**CLEAN DEVELOPMENT MECHANISM**
**PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)**
**Version 03 - in effect as of: 22 December 2006**

**CONTENTS**



**Annexes**

**Revision history of this document**

| Version Number | Date | Description and reason of revision |
|---|---|---|
| 01 | 25 Feb. 2008 | Initial adoption |
| 02 | 15 Mar. 2008 | Revision according to the advice of the expert |
| 03 | 22  May.2008 | Revision according to the latest additionality tool |
| 04 | 5 Aug. 2008 | Revision according to the latest guidance for completing the  PDD |
| 05 | 26 Aug.2008 | Updated with the latest additionality tool |
| 06 | 15 Feb.2009 | Revision according to DOE's opinion during the on site validation |

## SECTION A. General description of small-scale project activity

### A.1 Title of the small-scale project activity:

Project: Yunnan Lincang City Nanlinghe 1st level Small-scale Hydropower Project
Version 06: 15 Feb. 2009

### A.2. Description of the small-scale project activity:

Yunnan Lincang City Nanlinghe 1st level Small-scale Hydropower Project (hereafter referred to as the Project) is located on the intersection of Nanlahe River and Nanlinghe River in Nanla Town, Cangyuan County, Lincang City, Yunnan Province, P.R. China which is 80km to Cangyuan County and 15km to Nanla Town. The Project is developed by Lincang City Xinshui Hydropower Development Co. Ltd.. The Project is a run-of-river hydropower station with total installed capacity of 8 MW (2*4MW). The estimated annual operation hour is 4509h and annual generated electricity is 36072MWh. It will provide 30841.56 MWh generated electricity to Southern China Power Grid every year via one 35KV LGJ-185 outlet circuits.

Without the Project, the electricity will be supplied by Southern China Power Grid. Southern China Power Grid is mainly comprise of fossil fuel fired power plant[1], the Project will achieve greenhouse gas emission reductions by avoiding $CO_2$ emissions from the business-as-usual scenario electricity generation of those fossil fuel-fired power plants connected into the China Southern Power Grid. The average annual emission reductions of the Project are estimated to be 26,869t$CO_2$e.

The main propose of the Project is to generate electricity through hydro power. As a renewable energy project, the Project will contribute to sustainable development in following aspects:

- Providing clean electrical energy, which accords with the national and Yunnan Provincial strategic development ideas of "western electricity sent to east" and "Yunnan provincial electricity sent outside". This can mitigate the shortage of electricity supply; on the other hand, this can promote local economic development [2].
- Reducing greenhouse gas (GHG) and other pollutants emissions compared to business-as-usual scenario, protect the environment.
- Increasing local revenue and providing more than 15 job positions for the regions during the project operation period[3].

### A.3. Project participants:

| Name of Party involved (*) ((host | Private and/or public entity(ies) project participants (*) (as applicable) | Kindly indicate if the Party involved wishes to be considered as project |
|---|---|---|

[1] According to *China Energy Statistical Yearbook 2007 and 2008* among the total electricity fed into of the Southern China power Grid which the Project is connected into, the amount of fossil fuel-fired electricity accounts for about 65.3% in 2003 and 68.4% in 2004,69.3% in 2005, 70.3% in 2006,70.1% in 2007.

[2]Lincang City Nanlinghe 1st Level Hydropower Station Feasible Study Report P4-7

[3] Lincang City Nanlinghe 1st Level Hydropower Feasible Study Report P13-2

| **indicates a host Party)** | | **participant (Yes/No)** |
|---|---|---|
| China (host) | Lincang City Xinshui Hydropower Development Co. Ltd. | No |
| Japan | Mitsubishi Corporation | No |

More detailed contact information of the Project Participants is provided in Annex 1.

## A.4. Technical description of the small-scale project activity:

### A.4.1. Location of the small-scale project activity:

#### A.4.1.1. Host Party(ies):

The People's Republic of China

#### A.4.1.2. Region/State/Province etc.:

Yunnan Province

#### A.4.1.3. City/Town/Community etc:

Cangyuan County, Lincang City.

#### A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

The Project is sited on the Nanlinghe River within Cangyuan County, Lincang City, Yunnan Province, P.R. China. The Project is located in the intersection of Nanlahe River and Nanlinghe River. The Project geographic coordinate of the workshop is 98º 59´20´´E and 23º 25´05´´N.
The coordinate of the five dam is respectively:
Nanlahe: 98º 58´33´´E and 23º 23´41´´N;
Daizuhe: 98º 58´11´´E and 23º 24´07´´N;
Ailanghe: 98º 59´20´´E and 23º 25´32´´N;
Guanghahe : 98º 57´36´´E and 23º 26´03´´N.
Manjiuhe: 98º 57´36´´E and 23º 26´20´´N.
Detailed physical location follows as Fig. 1.

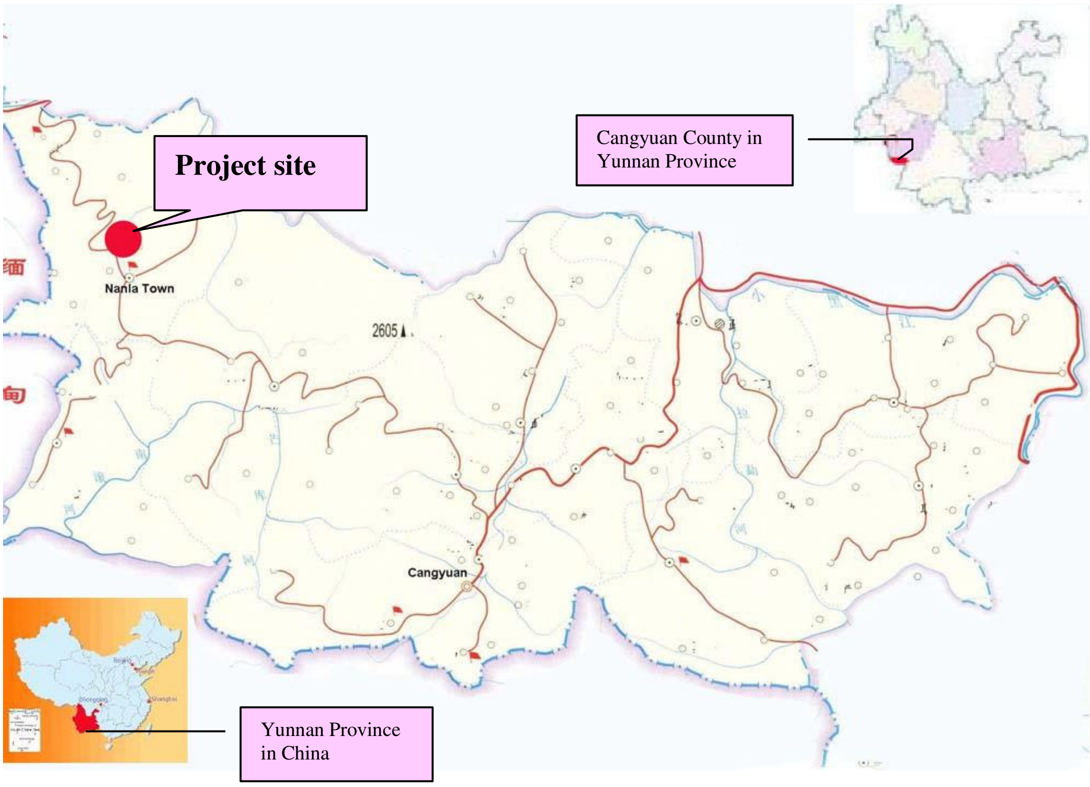



Fig. 1 Location of the Project

**A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:**

Using the categorization of Appendix B to the *Simplified Modalities and Procedures for Small-scale CDM Project Activities*, the Project type and category are defined as follows:

Type I: Renewable energy projects
Category I.D.: Renewable Energy Generation for a Grid
Sub-category: Hydro

**Technology of project activity**

The Project is a diversion run-of-river hydropower station. The main construction of the Project include: dam, water diversion channel, water diversion tunnel, pressure pool, pressure pipelines and plants, substations.

The Project have more than one diversion area (five) , so five dams were built.

Dam 1 was located on the Nanlahe River in the upstream branch of Nanlinghe River. The type of the dam is a gravity dam with a overflow dam length of 10.5m and a height of 4.6m.

Dam 2 was located on the upstream of Daizuhe River. The type of the dam is also a gravity dam with a overflow dam length of 11.0m and a height of 4.6m.

Dam 3 is located on the upstream of Ailanghe River. The type of the dam is also a gravity dam with a overflow dam length of 10.5m and a height of 4.6m.

Dam 4 is located on the upstream of Guanghahe River. The type of the dam is also a gravity dam with a overflow dam length of 4.3m and a height of 2.1m.

Dam 5 is located on the upstream of Manjiuhe River. The type of the dam is gravity dam with a overflow dam length of 10.5m and a height of 4.6m.

The water diversion channel is laid two channels based on the location of diversion dam. Where: the southern channel is open channel and is 5395m long . the northern channel is integrated of open channel and tunnel and 4365m long. The designed diversion flow is $3.05m^3/s$ .

The pressure pool is located on the foot of Ailangzhai. It is a 70m long, 13m wide and 6m deep pool. The rated water head of the pressure pipelines is 342m and rated flow is $3m^3/s$.

The workshop is located on Ailang Village in which two sets of 4MW indigenous turbine and associated generator will be installed in this plant. It is estimated that the Project can supply 30841.56MWh electricity that via one 35KV outlet circuits to Southern China Power Grid.

The type and parameter of turbines and generators are listed in Table 1 as follows:

Table 1. Main Equipment Type and Parameter

| **Parameter** | **Type/Figure** |
|---|---|
| **Turbine Type** | CJA475-W-125/2*11 |
| Quantity | 2 |
| Rated rotate speed | 600r/min |
| Rated water head | 342m |
| Rated flow | $1.4m^3/s$ |
| **Generator Type** | SFWG4000-10/2150 |
| Quantity | 2 |
| Rated power | 4MW |
| Rated voltage | 6.3kv |

The technology, which is used worldwide, is environmentally safe. All main equipments such as generator and turbine in the Project are domestically produced by Harbin Power Equipment Corporation[4] and bought newly on 03/08/2007. The Project involves no technology and installations from abroad.

