CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-PDD)
Version 03 - in effect as of: 28 July 2006

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Title: Twolions waste heat recovery from new sulphuric acid line for power generation project.
Version: 01
Date: 03/12/2007

A.2. Description of the project activity:

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The summary of the project activity:

The Twolions waste heat recovery from new sulphuric acid line for power generation project is developed by Twolions (Zhangjiagang) Fine Chemicals Co. Ltd. (hereafter referred to TFC for short) which will recover waste heat from a set of newly installed sulphuric acid production facility to produce electricity which will meet in-house power demand. The rated production capacity of new sulphuric acid facility by TFC is 1.0 million tonnes annually and most of the chemical reaction thermal energy by the industrial facility would be wasted in the cooling water and released to the atmosphere in the absence of the project activity.

Heat Recovery System (HRS) will be installed to recover the waste heat, and the generated steam by the systems will be input into the condensing turbine to generate electricity. The power generation capacity is 50MW, and with 7,500 operation hours per year, 300,128 MWh/y net electricity, calculated based on the total electricity generation and auxiliary electricity consumption as per feasibility study report, will be supplied to the company's internal facilities. The waste heat recovered from the industrial facility will lead to:

- In case there is a surplus of electricity generated by the proposed project activity, this excess amount of power will be sold to the East China Power Grid.
- In case there is a deficit of power at the Twolions Plant, the extra power needed will be purchased from the East China Power Grid.

As a result, the project will displace an equivalent amount of power which will be supplied by the fossil fuel based power plants connected to East China Power Grid in the absence of the proposed CDM project activity, hence, it is expected to reduce the GHG emissions about 260,361 tCO2e annually over the 10 years' credit period by avoiding CO2 emissions from electricity generation in fossil fuel power plants connected into the East China Grid.

The contribution of the sustainable development:

Being an environmentally sound project, the project will not only supply carbon-free electricity by means of utilization of waste heat, but also contribute to sustainable development of the local community, the host country by means of:

- Reducing GHG emissions compared to a business-as-usual scenario;
- Avoiding energy waste and facilitating the technology development of integrated resource utilization in sulphuric acid industry;

- Reducing the emission of other pollutants resulting from the power generation industry in China
- Creating 25 positions for local people by the project activity.

A.3. Project participants:

Table A.1 Project Participants

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity (ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
P.R.China (host)	Twolions(Zhangjiagang) Fine Chemicals Co. Ltd.	No
Spain	Zero Emissions Technologies, S.A.	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party (ies):

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China

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

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Jiangsu Province

A.4.1.3. City/Town/Community etc:

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Zhangjiagang City

A.4.1.4. Detail of physical location, including information allowing the unique identification of this project activity (maximum one page):

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The project site is located in the Jiangsu Yangtze River International Chemical Industry Park, which is 20km distance from the downtown of Zhangjiagang, Suzhou city, Jiangsu Province. The geographical coordinate of the center of project site is: East Longitude 120° 27′ 52″, North Latitude 32° 00′ 10″ (see Figure1 and Figure2)

Figure 1: Location of Jiangsu Province in China

Figure 2: Location of the proposed project in Jiangsu Province

A.4.2. Category(ies) of project activity:

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The project activity falls into Sectoral Category 1: Energy Industries.

A.4.3. Technology to be employed by the project activity:

>>The newly installed sulphuric acid production facility and the Heat Recovery Systems (HRS) are both designed by MECS, USA. The electricity generation units are purchased from domestic markets.

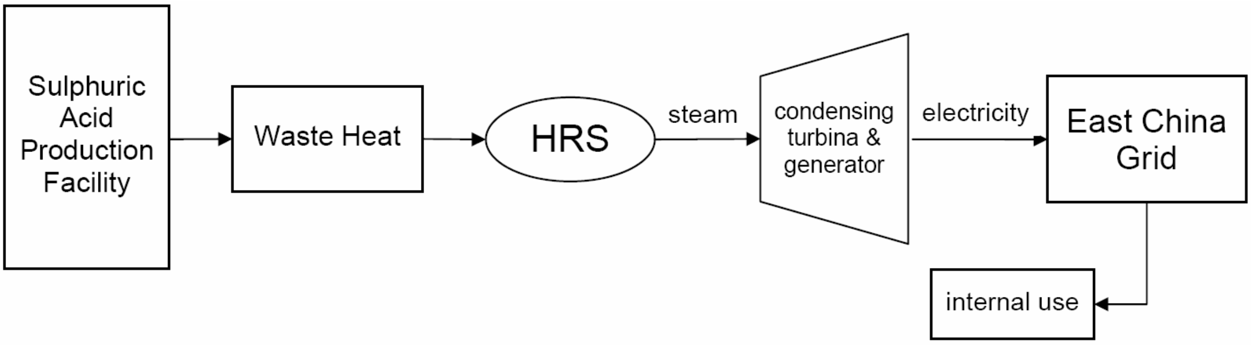

Figure 3: Technique process of the proposed project activity

In the proposed project activity, the HRS boilers and the relevant accessories are purchased from MECS and the other equipments are from domestic market. The adoption of HRS technology, which is patent technology of MECS, will accelerate the technology transfer. The replacement of the intermediary absorption towers of traditional techniques by HRS technology will lead to an enhanced heat recovery and reduced energy waste in the cycle water. The technology is proven to be reliable, as the first unit of HRS was installed in 1987 in Norway. Figure 4 below presents a simplified flow sheet of the HRS technology.

