gas | $10^8$ $m^3$ | 1.11 | 20.88 | | 48.61 | | **70.6** | 12.1 | 37,300 | 5,227 | 1,376,468 |
| Crude Oil | $10^4$t | | | | | | **0** | 20 | 71,100 | 41,816 | 0 |
| Gasoline | $10^4$t | | | | | | **0** | 18.9 | 67,500 | 43,070 | 0 |
| Diesel Oil | $10^4$t | 6.46 | 0.52 | | 0.49 | 0.12 | **7.59** | 20.2 | 72,600 | 42,652 | 235,027 |
| Fuel Oil | $10^4$t | 157.37 | 0.09 | | | | **157.46** | 21.1 | 75,500 | 41,816 | 4,971,182 |
| LPG | $10^4$t | | | | | | **0** | 17.2 | 61,600 | 50,179 | 0 |
| Refinery Dry Gas | $10^4$t | 0.51 | | | | | **0.51** | 15.7 | 48,200 | 46,055 | 11,321 |
| Natural Gas | $10^8$ $m^3$ | 47.21 | | | | 6.19 | **53.4** | 15.3 | 54,300 | 38,931 | 11,288,511 |
| Other petroleum produce | $10^4$t | 45.31 | | | | 0.83 | **46.14** | 20 | 72,200 | 41,816 | 1,393,020 |
| Other coking produce | $10^4$ t bc | | | | | | **0** | 25.8 | 95,700 | 28,435 | 0 |
| Other energy | | 152.99 | 98.56 | 23.01 | 49.01 | 20 | **343.57** | 0 | 0 | 0 | 0 |
| | | | | | | | | | | Subtotal | 360,578,694 |

Data Source: China Energy Statistics Yearbook 2010

Table A3-6 Fuel-fired Electricity Generation of SCPG for Year 2009

| Province | Electricity Generation | Electricity Generation | Internal Power Consumption Rate | Supplied Electricity |
|---|---|---|---|---|
| | ($10^8$ kWh) | (MWh) | (%) | (MWh) |
| Guangdong | 2143 | 214,300,000 | 6.16 | 201,099,120 |
| Guangxi | 428 | 42,800,000 | 6.69 | 39,936,680 |
| Guizhou | 978 | 97,800,000 | 6.68 | 91,266,960 |
| Yunnan | 548 | 54,800,000 | 6.52 | 51,227,040 |
| Hainan | 114 | 11,400,000 | 8.17 | 10,468,620 |
| Total | | | | 393,998,420 |
| Net import electricity from CCPG (MWh) | | 21,852,270 | | |
| Simple OM of CCPG in 2009 | | 0.95455 | | |
| Total emission of $CO_2$ in 2009 | | 381,437,884 | | |
| Electricity delivered to grid generate in 2009 | | 415,850,690 | | |
| 2009 Emission factor of SCPG | | 0.91725 | | |

Data Source: China Electric Power Yearbook 2010

Table A3-7 Operating Margin Emission Factor of SCPG (Weighted Average)

| Item | Unit | 2008 | 2009 | 2010 | Weighted Average |
|---|---|---|---|---|---|
| Total $CO_2$ emission | $tCO_2e$ | 374,392,940 | 349,658,904 | 381,437,884 | 1,105,489,728 |
| Electricity delivered to the grid | MWh | 383,087,370 | 366,108,210 | 415,850,690 | 1,165,046,270 |
| Operation margin(OM) | $tCO_2e/MWh$ | 0.97730 | 0.95507 | 0.91725 | **0.9489** |

Table A3-8 Share of emission from coal, oil and gas fuel in electricity generation in SCPG