[4] http://www.hpec.com/ShowClass_zzjg.asp?ClassID=8

### A.4.3 Estimated amount of emission reductions over the chosen crediting period:

The renewable crediting period will be applied in the Project, it is expected that the Project activity will generate about 26,869 $tCO_2e$ emission reductions per year during the first 7-year crediting period from Oct. 2009 to Sep. 2016.

| **Years** | **Estimation of annual emission reductions in tones of CO2e** |
|---|---|
| 01/10/2009-30/09/2010 | 26,869 |
| 01/10/2010-30/09/2011 | 26,869 |
| 01/10/2011-30/09/2012 | 26,869 |
| 01/10/2012-30/09/2013 | 26,869 |
| 01/10/2013-30/09/2014 | 26,869 |
| 01/10/2014-30/09/2015 | 26,869 |
| 01/10/2015-30/09/2016 | 26,869 |
| **Total estimated reductions (tonnes of $CO_2e$)** | **188,083** |
| **Total number of crediting years** | **7** |
| **Estimation of annual emission reductions in tones of CO2e** | **26,869** |

### A.4.4. Public funding of the small-scale project activity:

There is no public funding from Annex I parties for this Project.

### A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

According to *"the Simplified Modalities and Procedures for Small-scale CDM Project Activities, appendix C[5]"*, the project participants confirm that no project with same type and technology, whose boundary is within 1 kilometre of the proposed small-scale activity at the closest point, has been registered or is applying to register CDM project by same project owner. So the Project is not a debundled component of a larger project activity.

[5] http://cdm.unfccc.int/Projects/pac/howto/SmallScalePA/sscdebund.pdf

## SECTION B. Application of a baseline and monitoring methodology

### B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

AMS-I.D. (ver. 13) – *"Grid connected renewable electricity generation*. For more information, please refer to: *http://cdm.unfccc.int/methodologies/SSCmethodologies/approved.html*

*"Tool to calculate the emission factor for an electricity system"*(ver.01.1）. For more information, please refer to: *http://cdm.unfccc.int/Reference/Guidclarif/index.html*

### B.2 Justification of the choice of the project category:

The methodology AMS-I.D. is applicable to renewable energy generation units that supply electricity to and/or displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit. For the Project, it supply hydroelectricity to Southern China Power Grid. Southern China Power Grid is mainly comprise of fossil fuel fired power plant[6]

Moreover, the size of this run-of-river hydropower Project is 8 MW, which is not exceed the limit of 15 MW stipulated for the chosen methodology. Therefore, the methodology AMS-I.D. is applicable to the Project.

### B.3. Description of the project boundary:

The project boundary covers the power plant such as water-retaining structure, workshop, auxiliary facilities and the reservoir area, etc.

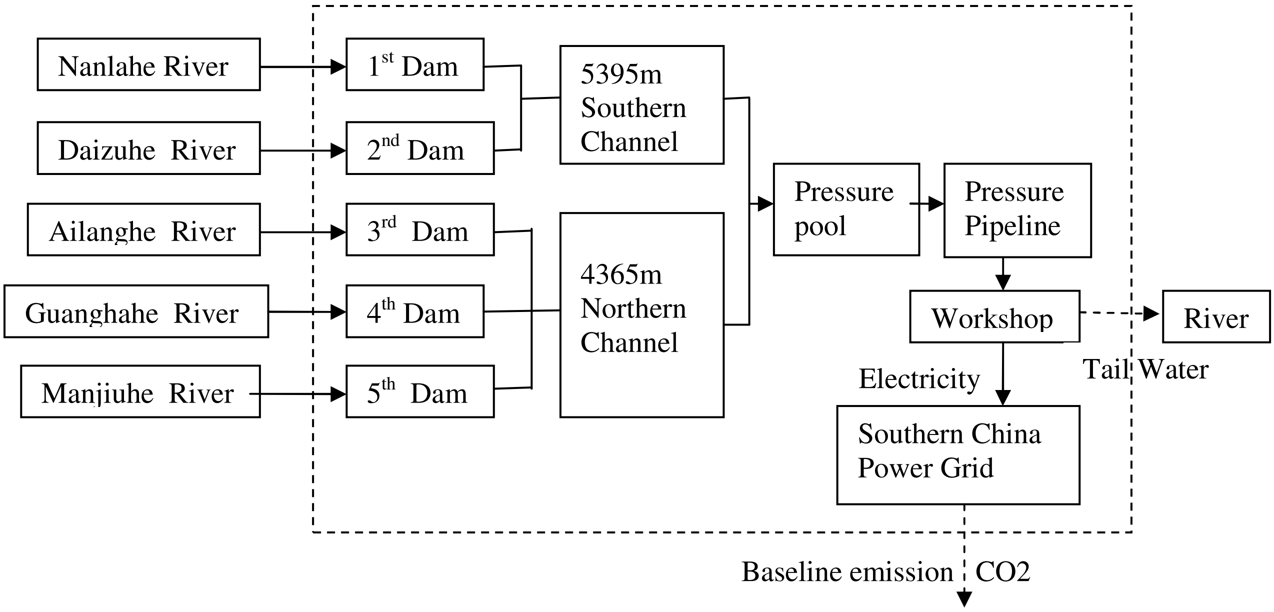
Electricity generated by the Project will be delivered to the Yunnan Power Grid. According to the Notification on Determining Baseline Emission Factor of China's Grid, Yunnan Power Grid is an integral part of the Southern China Power Grid. The Southern China Power Grid is defined as the electricity system boundary of the Project. It is composed of Guangdong Power Grid, Guangxi Power Grid, Yunnan Power Grid, Guizhou Power Grid.

| | Source | Gas | Included? | Justification / Explanation |
|---|---|---|---|---|
| **Baseline** | $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity. | $CO_2$ | Yes | Main emission sources |
| | | $CH_4$ | No | Minor emission source. |
| | | $N_2O$ | No | Minor emission source. |

[6] Southern China power Grid which the Project is connected into, the amount of low-cost/must run resources accounts for about 34.7% in 2003 and 31.58% in 2004, 300.7% in 2005 and 29.7% in 2006, 29.9% in 2007.

| | | | | |
|---|---|---|---|---|
| **Project Activity** | Emission of $CH_4$ from the reservoir | $CO_2$ | No | Minor emission source |
| | | $CH_4$ | No | The project is a run-of-river hydropower station. The power density of the project is higher than 10w/m$^2$. |
| | | $N_2O$ | No | Minor emission source |

The Project boundary included is shown in the figure below.




Nanlinghe Project

| **B.4**. **Description of baseline and its development:** |
|---|

In the absence of the proposed project, the possible alternatives to the proposed project would be as follow:

(1) The proposed hydropower plant development not undertaken as a CDM project activity;

(2) Construction of a fossil fuel power plant with the same amount of annual electricity generation;

(3) Construction of a power plant using other renewable energy sources with the same annual electricity generation;

(4) the Southern China Power Grid as the provider for the same electricity generation as the proposed project.

In point of project's investment benefit, the investment risk is comparatively high. If the proposed project is not implemented as a CDM project, the IRR of fixed assets investment of the proposed project will be below the benchmark interest rate (10%) of Chinese small-scale hydropower industry (please refer to section B.5 for the detailed analysis). Alternative (1) is not feasible.

The installed capacity of the Project is 8 MW, considering the same annual electricity generation; the alternative for the Project should be a fuel-fired power plant with installed capacity lower than 8MW. Further, as the Project is a grid-connected hydropower generation project, the alternative must be a grid connected fuel-fired power generation project. Fuel-fired power generation may be one of the type of coal-fired power generation, gas-fired power generation and oil-fired power generation. Compared with coal-fired power generation gas-fired power generation and oil-fired power generation are always restricted by the supply of fuel, high investment and low benefit which means they are not a plausible choice for the project owner. That is, the most possible fuel-fired power generation is coal-fired power generation. However, according to China's regulations, construction of fuel-fired power plants with the installed capacity lower than 135 MW is prohibited in the areas which can be covered by large grids such as provincial grids[7]. Alternative (2) has been excluded for it conflicts with China's current regulations.

In point of technical feasibility, among the current alternative technologies about grid-connected electricity generation from other kind of renewable energy source in China: wind energy technology is comparatively mature, but there is no usable wind resource in the site of the proposed project; biomass generation needs plenty of biomass material, there is lack of the biomass material in the mountainous area where the proposed project is located[8]. Alternative (3) is not feasible.

The Southern China Power Grid as the provider for the same electricity generation as the proposed project is incompliance with the national rules and regulations, and they are economical and feasible, so alternative (4) is feasible.

According to the above analysis, the Southern China Power Grid, to which the proposed project is connected, provides the same capacity and electricity as that of the proposed project is the baseline scenario of the proposed project.

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[7] http://www.gov.cn/gongbao/content/2002/content_61480.htm. Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135 MW or Below issued by the General Office of the State Council, decree No. 2002-6.

[8] According to the Nanlinghe Hydrography Analysis Report, the annual average wind velocity is only 1.9m/s, which is much lower than the wind velocity needed for construction of wind power station. The project is located in the Xinning County.

The mountain accounts for 99% of the area of the county and average farmland each farmer has is only 2.67Mu mountain farmland with low production. So, for the one hand, the region has no enough biomass resource to supply for the biomass power plant; for the other hand, the transportation condition is bad (http://www.ww8899.com/shownews.asp?newsid=2951).

The baseline scenario emission is power supply to the grid multiplied by the emission factor of the grid. The calculation of grid emission factor is provided in B.6.1

The system boundary of the Project is the Southern China Power Grid. Therefore, the emission reductions of the Project are the baseline emission factor of the Southern China Power Grid multiplied by the power the Project provided to the grid.

During the most recent 5 years, from 2003 to 2007, the hydroelectricity, nuclear-electricity and other low-cost/must run resources annual proportion in Southern China Power Grid is: 34.7% in 2003 [9],31.6% in 2004[10], 30.7% in 2005[11] and 29.7% in 2006[12], 29.9% in 2007[13].

parameters used to determine the baseline emission are listed in the followed table[14]:

Table 2 the main meters used to determine the baseline emission

| Variable | Value / Unit | Original Data Source |
|---|---|---|
| Operating Margin Emission Factor | 1.0608 tCO2/MWh | Calculated from the China Energy Statistic Yearbooks 2005-2007 and the China Electric Power Yearbooks 2005-2007 |
| Build Margin Emission Factor | 0.6816 tCO2/MWh | Calculated from the China Energy Statistic Yearbook 2007 and the China Electric Power Yearbooks 2005-2007 |
| Combined Margin Emission Factor | 0.8712 tCO2/MWh | Calculated from the China Energy Statistic Yearbooks 2005-2007and the China Electric Power Yearbooks 2005-2007 |
| Electricity supplied by the project to the grid in year y | 30841.56MWh | Feasible Study Report |

**B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:**

Based on the requirement of Attachment A of Appendix B: the *Simplified Modalities and Procedures for Small-scale CDM Project Activities*. Additionality of the Project is demonstrated by investment barrier analysis.