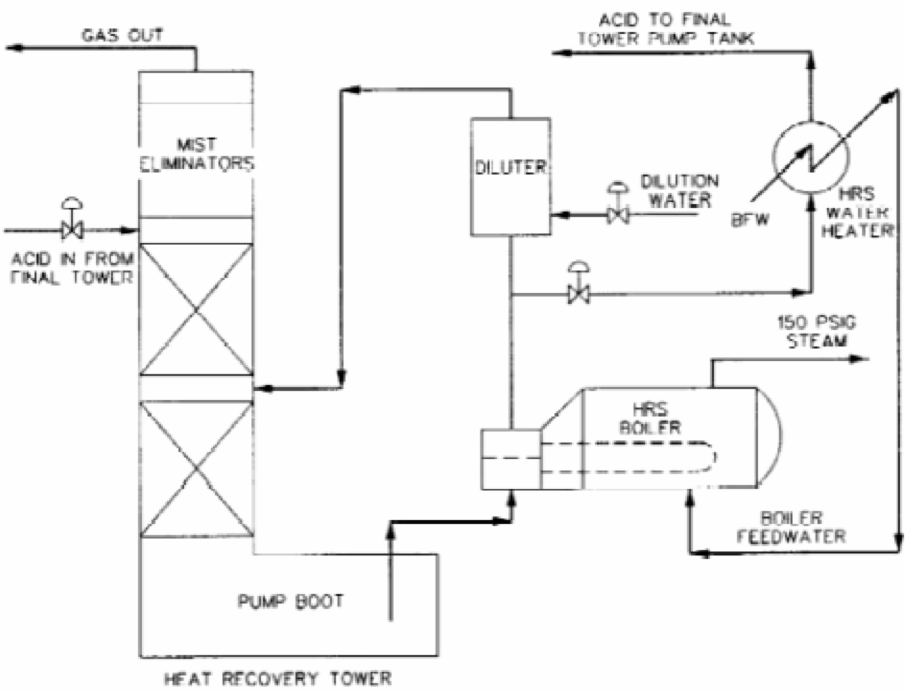

Figure 4 technological flow sheet of HRS technology

The HRS absorption tower is characterised by a high temperature of the gases at the exit, which allows the generation of additional saturated steam, and leads to a greater ratio between the heat recovered and the heat released by the exothermic absorption process. The main equipments of HRS technology can be seen in the table below (Table A.2).

Table A.2. Major Equipments of HRS technology

Device Name	Manufacturer
HRS Boiler	MECS
HRS Acid Circulation Pump	MECS
HRS Acid Diluter	MECS
HRS Heater	MECS
HRS Preheater	MECS
HRS 2nd Stage Cooler	MECS
HRS Tower Mist Eliminators	MECS
Heat Recovery Tower with Pump Boot	MECS
Steam Injection Nozzle	MECS
Steam Injection Vessel	MECS

The main parameters of the turbine and generator are listed in the following table A.3

Table A.3 Main parameters of generator units

Item	Steam turbine	generator
Model	NK63/3.2	50WX18Z-047LLT
Rated power	51500KW	50000KW
Rotation speed	3000r/min	3000r/min
Main steam gate: maximum steam input	165t/h	/
Supplementary: rating steam input	37.34t/h	/
Rated voltage	/	10500V
Power factor	/	0.8
efficiency	/	98.3%
Manufactory	Hangzhou steam turbine Co.Ltd.	Jinan electrical equipment factory

A.4.4 Estimated amount of emission reductions over the chosen crediting period:

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The chosen crediting period for the project activity is 10 years. The starting date of the crediting period for the project is expected to be Sept. 1st, 2008. During the crediting period, estimation of emission reductions of the project would be shown in the table A.4 below.

Table A.4 Estimated amount of emission reductions

Year	**Annual estimation of emission reductions In tonnes of CO_2 e**
2008(Sept. 1st – Dec. 31st)	86,787
2009	260,361
2010	260,361
2011	260,361
2012	260,361
2013	260,361
2014	260,361
2015	260,361
2016	260,361
2017	260,361
2018(Janua. 1st – Aug. 31st)	173,574
Total estimated reductions (tonnes of CO_2e)	2,603,610
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	260,361

A.4.5. Public funding of the project activity:

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There is no public funding from countries included in Annex I of the UNFCCC.