| | | Guangdong | Guangxi | Guizhou | Yunnan | Hainan | Total | NCV | Emission Factor | $CO_2$ Emission |
|---|---|---|---|---|---|---|---|---|---|---|
| Fuel | Unit | A | B | C | D | E | F=A+…+E | G | H | I=F*G*H/100,000 |
| Raw Coal | $10^4$ t | 8,011.98 | 1,815.41 | 4,925.23 | 3,311.44 | 376.59 | 18,440.65 | 20,908 | 87,300 | 336,591,357 |
| Cleaned Coal | $10^4$ t | 1.8 | 0 | 0 | 0 | 0 | 1.8 | 26,344 | 87,300 | 41,397 |
| Other Washed Coal | $10^4$ t | 0 | 0 | 11.67 | 44.92 | 0 | 56.59 | 8,363 | 87,300 | 413,158 |
| Briquette | $10^4$ t | 195.86 | 0 | 0 | 0 | 0 | 195.86 | 20,908 | 87,300 | 3,574,971 |
| Coke | $10^4$ t | 4.9 | 1.6 | 0 | 1.63 | 0 | 8.13 | 28,435 | 95,700 | 221,236 |
| Other Coking product | $10^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 28,435 | 95,700 | 0 |
| **Subtotal** | | | | | | | | | | 340,842,119 |
| | | | | | | | | | | |
| Crude Oil | $10^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 41,816 | 71,100 | 0 |
| Gasoline | $10^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 43,070 | 67,500 | 0 |
| Diesel Oil | $10^4$ t | 6.46 | 0.52 | 0 | 0.49 | 0.12 | 7.59 | 42,652 | 72,600 | 235,027 |
| Fuel Oil | $10^4$ t | 157.37 | 0.09 | 0 | 0 | 0 | 157.46 | 41,816 | 75,500 | 4,971,182 |
| Other petroleum products | $10^4$ t | 45.31 | 0 | 0 | 0 | 0.83 | 46.14 | 41,816 | 72,200 | 1,393,020 |
| **Subtotal** | | | | | | | | | | 6,599,229 |
| | | | | | | | | | | |
| Natural Gas | $10^7$ $m^3$ | 472.1 | 0 | 0 | 0 | 61.9 | 534 | 38,931 | 54,300 | 11,288,511 |
| Coke Oven Gas | $10^7$ $m^3$ | 0 | 28.9 | 20.2 | 24.8 | 0 | 73.9 | 16,726 | 37,300 | 461,047 |
| Other Gas | $10^7$ $m^3$ | 11.1 | 208.8 | 0 | 486.1 | 0 | 706 | 5,227 | 37,300 | 1,376,468 |
| LPG | $10^4$ t | 0 | 0 | 0 | 0 | 0 | 0 | 50,179 | 61,600 | 0 |
| Refinery Dry Gas | $10^4$ t | 0.51 | 0 | 0 | 0 | 0 | 0.51 | 46,055 | 48,200 | 11,321 |
| **Subtotal** | | | | | | | | | | 13,137,347 |
| **Total** | | | | | | | | | | **360,578,694** |

Data Source: China Energy Statistics Yearbook 2010

$\lambda_{Coal,y}$ =94.53%, $\lambda_{Oil,y}$ =1.83%, $\lambda_{Gas,y}$ =3.64%

Table A3-9 Parameters used for calculating fuel-fired emission factor

| | Parameter | Efficiency of Power Supply | Emission Factor of Fuel ($kgCO_2/TJ$) | Emission Factor ($tCO_2e/MWh$) |
|---|---|---|---|---|
| | | A | B | C=3.6/A/1,000,000*B |
| Coal-fired Power Plant | $EF_{Coal,Adv}$ | 39.45 | 87,300 | 0.7967 |
| Gas-fired Power Plant | $EF_{Gas,Adv}$ | 51.77 | 75,500 | 0.5250 |
| Oil-fired Power Plant | $EF_{Oil,Adv}$ | 51.77 | 54,300 | 0.3776 |

$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.7765\ tCO_2/MWh$

Table A3-10 Installed Capacity of SCPG in 2009

| Installed capacity | Unit | Guangdong | Guangxi | Yunnan | Guizhou | Hainan | Total |
|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 48,300 | 10,770 | 10,710 | 17,310 | 3,090 | 90,180 |
| Hydro | MW | 11,260 | 14,750 | 20,900 | 13,610 | 700 | 61,220 |
| Nuclear | MW | 3,950 | 0 | 0 | 0 | 0 | 3,950 |
| Wind & Others | MW | 560 | 0 | 80 | 0 | 60 | 700 |
| Total | MW | 64,070 | 25,520 | 31,690 | 30,920 | 3,850 | 156,050 |

Data Source: China Electric Power Yearbook 2010

Table A3-11 Installed Capacity of SCPG in 2008

| Installed capacity | Unit | Guangdong | Guangxi | Yunnan | Guizhou | Hainan | Total |
|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 45,730 | 10,270 | 10,030 | 17,170 | 2,370 | 85,570 |
| Hydro | MW | 10,280 | 13,970 | 15,740 | 9,470 | 410 | 49,870 |
| Nuclear | MW | 3,780 | 0 | 0 | 0 | 0 | 3,780 |
| Wind & Others | MW | 290 | 0 | 80 | 0 | 10 | 380 |
| Total | MW | 60,080 | 24,240 | 25,850 | 26,640 | 2,790 | 139,600 |