***Investment analysis***

[9] China Energy Statistical Year Book2007
[10] China Energy Statistical Year Book2007
[11] China Energy Statistical Year Book2007
[12] China Energy Statistical Year Book2007
[13] China Energy Statistical Year Book2007
[14]http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/2008/200887164119674.pdf

We should determine whether the Project is economically and financially less attractive than alternative 4) without considering the CERs sales revenues or not through analysis of this step. We take following sub-steps to conduct investment analysis:

The latest Tools for the Demonstration and Assessment of Additionality (05.2) suggests three analysis methods which are simple cost analysis (Option I), investment comparison analysis (Option II) and benchmark analysis (Option III). Since the Project will earn revenues not only from the CERs sales but also from electricity sales, the simple cost analysis method is not appropriate. Investment comparison analysis method is only applicable to projects whose alternatives are similar investment projects. The Alternative 4 of the Project is the Southern China Power Grid rather than new investment projects. Therefore Option II is not appropriate. The Project will use benchmark analysis method (Option III) based on the consideration that benchmark IRR of the power sector is available.

***(1) Benchmark analysis***

According to the *Economic Evaluation Code for Small Hydropower Projects* (SL16-95), the financial benchmark rate of return adopted by the proposed is 10% for the after tax Internal Rate of Return (IRR) of total investment. It is not considered the Project is financially attractive if the project IRR (after tax) without additional revenue is lower than 10% (benchmark IRR).

***(2) Calculation and Comparison of Financial Indicators***

According to the *Feasible Study Report* (FSR) which is approved by Lincang City Development and Reform Commission in Nov.03,2006([2006]727), the basic parameters for calculation of financial indicators of the Project are listed in Table 3 as follows:

Table 3 Financial Parameters of the Project

| **Parameter** | **Figure** | **Units** | **Resource** |
|---|---|---|---|
| Installed capacity | 8 | MW | FSR p13-1 |
| Estimated annual generated electricity | 36072 | MWh | FSR p13-1 |
| Project lifetime(include construction period) | 21 | years | FSR p13-1 |
| Total investment | 3827.55 | 10000RMB | FSR p13-1 |
| Expected bus-bar tariff (including VAT) | 0.18 | RMB/kWh | FSRp13-3 |
| Annual O&M cost | 88.3671 | 10000RMB | FSR p13-2 |
| Value added tax rate | 6 | % | FSR p13-3 |
| Income tax rate | 33 | % | FSR p13-3 |
| Expense for city maintenance and construction | 5 | % | FSR p13-3 |
| Education fee addition | 3 | % | FSR p13-3 |
| CER price | 10 | $/t$CO_2$e | FSR p13-4 |

Based on the data above, without CERs revenue, the IRR (after tax) of fixed assets investment

of Project is 8.17% which is lower than benchmark 10%. Therefore, the Project activity is not a financially attractive project.

***(3) Sensitivity analysis***

According to the annex 35 of EB 39, only variables, including the initial investment cost, that constitute more than 20% of either total project costs or total project revenues should be subjected to reasonable variation. For the project, the following financial parameters were taken as uncertain factors for sensitivity analysis of financial attractiveness:

- Fixed assets investment
- Annual O&M cost
- Annual output
- Electricity price

Assuming the above three indicators varied in the range of -10%-+10%, the IRR varieties of the Project is shown in Table 4 and Figure 2.

Table 4. IRR of fixed assets investment sensitivity analysis of the Project (Without CERs revenues)

| Range / Parameter | -10% | 0 | +10% |
|---|---|---|---|
| **Fixed assets investment** | 9.66% | 8.17% | 6.92% |
| **Annual O&M cost** | 8.41% | 8.17% | 7.94% |
| **Annual output of electricity** | 6.78% | 8.17% | 9.55% |
| **Electricity price** | 6.78% | 8.17% | 9.55% |

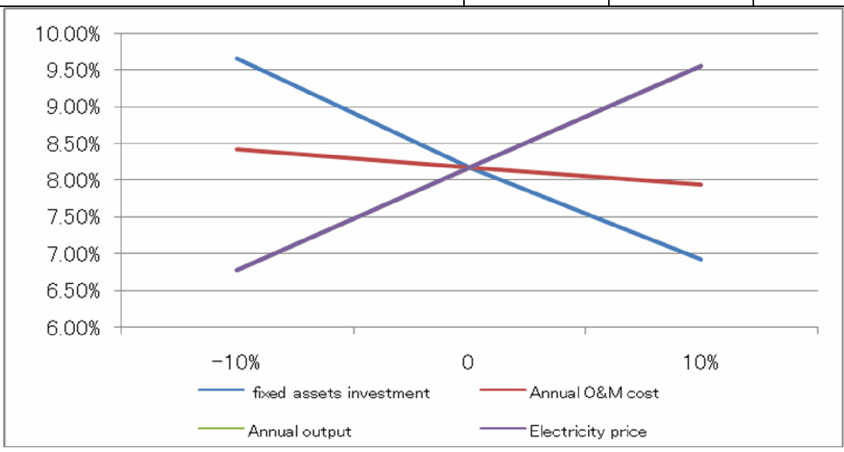


Figure 2. IRR of fixed assets investment sensitivity analysis of the Project (Without CERs revenues)

As shown in the sensitivity analysis, impacts of fixed assets investment and annual output on IRR of fixed assets investment are obvious. Even the variation range of the factor reaches 10%, the IRR of fixed assets investment of the Project could not reach the benchmark.

If the Project can be successfully registered as a CDM project, the CERs sales revenues will improve the financial factors of the Project. Considering of the CERs revenues (calculated with \$10/t$CO_2$e, 21yrs crediting period, 1:8 for exchange rate between Europe dollar and RMB in Nov.2006[15]), the IRR of the fixed assets investment of the Project will be increased to 15.35% which is shown in Table 5.

Table 5. The IRR of the total investment of the Project

| | Without CERs Revenues | Benchmark | With CERs Revenues |
|---|---|---|---|
| **IRR of the fixed assets investment of the Project(%)** | 8.17 | 10 | 15.35 |

Before the beginning of project construction, the project owner took the CDM into account seriously. CDM played a key role in the implementation of the Project. The CDM incentive information listed as below.

| Date | Event |
|---|---|
| 09/ 2006 | The terminal FSR finished. According to the FSR, the fixed assets investment IRR is lower than the benchmark and the design institute suggested the Project owner to apply for CDM to improve the financial situation of the Project. |
| 03/11/2006 | The FSR was approved by Lincang City Development and Reform Commission |
| 16/04/2007 | The Project owner held Board meeting to discuss the issue of the Project applying for CDM. On the meeting it is decided to designate one person who take charge of the whole thing . |
| 03/08/2007 | The total construction contract has been signed which can be considered as the start of the Project. |
| 03/08/2007 | The equipment purchase contract has been signed. |
| 01/2008 | The Project owner signed the consultant contract with AGET. |
| 22/05/2008 | The Project owner signed the ERPA with Mitsubishi Corperation. |
| 14/08/2008 | The Project has got the LoA from China NDRC. |
| 10/09/08 | The Project is for GSP. |

Conclusively, the Project is additional.

## B.6. Emission reductions:

### B.6.1. Explanation of methodological choices:

**1. Calculate the baseline emissions**

The small-scale CDM methodology AMS-I.D. is applied in the Project. According to the methodology the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg $CO_2$e/kWh) calculated in a transparent and conservative manner as:

(a) A combined margin (CM), consisting of the combination of operating margin (OM) and

[15] http://www.bankofchina.com/sourcedb/lswhpj/

build margin (BM) according to the procedures prescribed in the *Tool to calculate the emission factor for an electricity system* OR

(b) The weighted average emissions (in kg CO2e/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

The Project adopted method (a) to calculate the emission coefficient.

The following is the detailed process of calculating the baseline CO2 emission factor of the grid which the Project connected to according to the steps provided by the *Tool to calculate the emission factor for an electricity system.*

**Sub-step 1a. Identify the relevant electric power system.**

Chinese DNA has published a delineation of the project electricity system and connected electricity system. The project physically connects through transmission and distribution lines to the Southern China Power Grid. It is composed of Guangdong Power Grid, Guangxi Power Grid, Yunnan Power Grid, Guizhou Power Grid. Therefore, the project selects the Southern China Power Grid for the calculation of baseline emission factor.

When there exists net electricity imports from a connected electricity system within the same host country(ies)，one of the following options to determine the $CO_2$ emission factor(s) for net electricity imports (EFgrid,import,y) from a connected electricity system within the same host country(ies):

(a) 0 $tCO_2$/MWh, or

(b) The weighted average operating margin (OM) emission rate of the exporting grid, determined as described in step 3 (d) below; or

(c) The simple operating margin emission rate of the exporting grid, determined as described in step 3 (a), if the conditions for this method, as described in step 2 below, apply to the exporting grid; or

(d) The simple adjusted operating margin emission rate of the exporting grid, determined as described in step 3 (b) below.

Option C will be chose in the PDD.

**Sub-step 1b. Select an operating margin (OM) method.**

According to the *Tool*, four methods compute the Operating Margin Emission factor can be used as follows:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch data analysis OM, or

(d) Average OM.

The simple OM method only can be used when low-cost/must run resources constitute less than 50% of total amount of grid generating output 1) in the recent five years, or 2) by taking into account long-term normal for hydroelectricity generation. If the dispatch data is available the (c) Dispatch Data Analysis OM method should be the first methodological choice, while in case of the Project, the (a) Simple OM method is adapted with two reasons as follows:

(1) In cases where China presently the power grid dispatch and load data are unavailable as business secrets, so (b) and (c) cannot apply in the Project for calculating the Operating Margin Emission Factor ($EF_{grid,OM,y}$).

During the most recent 5 years, from 2003 to 2007, the hydroelectricity, nuclear-electricity and other low-cost/must run resources annual proportion in Southern China Power Grid is: 34.7% in 2003 [16],31.6% in 2004[17], 30.7% in 2005[18], 29.7% in 2006[19] and 29.9% in 2007[20].

(2) For simple OM, 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 at the time of submission of the CDM-PDD for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or
- Ex post option: The year in which the project activity displaces grid electricity, requiring the emission factor to be updated annually during monitoring. If the data required calculating the emission factor for year y usually only available later than six months after the end of year y.

Project participant employs "ex-ante" for its operation margin calculation with two reasons as follows:

1) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission; and
2) the calculation adopt *Notification on Determining Baseline Emission Factor of China's Grid (18/07/2008)*, which is published by Chinese DNA, therefore it is considered as authoritative data. In this notification, the OM is calculated *ex-ants*.

**Sub-step 1c. Calculate the operating margin emission factor according to the selected method.**

From the *Tool to calculate the emission factor for an electricity system*, ($EF_{grid,simple,OM}$) may be

[16] China Energy Statistical Year Book2007
[17] China Energy Statistical Year Book2007
[18] China Energy Statistical Year Book2007
[19] China Energy Statistical Year Book2007

[20] China Energy Statistical Year Book2008

calculated:

- Based on data on fuel consumption and net electricity generation of each power plant / unit (Option A), or
- Based on data on net electricity generation, the average efficiency of each power unit and the fuel type(s) used in each power unit (Option B), or
- Based on data on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system (option C)

Because the fuel consumption data is unavailable for each power plant / unit, Operation A and Operation B can not be used. At the same time 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 so Option C was the only operation can be used.

Where Option C is used, the simple OM method formula of $EF_{Grid,OM,Simple,y}$ calculation is:

$$EF_{Grid,OM,simple,y} = \frac{\sum_i FC_{i,y} \bullet NCV_{i,y} \bullet EF_{CO2,i,y}}{\sum EG_y} \quad (5)$$

where:

$EF_{grid,OMsimply,y}$ is simple operating margin $CO_2$ emission factor in year y($tCO_2$/MWh);

$FC_{i,y}$ is amount of fossil fuel type i consumed in the project electricity system in year y;

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

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

$EG_y$ is net electricity generated and delivered to the grid by power plant / unit m in year y (MWh);

$i$ is all fossil fuel types combusted in power sources in the project electricity system in year y;

$y$ is either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2.

When there exists net electricity imports from a connected electricity system within the same host country(ies):

(1) the emission factor(s) of the specific power plant(s) from which electricity is imported, if and only if the specific plants are clearly known, or

(2) the emission factor of the exporting grid, if the specific plants are not clearly known.

The data on electricity generation and auxiliary electricity consumption are obtained from the *China Electric Power Yearbook* from 2005 to 2007 (published annually). The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2005 to 2007 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

The detailed calculation can be find in Annex 3, the $EF_{grid,OM,y}$ = 1.0608t$CO_2$/MWh

**Sub-step 1d. Identify the cohort of power units to be included in the build margin (BM).**

The sample group of power units *m* used to calculate the build margin consists of either:

a) The set of five power units that have been built most recently, or

b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently[21].

Project participants should use the set of power units that comprises the larger annual generation.

In China it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently. Taking notice of this situation, EB accepts[22] the following deviation in methodology application:

1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity, i.e. the capacity addition over 1-3years, whichever results in a capacity addition that is closet to 20% of total installed capacity.

2) Use proportional weights that correlate to the distribution of installed capacity in place during the selected period above, using plant efficiencies and emission factors of commercially available best practice technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

In terms of vintage of data, project participants can choose between one of the following two options: Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor

[21] If 20% falls on part capacity of a unit, that unit is fully included in the calculation.

22 Http://cdm.unfccc.int/Projects/Deviations.

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 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 PDD choose Option 1.

**Sub-step 1e. Calculate the build margin emission factor.**

According to the *Tool*, the following equation (6) is adopted to calculate $EF_{grid,BM,y}$.

$$EF_{Grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (6)$$

where:

$EF_{grid,BM,y}$ is build margin $CO_2$ emission factor in year y ($tCO_2/MWh$);

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

$EF_{EL,m,y}$ is $CO_2$ emission factor of power unit m in year y ($tCO_2/MWh$);

*m* is power units included in the build margin;

*y* is most recent historical year for which power generation data is available;

Consider of data availability, The Project adopted the following deviation method which was published by Chinese DNA and accepted by CDM EB[23]:

1) Use of capacity additions during the last 1~3 years for estimating the build margin emission factor for grid electricity.

2) Use of weights estimated using installed capacity in place of annual electricity generation.

And it is suggested to use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy.

Therefore for the Project: First, calculate the share of different power generation technology in recent capacity additions. Second, calculate the weight for capacity additions of each power generation technology. And finally calculate the emission factor use the efficiency level of the

[23] http://cdm.unfccc.int/Projects/Deviations ; DNV deviation request, "Request for clarification on use of approved methodology AM0005 for several projects in China"

best technology commercially available in China.

Since data of installed capacities can not be separated to coal based, oil based and gas based at present, BM is calculated with following steps and formula:

(1) Calculate the power generation emissions for solid, liquid and gas fuel and each share of total emissions based on the *Energy Balance Table* of the most recent year

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times NCV_{i,j,y} \times COEF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j,y} \times COEF_{i,j,y}} \quad (7)$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times NCV_{i,j,y} \times COEF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j,y} \times COEF_{i,j,y}} \quad (8)$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times NCV_{i,j,y} \times COEF_{i,j,y}}{\sum_{i,j} F_{i,j,y} \times NCV_{i,j,y} \times COEF_{i,j,y}} \quad (9)$$

where:

$F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by power j in year(s) y;

$NCV_{i,j,y}$ is the net caloric value of fuel i consumed by power j in year y;

$COEF_{i,j,y}$ is the $CO_2$ emission coefficient of fuel i ($tCO_2/tCe$), taking into account the carbon content of the fuels (coal, oil and gas) used by power j and the percent oxidation of the fuel in year(s) y, and

COAL, OIL and GAS are footnote group for solid fuels, liquid fuels and gas fuels.

(2) Calculate emission factor for thermal power of the grid based on the result of Step a and the efficiency level of the best technology commercially available in China

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (10)$$

Where $EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ represents the efficiency level of the best coal-fired, oil-based and gas-based power generation technology commercially available in China.

Step c. Calculate BM of the grid based on the result of Step b and the share of thermal power of recent 20% capacity additions.

$$EF_{grid,BM,y} = \frac{CAP_{Thermal}}{CAP_{Total}} \times EF_{Thermal} \quad (11)$$

Where $CAP_{Total}$ is total capacity additions while $CAP_{Thermal}$ is capacity additions of thermal power.

The data on different fuel consumptions for power generation and the net caloric values of the fuels are obtained from the *China Energy Statistical Yearbook* from 2005 to 2007 (published annually after 2003). The emission factors and oxidation factors of the fuels adopted are obtained from *Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories.*

With reference to the Notification on Determining Baseline Emission Factor of China's Grid, the weighted average fuel consumption for power generation of the top 30 sets of 600 MW lowest coal-consumed power generators built in 2006 (329.94 gCe/kWh) and the 200 MW oil/gas based combined cycle power generators (252 gCe/kWh) are taken as the efficiency level of the best technology commercially available in China.

The detailed calculation can be find in Annex 3, the $EF_{grid,BM,y}$ = 0.6816 $tCO_2$/MWh.

**Sub-step 1f. Calculate the combined margin (CM) emissions factor.**

Based on the *Tool*, the baseline emission factor ($EF_{grid,CM,y}$) is calculated as the weighted average of the operating margin emission factor ($EF_{grid,OM,y}$) and the build margin emission factor ($EF_{grid,BM,y}$), as

$$EF_{grid,CM,y} = \omega_{OM} \cdot EF_{grid,OM,y} + \omega_{BM} \cdot EF_{grid,BM,y} \quad (12)$$

According to the *Tool*, both the weight $w_{OM}$ and the weight $w_{BM}$ take 0.5 as default. Therefore the combined baseline emission factor

$EF_{grid,CM,y}$=0.5×1.0608+0.5×0.6816=0.8712 ($tCO_2e$/MWh).

**Step 2. Calculate the project GHG emissions**

According to methodology AMS-I.D.(ver.13), project emissions should not be considered, i.e. $PE_y$ =0 $tCO_2e$.

**Step 3. Calculate the project leakage GHG emissions**

The Project can take no account of leakages, $L_y$=0 $tCO_2e$.

**Step4. Calculate the emission reductions**

The project activity will generate GHG emission reductions by avoiding $CO_2$ emissions from electricity generated by fossil fuel power plants. The emission reduction ($ER_y$) during a given year y is calculated as follows:

$$ER_y = BE_y - PE_y - L_y \tag{11}$$

**B.6.2. Data and parameters that are available at validation:**

| **Data / Parameter:** | $EG_y$ |
|---|---|
| Data unit: | MWh |
| Description: | net electricity generated and delivered to the grid by power plant / unit m in year y |
| Source of data used: | *China Electric Statistical Yearbook, 2005-2007* |
| Value applied: | Values depend on specifically fuel, referring to Annex 3. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available. |
| Any comment: | Reasonable |

| **Data / Parameter:** | $FC_{i,y}$ |
|---|---|
| Data unit: | mass or volume unit |
| Description: | Amount of fossil fuel type i consumed in the project electricity system in year y |
| Source of data used: | *China Energy Statistical Yearbook, 2005-2007* |
| Value applied: | Values depend on specifically fuel, referring to Annex 3. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available. |
| Any comment: | Reasonable |

| **Data / Parameter:** | $F_{i,j,y}$ |
|---|---|
| Data unit: | Mass or volume |
| Description: | The fuel consumption of fuel i in power plant j during year y |
| Source of data used: | *China Energy Statistical Yearbook, 2005-2007* |
| Value applied: | Values depend on specifically fuel, referring to Annex 3. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available. |
| Any comment: | Reasonable |

| **Data / Parameter:** | $NCV_{i,y}$ |
|---|---|
| Data unit: | TJ/t, $TJ/km^3$ |
| Description: | Net calorific value (energy content) per mass or volume unit of a fuel *i* in year *y* |
| Source of data used: | *China Energy Statistical Yearbook, 2007* |
| Value applied: | Values depend on specifically fuel, referring to Annex 3. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the *Tool to calculate the emission factor for an electricity system* requirement, use accurate and reliable local or national data where available. |
| Any comment: | Reasonable |

| **Data / Parameter:** | $EF_{CO2,i,y}$ |
|---|---|
| Data unit: | tC/TJ ($tCO_2e/TJ$) |
| Description: | $CO_2$ emission factor of fossil fuel type i in year y ($tCO_2/GJ$) |
| Source of data used: | *IPCC 2006 Revised Guidelines* |
| Value applied: | Values depend on specifically fuel, referring to Annex 3. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the *Tool to calculate the emission factor for an electricity system* requirement, use IPCC default value. |
| Any comment: | Reasonable |

| **Data / Parameter:** | $OXID_{i,y}$ |
|---|---|
| Data unit: | % |
| Description: | Oxidation factor of the fuel *i* in year *y* |
| Source of data used: | *IPCC 2006 Revised Guidelines* |
| Value applied: | Values depend on specifically fuel, referring to Annex 3. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | According to the *Tool to calculate the emission factor for an electricity system* requirement, use IPCC default value. |
| Any comment: | Reasonable |

| **Data / Parameter:** | Internal use rate of power plant |
|---|---|
| Data unit: | % |
| Description: | The internal power consumption of power plants in year(s) *y* |
| Source of data used: | *China Electric Power Yearbook 2005-2007* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |

| | |
|---|---|
| Any comment: | |

| | |
|---|---|
| **Data / Parameter:** | $CAP_{i, j, y}$ |
| Data unit: | MW |
| Description: | Installed capacities of power plant category *i* of province *j* in years *y*. |
| Source of data used: | *China Electric Power Yearbook 2005-2007* |
| Value applied: | See Annex 3 for details. |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | Data used are from Chinese authorities. |
| Any comment: | |