Data Source: China Electric Power Yearbook 2009

Table A3-12 Installed Capacity of SCPG in 2007

| Installed capacity | Unit | Guangdong | Guangxi | Yunnan | Guizhou | Hainan | Total |
|---|---|---|---|---|---|---|---|
| Fuel-fired | MW | 44,710 | 9,310 | 10,630 | 15,960 | 2,400 | 83,010 |
| Hydro | MW | 10,110 | 10,440 | 11,580 | 8,210 | 590 | 40,930 |
| Nuclear | MW | 3,780 | 0 | 0 | 0 | 0 | 3,780 |
| Wind & Others | MW | 250 | 0 | 0 | 0 | 24 | 274 |
| Total | MW | 58,850 | 19,750 | 22,210 | 24,170 | 3,014 | 127,994 |

Data Source: China Electric Power Yearbook 2008

Table A3-13 Newly Added Installed Capacity from Year 2007-2009

| | 2007 | 2008 | 2009 | D=C-A | E=C-B | Percentage of newly added fuel-fired plants |
|---|---|---|---|---|---|---|
| | A | B | C | | | |
| Fuel-fired (MW) | 83,010 | 85,570 | 90,180 | 14,446.9 | 8,705.6 | 40.66% |
| Hydro (MW) | 40,930 | 49,870 | 61,220 | 20,487.9 | 11,350 | 57.66% |
| Nuclear(MW) | 3,780 | | | 170 | 170 | 0.48% |
| Wind & Others(MW) | 274 | 380 | 700 | 426 | 320 | 1.20% |
| Total(MW) | **127,994** | **139,600** | **156,050** | **35,530.8** | **20,545.6** | **100.00%** |
| Percentage of installed capacity to 2009 | | | | 22.77% | 13.17% | |

$EF_{BM,y}$=0.7765×40.66%=0.3157 $tCO_2/MWh$

Table A3-14 Baseline emission factor of SCPG ($tCO_2/MWh$)

| | | |
|---|---|---|
| Operating margin emission factor | A | 0.9489 |
| Build margin emission factor | B | 0.3157 |
| Combined emission factor | C=0.5×A+0.5×B | 0.6323 |

# Appendix 5. Further background information on monitoring plan

N/A

# Appendix 6. Summary of post registration changes

In the registered PDD, there are two transmission lines, both of them are 110KV and the generated electricity can be transferred to Qinglong Substation or Xiyi Substation. The two main meters (M1 and M2) are located at the high voltage side of the transformer in the project site.

The actual monitoring system is that the electricity generated by the project activity is connected via one 110KV line to Qinglong substation and one 35KV line to Xiyi substation, the location of the two main meters (M1 and M2) is in Qinglong substation and Xiyi substation.

The line to Xiyi Substation has not been connected and M2 is not installed so far.

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**Document information**

| *Version* | *Date* | *Description* |
|---|---|---|
| 08.0 | 22 July 2016 | EB 90, Annex 1<br>Revision to include provisions related to automatically additional project activities. |
| 07.0 | 15 April 2016 | Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0). |
| 06.0 | 9 March 2015 | Revisions to:<br>• Include provisions related to statement on erroneous inclusion of a CPA;<br>• Include provisions related to delayed submission of a monitoring plan;<br>• Provisions related to local stakeholder consultation;<br>• Provisions related to the Host Party;<br>Editorial improvement. |

| Version | Date | Description |
|---|---|---|
| 05.0 | 25 June 2014 | Revisions to:<br>• Include the Attachment: Instructions for filling out the project design document form for CDM project activities (these instructions supersede the "Guidelines for completing the project design document form" (Version 01.0));<br>• Include provisions related to standardized baselines;<br>• Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1;<br>• Change the reference number from *F-CDM-PDD* to *CDM-PDD-FORM;*<br>• Editorial improvement. |
| 04.1 | 11 April 2012 | • Editorial revision to change version 02 line in history box from Annex 06 to Annex 06b |
| 04.0 | 13 March 2012 | Revision required to ensure consistency with the “Guidelines for completing the project design document form for CDM project activities” (EB 66, Annex 8). |
| 03.0 | 26 July 2006 | EB 25, Annex 15 |
| 02.0 | 14 June 2004 | EB 14, Annex 06b |
| 01.0 | 03 August 2002 | EB 05, Paragraph 12<br>Initial adoption. |

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