**B.6.3 Ex-ante calculation of emission reductions:**

**Step 1. Estimated the baseline emissions of greenhouse gases**

Baseline emissions are calculated with combined baseline emission factor and the electricity delivered to the grid by the Project. The electricity delivered to the grid by the Project in year y ($EG_y$) is calculated as subtract the electricity import from the grid in year y ($EG_{aux,y}$) from the electricity exported to the grid in year y ($EG_{output,y}$), that is:

$$BE_y = EG_y \times EF_{grid,CM,y} = (EG_{output.y} - EG_{aux.y}) \times EF_{grid,CM.y} \qquad (12)$$

Assuming the $EG_{aux,y} = 0$ in ex-ante calculation of emission reductions for the Project.

According to the *FSR* of the three Plants, the electricity exported to the grid in year y is estimated to be 30841.56 MWh. According to the calculation in B.6.1, the baseline emission factor for the Project is 0.8801$tCO_2e$/MWh and the annual baseline emission of the Project is:

$BE_y = EG_y \times EF_{grid,CM,y} = (EG_{output.y} - EG_{aux.y}) \times EF_{grid,CM.y} =$ (30,841.56 - 0) MWh × 0.8712$tCO_2e$/MWh =26,869$tCO_2e$。

**Step 2. Estimated project activity emissions**

The Project is a run-of-river hydropower plant that the project emissions should not be considered as per AMS-I.D., i.e. $PE_y = 0\ tCO_2e$.

**Step 3. Estimated project leakage emissions:**

As above AMS-I.D., the leakage of the Project is not considered, i.e. $L_y = 0\ tCO_2e$.

**Step 4. Estimated emission reductions**

As per formula (11), the annual emission reductions of the Project are:

$$ER_y = BE_y - PE_y - L_y = 26869 \text{ tCO}_2\text{e}$$

### B.6.4 Summary of the ex-ante estimation of emission reductions:

It is expected that the proposed project activity will generate about 188,083 **$tCO_2e$** emission reductions over the first 7-year crediting period from Oct. 2009 to Sep. 2016.

| Year | Estimation of project activity emissions ($tCO_2e$) | Estimation of baseline emissions ($tCO_2e$) | Estimation of leakage ($tCO_2e$) | Estimation of overall emissions reductions ($tCO_2e$) |
|---|---|---|---|---|
| 01/10/2009-30/09/2010 | 0 | 26,869 | 0 | 26,869 |
| 01/10/2010-30/09/2011 | 0 | 26,869 | 0 | 26,869 |
| 01/10/2011-30/09/2012 | 0 | 26,869 | 0 | 26,869 |
| 01/10/2012-30/09/2013 | 0 | 26,869 | 0 | 26,869 |
| 01/10/2013-30/09/2014 | 0 | 26,869 | 0 | 26,869 |
| 01/10/2014-30/09/2015 | 0 | 26,869 | 0 | 26,869 |
| 01/10/2015-30/09/2016 | 0 | 26,869 | 0 | 26,869 |
| **Total (tonnes of $CO_2e$)** | **0** | **188,083** | **0** | **188,083** |

### B.7 Application of a monitoring methodology and description of the monitoring plan:

### B.7.1 Data and parameters monitored:

| **Data / Parameter:** | $EG_{output,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity exported to the grid by the Project in year y |
| Source of data to be used: | Accurate value from meters. |
| Value of data | 30841.56 |
| Description of measurement methods and procedures to be applied: | Continuously measured by meters, data is recorded by computer and recorded manually. |
| QA/QC procedures to be applied: | Invoices and/or receipts are used as cross-check. |
| Any comment: | -- |

| **Data / Parameter:** | $EG_{aux,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Electricity imported from the grid in year y |
| Source of data to be used: | Assuming 0 in PDD, accurate value from meters. |
| Value of data | 0 |
| Description of measurement | Continuously measured by meters and recorded monthly by |

| | |
|---|---|
| methods and procedures to be applied: | staff. |
| QA/QC procedures to be applied: | Invoices and/or receipts are used as cross-check. |
| Any comment: | -- |

**B.7.2 Description of the monitoring plan:**

**Purpose**

Baseline emission factor of the Project is determined ex ante. Therefore the electricity delivered by the Project to the Southern China Power Grid ($EG_y$) is defined as the key data to be monitored. The monitoring plan is drafted to focus on monitoring the electricity delivered by the Project to the Southern China Power Grid. Meanwhile the electricity delivered to the grid by the Project in year y ($EG_y$) is calculated as subtract the electricity import from the grid in year y ($EG_{aux,y}$) from the electricity exported to the grid in year y ($EG_{output,y}$) therefore the electricity import from the grid in year y ($EG_{aux,y}$) and the electricity exported to the grid in year y ($EG_{output,y}$) are the key parameters to be monitored.

**Monitoring Structure**

The Project owner assigns the person in charge of CDM operation with assistance of the technological department and financial department. The structure shows as the following Figure 3.

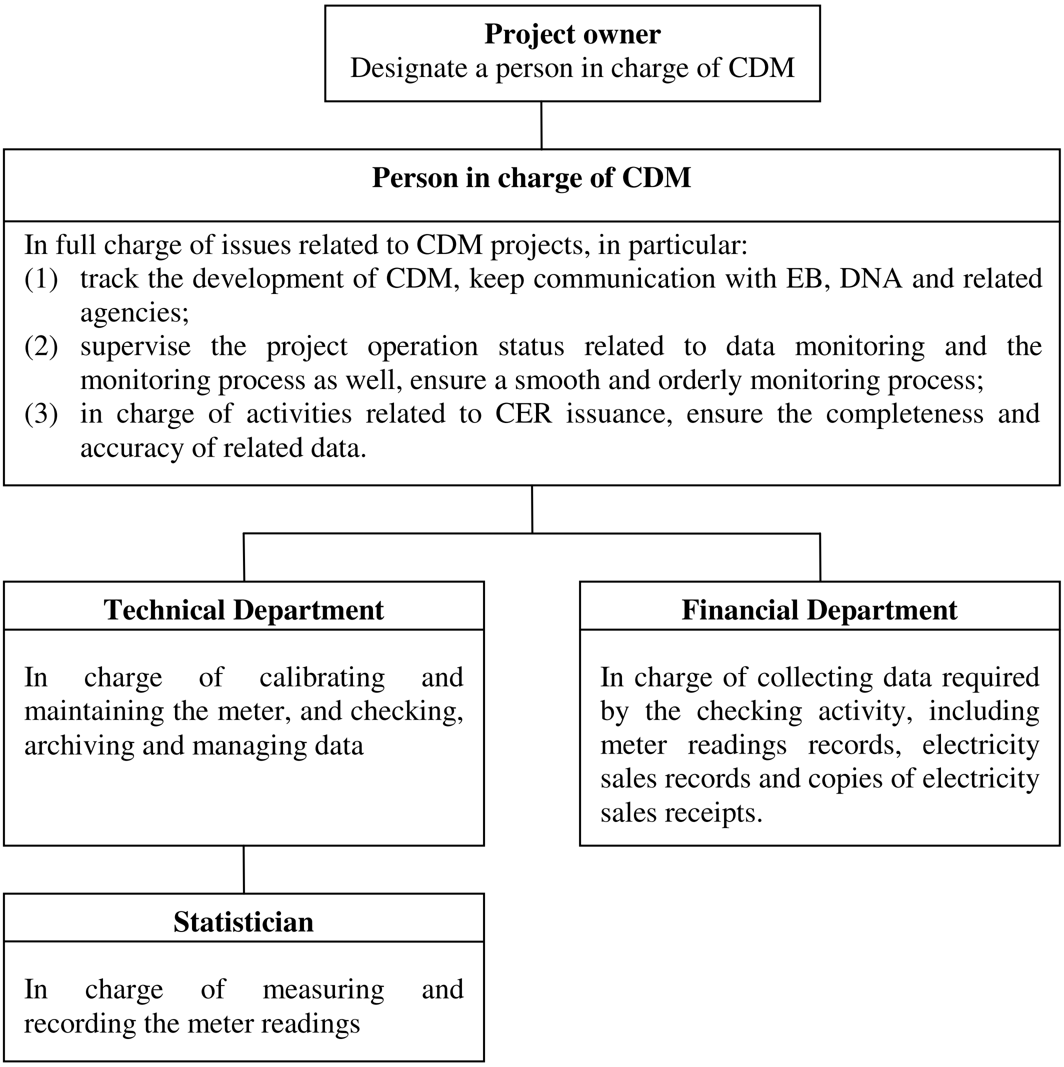


Figure 3. Management Structure of Monitoring Plan

**Person in charge of CDM:** designated by the Project owner and take full charge of the issues related to CDM projects. Under the person, two departments will be founded:
**Technical department:** in charge of the calibrating and maintaining the ammeter, and checking, archiving and managing data.
**Financial department:** in charge of collecting data required by the checking activity, such as electricity receipt and/or invoice.

**Equipment and Installation of Monitoring**

Electricity meters should meet the relevant local standards at the time of installation. Before the installation of the meters, it should be calibrated. The meters will be installed by either the project developer or the grid company according to the national Chinese standard "electricity meter installation technical management code" (DL/T448-2000).

The main meter (M1 in the drawing), for monitoring the net electricity supplied to the grid, will be installed at substation. Main meter is used for identifying payment. The accuracy of main meter is at least 0.5. The main meter is belonged to the grid company and grid company takes responsibility for main meter installation, operation, maintenance and calibration.

The check meter (M2 in the drawing) is installed at high-voltage side of transformer within project site. Check meter also measures exported and imported electricity by the Project. The accuracy of check meter is 0.5. Check meter is belonged to project owner and project owner takes responsibility for installation, operation, maintenance and calibration.

One meter (M3-1 and M3-2 in the drawing) is installed at outlet of each generator, which measures power generation for each generator.

The distributing figure described as follow Fig.4:

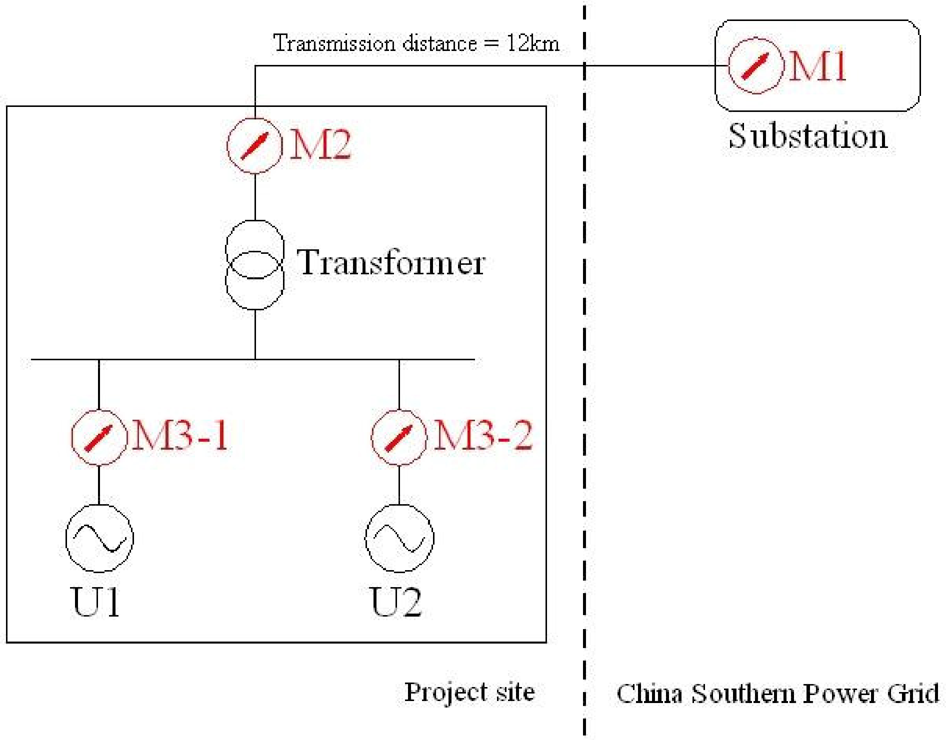


Fig.4: Meter distribution drawing

**Training:**

Some technicians come from electric power colleges. The others come from old power stations. The formal training has been held before their duty. Before the formal operation of the proposed project, the personal in charge of CDM will organize the relevant personals to participate the CDM training.

**Data Collection**

The data for emission reduction calculation is collected as below:

Metering Electricity Supplied to the Grid:

(1) The grid company records main meter (M1) data according to Power Purchase Agreement, and then issues electricity record sheet to project owner monthly.
(2) The project owner offers relevant electricity sales receipt to grid company and keeps the photocopy of receipt; the project owner keeps the purchase receipt which offered by grid company for showing the electricity imported.
(3) The project owner records the net quantity of electricity offered to the grid (the net quantity of electricity offered to the grid is calculated as subtract the imported electricity from the exported electricity).

Metering of Electricity Generation from the Hydro Station (the check Meter)

The check meter (M2) will be installed, operated and maintained according to the relevant Chinese standard to enable the use of the data as a cross check or back up in the case of a failure of the M1.

The main meter recorded will be checked by the check meter monthly.

Main meter failure (please refers to the electricity meter specification) – use of check meter data:

If the main electricity meter is found to be faulty during its reading, data from the check meters will be used.

Electricity meters failure(please refers to the electricity meter specification):

In the event of the main meter or check meter failing, it will be repaired or replaced by an accredited equipment testing organisation. Maintenance records and any calibration documents will be retained by the project.

**<u>QA/QC</u>**

In order to maintain high precision for meters, the calibration should be implemented according to state and/or sector standards and rules and certificated after calibration. Since M1 meter belongs to grid company, the calibration of M1 is carried out by grid company. The M2 meters should be calibrated every year normally according to the national standard JJF1055-1997.
Within 10 days on the date of:
(1) The error of duty meters and checking meters oversteps the permissible range;
(2) Repairs due to meters failure.
All the installed meters should be tested by relevant qualified institution which designated by both project owner and grid company.

**<u>Data Management and internal audit</u>**

1. The Month meter measurement data will be checked and reported to the responsible people of technical department by statistician and the responsible people of the technology departments will report to the person in charge of CDM; The Month electricity purchase invoice will be reported to the person in charge of CDM by the responsible people of financial department. All the data will be checked again and signed by the person in charge of CDM and then sent to the relevant department for filing. The technical data will be filed in the technical department and the financial data will be filed in the financial department.
2. The document stored in the form of electronic copy should be backed up regularly. All the data should be kept at least 2 copies, and one of copy is used for day-to-day inspection.
3. The person in charge of CDM is responsible for the data filing of those year and prepared for the DOE validation.
4. all the data should be saved up to 2 years after the end of the crediting period.

**Verification and Monitoring report**

After the proposed project is registered and begins its operation, the monitoring report should be submitted depend on client requirement for the verification of DOE. The report should cover the monitoring of grid-connected power generation, check report, report on calculation of the emission reductions and records of monitoring instrument repair and calibration, etc.

**B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)**

The application of the baseline study and monitoring methodology of the Project was completed on 15/02/2009 by:
Miss. Haifeng Jiang
Email: jianghf@accordgetc.com.
Tel:+86(0) 10 65085566-8006
Fax: +86(0) 10 65085565
Entity: Accord Global Environment Technology (Beijing) Co., Ltd.
The person/entity is not project participant listed in Annex 1.

**SECTION C. Duration of the project activity / crediting period**

**C.1 Duration of the project activity:**

**C.1.1. Starting date of the project activity:**

03/08/2007(the date of the total contract signed).

**C.1.2. Expected operational lifetime of the project activity:**

20 years .

**C.2 Choice of the crediting period and related information:**

**C.2.1. Renewable crediting period**

**C.2.1.1. Starting date of the first crediting period:**

01/10/2009 (or the date of registration).

**C.2.1.2. Length of the first crediting period:**

7years.

**C.2.2. Fixed crediting period:**

**C.2.2.1. Starting date:**

Not applicable.

**C.2.2.2. Length:**

Not applicable.

## SECTION D. Environmental impacts

### D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

*Environmental Impact Assessment Report* has been developed by Honghe Environment Science Research Institute and has been approved by Lincang City Environment Protection Bureau in 2006 ([2006]13) on 03/11/2006. According to the *Environmental Impact Assessment Report*, the environment impacts possibly caused by the Project and the corresponding measures adopted by the Project owner are analyzed as followings:

***Land use***

The Project is small-scale low-dam water intake, no object was submerged. No house was occupied by the permanent buildings such as dam, diversion construction, workshop and road, therefore, no migrants should be settled. 292.5Mu lands will be occupied permanently and 93.4Mu lands will be temporarily occupied by the Project during the Project construction period. To ensure the lives of residents occupied lands the Project owner provided compensation according to the cumulative value of the occupation land; The temporary occupation land should be returned to the farmers after the finishing of the Project.

***Air pollution***

The main impact on the surrounding atmosphere by the Project is mainly the dust generated in the course of drilling, blasting, using of construction materials such as cement; the dust caused by vehicle transporting; organic hydrocarbons, CO, SO2, NO2 generated by machinery fuel burning. However, due to there is no settlements near the site the construction workers are the only object influenced. And because of the total quantity of air pollutants is small and pollutants generation is intermittent and transient, in the construction site with good ventilation environment and appropriate labor insurance measures were taken by the construction staff the impact of the construction can be reduced. At the same time, the project owner has also taken certain measures to reduce air pollution: taking wet or closed operation method during the construction; strengthening the maintaining of the large-scale machine to decrease the emission of pollution; sprinkling water on the road; operators adopt labour insurance and post shifting system to reduce the impact of the air pollution.

***Noise***

Noise mainly generated by vehicles transportation, construction, excavation and explosion with the character of high level, ruleless and unexpected. The measures which are adopted by the construction units includes: Arrange construction time reasonably to avoid excavating during the rest time; Use equipment with low noise; strengthen the maintenance of equipment; The operators near the facilities are main noise receivers and labour insurances are adopted by the

operators to reduce the noise impacts. There are no residential areas within 1km around the construction site, noise only impact in a certain small area.

***Waste water***

Production wastewater generated at the operation course of foundation excavation, cofferdam construction, concrete mixing and machine maintenance. Production wastewater has a high concentration of suspended solids and higher PH. Domestic sewage is mainly comprised of cleaning sewage water and human excrement. Measures taken by the Project owner are: set up wastewater recycling system in the construction material processing; concrete mixing wastewater should be discharged after treatment; domestic sewage should be first dealt with the settlement pond, then treated by septic tanks which is finally be used as the green water.

***Solid waste***

Solid waste composes of engineering discarded solid generated during the construction and residential garbage. All engineering discharged solid will be used recycled and the residential garbage will be collected and regularly sent to garbage disposal station.

***Ecological impact***

There is no rare animals and vegetation in the Project area. The vegetation of built-up areas is basically a secondary bushes and artificial vegetation and this type of vegetation is widely distributed in the region. Therefore, no great impact on the vegetation can be caused by the Project. Terrestrial animals in the region is mainly ordinary small rodents with broad distribution area and large number in the region. The ecological and environmental changes caused by the reservoir construction is still suitable for the animals' growth and reproduction. Therefore, no great impact on terrestrial animals generated by the Project. The Project is located in the areas with higher human activity and fish resources have been destroyed greatly, which result in a small number of fish populations. Therefore, the influence of construction of the dam on the fish population is not obvious.

The Project owner also take a series of protective measures: shed and material field was built in the open area with no vegetation and never disturbed the local vegetation; safe use of fire to prevent forest fires; and strengthening the awareness of the construction staff on wildlife and ecological environment protection and so forth.

In summary, the Project will not bring significant impacts on the environment.

**D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:**

Environmental impacts of the Project are not considered significantly.

## SECTION E. Stakeholders' comments

### E.1. Brief description how comments by local stakeholders have been invited and compiled:

The stakeholders identified for the Project are the residents near the Project and local government. The investigation was implemented in Feb. 2008, Total 50 questionnaires are distributed and 50 questionnaires are returned, with 100% response rate. The questionnaire includes:

- The stakeholder's attitude to the implementation of the Project;
- The positive effects cause of construction and operation of the Project;
- The negative effects cause of construction and operation of the Project;
- Any suggestion for mitigating the identified negative effects.

### E.2. Summary of the comments received:

Based on the 50 returned questionnaires, the summary of the comments of each power plant shows:

- 100% of the respondents support the Project construction, no respondent is against the Project;
- Possible positive impacts considered by the people surveyed to be caused by the construction of the Project include improvement of living conditions (100%), increases in income (100%), increases in electricity supply (100%), reduction of electricity price (84%), creation of employment opportunities (100%);
- Possible negative impacts as a result of the construction of the Project concerned by the people surveyed include destruction of land occupation (96%), solid waste (90%), decreases in the output of arable land (88%), noises generated (12%) ;
- All of the 50 informant whose land occupied or the Project impact their using water are all obtain satisfied compensation;
- In addition, during the investigation the issues people cared more include:
  Hope that the land compensation can be delivered in full;
  Hope that the local labour force can participate in power station construction, and increase revenue;
  Hope waterway improvement to facilitate transport and water aquaculture to increase revenue;

### E.3. Report on how due account was taken of any comments received:

The Project owner take account the problems provided in the questionnaires as following:

(1) For the issue of land occupation, the Project owner promised to minimize the land occupation as far as possible. Temporary land occupation should be afforested timely to restore the original vegetation after the end of the construction. In addition, the Project provides compensation strictly according to the relevant laws and regulations and all the people whose lands were occupied were satisfied with the compensation;

(2) For the issue of solid waste, the Project owner commit that the solid waste generated during the Project will be used recycled as far as possible. Those can not be used will be transported to 20 disposal sits .

(3) For the issue of decreases in the output of arable land, the Project owner promised to build a new water-inducting channel to guarantee irrigation water using and keep the steady of agriculture output; on the other hand increasing water use efficiency is necessary and encouraged;

(4) For the issue of the noise, the Project owner adopts modern and high-quality equipments for constructing and avoid constructing during rest-time and night-time;

(5) In addition:
The Project owner will help to recommend local labour forces to participate in the construction of the power station;
The Project owner will be in strict accordance with the relevant requirements of EIA to implement environmental protection measures. After the completion the Project can put into operation only after the check and acceptance by the environmental protection departments;

The Project owner will enhance the communication with the residents and local government, and report the development of the construction of the Project regularly and reduce negative impacts brought by the Project and promote local economy development.

In conclusion, the Project obtained support from local residents and government thus modification and adjustment on design, construction and operation of the Project are unnecessary.

## Annex 1

### CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

| | |
|---|---|
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| | |
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**Annex 2**

## INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I Parties for this Project.

## Annex 3

## BASELINE INFORMATION

Data recommended in the *2008 Baseline Emission Factor of Chinese Grid* for Southern China Power Grid are adopted for the Project.
The information provided by the tables includes data, data sources and the underlying calculations.

Table 3.1 Electricity generation of the Southern China Power Grid in 2004

| Province | Electricity generation (MWh) | Auxiliary electricity consumption (%) | Electricity delivered to the grid (MWh) |
|---|---|---|---|
| Guangdong | 169,389,000 | 5.42 | 160,208,116 |
| Guangxi | 20,143,000 | 8.33 | 18,465,088 |
| Guizhou | 49,720,000 | 7.06 | 46,209,768 |
| Yunnan | 24,322,000 | 7.56 | 22,483,257 |
| **Total** | | | 247,366,229 |

*Data source: China Electric Power Yearbook 2005*

Table 3.2 Electricity generation of the Southern China Power Grid in 2005

| Province | Electricity generation (MWh) | Auxiliary electricity consumption (%) | Electricity delivered to the grid (MWh) |
|---|---|---|---|
| Guangdong | 176,453,000 | 5.58 | 166,606,923 |
| Guangxi | 25,023,000 | 7.95 | 23,033,672 |
| Guizhou | 58,430,000 | 7.34 | 54,141,238 |
| Yunnan | 27,281,000 | 6.94 | 25,387,699 |
| Total | | | 269,169,531 |

*Data source: China Electric Power Yearbook 2006*

Table 3.3 Electricity generation of the Southern China Power Grid in 2006

| Province | Electricity generation (MWh) | Auxiliary electricity consumption (%) | Electricity delivered to the grid (MWh) |
|---|---|---|---|
| Guangdong | 188,429,000 | 5.27 | 178,498,792 |
| Guangxi | 27,967,000 | 4.45 | 26,722,469 |
| Guizhou | 76,039,000 | 6.06 | 71,431,037 |
| Yunnan | 39,791,000 | 4.12 | 38,151,611 |
| **Total** | | | 314,803,908 |

*Data source: China Electric Power Yearbook 2007*

Table 3.4 Calculation of simple OM emission factor of the Southern China Power Grid in 2004

| Fuel | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Toal fuel | Default carbon content (tC/TJ) | Oxidation Rate (%) | NCV (MJ/t or $1000m^3$) | Emission ($tCO_2e$) [24] |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | I=G*H*F*E*44/12/$10^2$ |
| coal | $10^4$t | 6,017.7 | 1305 | 2,643.9 | 1,751.28 | **11,717.88** | 25.8 | 100 | 20,908 | 231,767,573.55 |
| Cleaned coal | $10^4$t | 0.21 | | | | **0.21** | 25.8 | 100 | 26,344 | 5233.50 |
| Other washed coal | $10^4$t | | | | | **0** | 25.8 | 100 | 8,363 | 0.00 |
| Coke | $10^4$t | | | | | **0** | 29.2 | 100 | 28,435 | 0.00 |
| Coke oven gas | $10^8m^3$ | | | | | **0** | 12.1 | 100 | 16,726 | 0.00 |
| Other gas | $10^8m^3$ | 2.58 | | | | **2.58** | 12.1 | 100 | 5,227 | 59,831.38 |
| Crude oil | $10^4$t | 16.89 | | | | **16.89** | 20 | 100 | 41,816 | 517,932.98 |
| Gasoline | $10^4$t | | | | | **0** | 18.9 | 100 | 43,070 | 0.00 |
| Diesel oil | $10^4$t | 48.88 | | | 1.83 | **50.71** | 20.2 | 100 | 42,652 | 1,601,975.28 |
| Fuel oil | $10^4$t | 957.71 | | | | **957.71** | 21.1 | 100 | 41,816 | 30,983,494.25 |
| LPG | $10^4$t | | | | | **0** | 17.2 | 100 | 50,179 | 0.00 |
| Refinery gas | $10^4$t | 2.86 | | | | **2.86** | 15.7 | 100 | 46,055 | 75,825.26 |
| Nature gas | $10^8m^3$ | 0.48 | | | | **0.48** | 15.3 | 100 | 38,931 | 104,833.40 |
| Other oil products | $10^4$t | 1.66 | | | | **1.66** | 20 | 100 | 38,369 | 46,707.86 |
| Other coking products | $10^4$t | | | | | **0** | 25.8 | 100 | 28,435 | 0.00 |
| Other energy | $10^4$tCe | 79.42 | | | | **79.42** | 0 | 100 | 0 | 0.00 |
| **Total emission of the China Southern Power Grid ($tCO_2e$) J** | | | | | | 265,163,407.45 | | | | |
| **Fossil power supply of the China Southern Power Grid (MWh) K** | | | | | | 247,366,229 | | | | |
| **Imported electricity from the Central China Grid (MWh) L** | | | | | | 10,951,240 | | | | |
| **Emission factor of Central China Grid ($tCO_2e$/MWh) M** | | | | | | 0.82732 | | | | |
| **Total emission ($tCO_2e$) N=J+L*M** | | | | | | 274,223,576 | | | | |
| **Total electricity delivered to the grid (MWh) O=K+L** | | | | | | 258,317,469 | | | | |

*Data sources: China Energy Statistical Yearbook 2005*

[24] If the unit is $10^4$t，I=G*H*F*E*44/12/$10^2$；if the unit is $10^8m^3$， I=G*H*F*E*44/12/10. The same calculations used in Table 3.5 and Table 3.6.

Table 3.5 Calculation of simple OM emission factor of the Southern China Power Grid in 2005

| Fuel | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Toal fuel | Default carbon content (tC/TJ) | Oxidation Rate (%) | NCV (MJ/t or 1000m$^3$) | Emission ($tCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | I=G*H*F*E*44/12/10$^2$ |
| coal | $10^4$t | 6,696.47 | 1435 | 3,212.31 | 1,975.55 | **13,319.33** | 25.8 | 100 | 20,908 | 263,442,601.85 |
| Cleaned coal | $10^4$t | | | | 0.15 | **0.15** | 25.8 | 100 | 26,344 | 3,738.21 |
| Other washed coal | $10^4$t | | | 10.39 | 33.88 | **44.27** | 25.8 | 100 | 8,363 | 350,237.59 |
| Coke | $10^4$t | 4.79 | | | 8.05 | **12.84** | 29.2 | 100 | 28,435 | 390,906.18 |
| Coke oven gas | $10^8m^3$ | | | | 0.79 | **0.79** | 12.1 | 100 | 16,726 | 58,624.07 |
| Other gas | $10^8m^3$ | 1.87 | | | 15.96 | **17.83** | 12.1 | 100 | 5,227 | 413,485.84 |
| Crude oil | $10^4$t | 10.91 | | | | **10.91** | 20 | 100 | 41,816 | 334,555.88 |
| Gasoline | $10^4$t | 0.68 | | | | **0.68** | 18.9 | 100 | 43,070 | 20,296.31 |
| Diesel oil | $10^4$t | 31.96 | 2.02 | | 1.81 | **35.79** | 20.2 | 100 | 42,652 | 1,130,638.84 |
| Fuel oil | $10^4$t | 887.21 | | | | **887.21** | 21.1 | 100 | 41,816 | 28,702,703.26 |
| LPG | $10^4$t | | | | | **0** | 17.2 | 100 | 50,179 | 0.00 |
| Refinery gas | $10^4$t | 4.92 | | | | **4.92** | 15.7 | 100 | 46,055 | 130,440.66 |
| Nature gas | $10^8m^3$ | 0.93 | | | | **0.93** | 15.3 | 100 | 38,931 | 203,114.71 |
| Other oil products | $10^4$t | 1.7 | | | | **1.7** | 20 | 100 | 38,369 | 47,833.35 |
| Other coking products | $10^4$t | | | | | **0** | 25.8 | 100 | 28,435 | 0.00 |
| Other energy | $10^4$tCe | 104.66 | 133.15 | | 59.72 | **297.53** | 0 | 100 | 0 | 0.00 |
| **Total emission of the China Southern Power Grid ($tCO_2e$) J** | | | | | | 295,229,177 | | | | |
| **Fossil power supply of the China Southern Power Grid (MWh) K** | | | | | | 269,169,531 | | | | |
| **Imported electricity from the Central China Grid (MWh) L** | | | | | | 20,264,000 | | | | |
| **Emission factor of Central China Grid ($tCO_2e$/MWh) M** | | | | | | 0.77216 | | | | |
| **Total emission ($tCO_2e$) N=J+L*M** | | | | | | 310,876,215 | | | | |
| **Total electricity delivered to the grid (MWh) O=K+L** | | | | | | 289,433,531 | | | | |

*Data sources: China Energy Statistical Yearbook 2006*

Table 3.6 Calculation of simple OM emission factor of the Southern China Power Grid in 2006

| Fuel | Unit | Guangdong | Guangxi | Guizhou | Yunnan | Toal fuel | Default carbon content (tC/TJ) | Oxidation Rate (%) | NCV (MJ/t or 1000m$^3$) | Emission ($tCO_2e$) |
|---|---|---|---|---|---|---|---|---|---|---|
| | | A | B | C | D | E=A+B+C+D | F | G | H | I=G*H*F*E*44/12/10$^2$ |
| coal | $10^4$t | 7,303.19 | 1,490.01 | 4,001.54 | 2,735.88 | **15,530.62** | 25.8 | 100 | 20,908 | 307,179,636.00 |
| Cleaned coal | $10^4$t | | | | | **0** | 25.8 | 100 | 26,344 | 0.00 |
| Other washed coal | $10^4$t | | | 19.53 | 45.8 | **65.33** | 25.8 | 100 | 8,363 | 516,851.63 |
| Coke | $10^4$t | 133.75 | | | | **133.75** | 26.6 | 100 | 20,908 | 2,727,466.02 |
| Coke oven gas | $10^8m^3$ | | | | 1.31 | **1.31** | 29.2 | 100 | 28,435 | 39,882.17 |
| Other gas | $10^8m^3$ | | 0.84 | | 2.06 | **2.9** | 12.1 | 100 | 16,726 | 215,202.29 |
| Crude oil | $10^4$t | 0.89 | | | 19.15 | **20.04** | 12.1 | 100 | 5,227 | 464,736.75 |
| Gasoline | $10^4$t | 0.87 | | | | **0.87** | 20 | 100 | 41,816 | 26,678.61 |
| Diesel oil | $10^4$t | | | | | **0** | 18.9 | 100 | 43,070 | 0.00 |
| Fuel oil | $10^4$t | 29.92 | 1.26 | | 3 | **34.18** | 20.2 | 100 | 42,652 | 1,079,777.46 |
| LPG | $10^4$t | 685.85 | 0.09 | | | **685.94** | 21.1 | 100 | 41,816 | 22,191,287.60 |
| Refinery gas | $10^4$t | | | | | **0** | 17.2 | 100 | 50,179 | 0.00 |
| Nature gas | $10^8m^3$ | | | | | **0** | 15.7 | 100 | 46,055 | 0.00 |
| Other oil products | $10^4$t | 7.92 | | | | **7.92** | 15.3 | 100 | 38,931 | 1,729,751.05 |
| Other coking products | $10^4$t | 0.67 | | | | **0.67** | 20 | 100 | 38369 | 18,851.97 |
| Other energy | $10^4$tCe | | | | | **0** | 25.8 | 100 | 28435 | 0.00 |
| **Total emission of the China Southern Power Grid ($tCO_2e$) J** | | | | | | 336,190,122 | | | | |
| **Fossil power supply of the China Southern Power Grid (MWh) K** | | | | | | 314,803,908 | | | | |
| **Imported electricity from the Central China Grid (MWh) L** | | | | | | 21,730,840 | | | | |
| **Emission factor of Central China Grid ($tCO_2e$/MWh) M** | | | | | | 0.77134 | | | | |
| **Total emission ($tCO_2e$) N=J+L*M** | | | | | | **353,951,950** | | | | |
| **Total electricity delivered to the grid (MWh) O=K+L** | | | | | | **336,534,748** | | | | |

*Data sources: China Energy Statistical Yearbook 2007*

$EF_{OM,y}=(N_{2002}+N_{2003}+N_{2004}) / (O_{2002}+O_{2003}+O_{2004}) = 1.0608tCO_2e/MWh$

Table 3.7 Data and result of Step (1)

| Fuel | Unit | Guangdong<br>A | Guangxi<br>B | Guizhou<br>C | Yunnan<br>D | Total fuel<br>E=A+B+C+D | NCV (MJ/t 或 1000m$^3$)<br>F | Default carbon content (tC/TJ)<br>G | Oxidation Rate<br>H | Emission ($tCO_2e$)<br>I=G*H*F*E*44 /12/10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Coal | $10^4$t | 7,303.19 | 1,490.01 | 4,001.54 | 2,735.88 | **15,530.62** | 20,908 | 25.8 | 1 | 307,179,636 |
| Cleaned coal | $10^4$t | | | | | **0** | 26,344 | 25.8 | 1 | 0 |
| Other washed coal | $10^4$t | | | 19.53 | 45.8 | **65.33** | 8,363 | 25.8 | 1 | 516,852 |
| coke | $10^4$t | 133.75 | | | | **133.75** | 20,908 | 26.6 | 1 | 2,727,466 |
| **Total solid fuel** | | | | | | | | | | **310,463,836** |
| Oil | $10^4$t | 0.87 | | | | **0.87** | 41,816 | 20 | 1 | 26,679 |
| Gasoline | $10^4$t | | | | | **0** | 43,070 | 18.9 | 1 | 0 |
| Kerosene | $10^4$t | | | | | **0** | 43,070 | 19.6 | 1 | 0 |
| Diesel oil | $10^4$t | 29.92 | 1.26 | | 3 | **34.18** | 42,652 | 20.2 | 1 | 1,079,777 |
| Fuel oil | $10^4$t | 685.85 | 0.09 | | | **685.94** | 41,816 | 21.1 | 1 | 22,191,288 |
| Other oil products | $10^4$t | 0.67 | | | | **0.67** | 38,369 | 20 | 1 | 18,852 |
| **Total liquid fuel** | | | | | | | | | | **23,316,596** |
| Nature gas | $10^7m^3$ | 0.93 | | | | 0.93 | 38,931 | 15.3 | 1 | 203,114.7063 |
| Coke oven gas | $10^7m^3$ | | | | 0.79 | 0.79 | 16,726 | 12.1 | 1 | 58,624.07247 |
| Other coal gas | $10^7m^3$ | 1.87 | | | 15.96 | 17.83 | 5,227 | 12.1 | 1 | 413,485.8424 |
| LPG | $10^4$t | | | | | 0 | 50,179 | 17.2 | 1 | 0 |
| Finery gas | $10^4$t | 4.92 | | | | 4.92 | 46,055 | 15.7 | 1 | 130,440.6554 |
| **Total gas fuel** | | | | | | | | | | **2,409,690** |
| **Total** | | | | | | | | | | **33,619,0122** |

*Data sources: China Energy Statistical Yearbook 2007*

Table 3.8 Emission factor of best technology

| | Variable | Electricity supply efficiency | Carbon content of fuel* (tC/TJ) | Oxidation rate* | Emission factor ($tCO_2$/MWh) |
|---|---|---|---|---|---|
| | | A | B | C | D=3.6/A/1000*B*C44/12 |
| **Coal-based power plants** | $EF_{Coal,Adv}$ | 37.28% | 25.8 | 1 | 0.9135 |
| **Gas-based power plants** | $EF_{Gas,Adv}$ | 48.81% | 15.3 | 1 | 0.4138 |
| **Oil-based power plants** | $EF_{Oil,Adv}$ | 48.81% | 21.1 | 1 | 0.5706 |

Calculate with formula (7), (8) and (9), the value for $\lambda_{COAL}$ is 92.35%, the value for $\lambda_{OIL}$ is 6.94% and the value for $\lambda_{GAS}$ is 0.71% Therefore :

$EFThermal= \lambda_{COAL} \times EF_{Coal,Adv} + \lambda_{OIL} \times EF_{Oil,Adv} + \lambda_{GAS} \times EF_{Gas,Adv} = 0.8862MWh$。

Table 3.9 Calculation of BM emission factor of the Southern China Power Grid

| | Installed capacity in 2004 (MW) A | Installed capacity in 2005 (MW) B | Installed capacity in 2006 (MW) C | Capacity additions from 2004 to 2006 (MW) D=C-A | Share in total capacity additions |
|---|---|---|---|---|---|
| **Thermal power** | 46,659.7 | 54,507 | 68,963 | 22,303.3 | 76.91% |
| **Hydro power** | 27,580.1 | 30,347.1 | 34,176 | 6,595.9 | 22.75% |
| **Nuclear power** | 3,780 | 3,780 | 3,780 | 0 | 0.00% |
| **Wind power and other** | 83.4 | 83.4 | 183 | 99.6 | 0.34% |
| **Total** | **78,103.2** | **88,717.5** | **107,102** | **28,998.7** | **100.00%** |

$EF_{BM,y}$ = 0.8862×76.91%=0.6816 $tCO_2e$/MWh.

**<u>Annex 4</u>**

**MONITORING INFORMATION**

No other additional information.

**- - - - -**