SECTION B. Application of a baseline and monitoring methodology

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

Title: "Consolidated baseline methodology for GHG emission reduction s for waste gas or waste heat or waste based energy system". Reference: Approve Consolidated Baseline and Monitoring Methodology ACM0012, Version 02, sectoral Scope 01 and 04, EB 35.

The additionality of the project has been justified using the approved "Tool for the demonstration and assessment of additionality", Version 04, EB36.

The latest version of the "Tool to calculate the emission factor for an electricity system", version 01, EB35.

It has been referred from the list of approved methodologies for CDM project activities in the UNFCCC CDM website (http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html).

B.2 Justification of the choice of the methodology and why it is applicable to the project activity:

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According to applicability of ACM0012, this methodology applies to project activities that *utilize waste gas and/or waste heat (henceforth referred to as waste gas/heat) as an energy source for:*

> Cogeneration; or

> Generation of electricity; or

> Direct use as process heat source; or

> For generation of heat in element process (e.g. steam, hot water, hot oil, hot air);

The consolidated methodology is also applicable to project activities that use waste pressure to generate electricity.

The proposed project activity recovers and utilizes the waste heat from the sulphuric acid production process to generate electricity. The project activity will generate electricity only, hence the proposed project activity accords with this applicability criteria.

Apart from the key applicability criteria stated above, the project activity is required to meet the following conditions in order to apply the baseline methodology:

"*If project activity is use of waste pressure to generate electricity, electricity generated using waste gas pressure should be measurable*"

The waste gas pressure is not used to generate electricity in this proposed project. so this option is not further considered.

"Energy generated in the project activity may be used within the industrial facility or exported outside the industrial facility"

The energy (electricity) generated in the project activity is exported outside the industrial facility for in-house power demands.

"The electricity generated in the project activity may be exported to the grid"

The electricity generated in the project activity will be exported to the East China Power Grid in case there is surplus electricity.

"Energy in the project activity can be generated by the owner of the industrial facility producing the waste gas/heat or by a third party (e.g.ESCO) within the industrial facility"
The energy in the project activity is generated by the owner of the industrial facility *i.e. the* project proponent itself.

"Regulations do not constrain the industrial facility generating waste gas from using the fossil fuels being used prior to the implementation of the project activity"
There are no such regulations which constrain the industrial facility generating the waste gas from fossil fuels being used before implementation of the project activity in China.

"The methodology covers both new and existing facilities. For existing facilities, the methodology applies to existing capacity. If capacity expansion is planned, the added capacity must be treated as a new facility."
For the case of the project activity under consideration, the industrial facility is newly installed and the methodology is applicable to the new facility. In case there is any addition to the power generation capacity of the facility it will be treated as a completely new project activity.

"The waste gas/pressure utilized in the project activity was flared or released into the atmosphere in the absence of the project activity at existing facility. This shall be proven by either one of the following:

- *> By **direct measurements** of energy content and amount of the waste gas for at least three years prior to the start of the project activity.*
- *> **Energy balance** of relevant sections of the plant to prove that the waste gas/heat was not a source of energy before the implementation of the project activity. For the energy balance the representative process parameters are required. The energy balance must demonstrate that the waste gas/heat was not used and also provide conservative estimations of the energy content and amount of waste gas/heat released.*
- *> **Energy bills** (electricity, fossil fuel) to demonstrate that all the energy required for the process (e.g. based on specific energy consumption specified by the manufacturer) has been procured commercially. Project participants are required to demonstrate through the financial documents (e.g. balance sheets, profit and loss statement) that no energy was generated by waste gas and sold to other facilities and/or the grid. The bills and financial statements should be audited by competent authorities.*
- *> Process **plant manufacturer**'s original specification/information, schemes and diagrams from the construction of the facility could be used as an estimate of quantity and energy content of waste gas/heat produced for rated plant capacity/per unit of product produced.*
- *> On site checks by **DOE** prior to project implementation can check that no equipment for waste gas recovery and use has been installed prior to the implementation of the CDM project activity."*

  In this case, the sulphuric acid production facility which generates the waste heat is newly built. DOE will check it on site at the time of validation.

"The credits are claimed by the generator of energy using waste gas/heat/pressure.
In case the energy is exported to other facilities an agreement is signed by the owner's of the project energy generation plant (henceforth referred to as generator, unless specified otherwise) with the recipient plant(s) that the emission reductions would not be claimed by recipient plant(s) for using a zero-emission energy source."
The energy's recipient plants are belonging to Twolions itself (except the grid), hence, the credits are claimed by the generator of energy using waste heat.

"For those facilities and recipients, included in the project boundary, which prior to implementation of the project activity (current situation) generated energy on-site (sources of energy in the baseline), the credits can be claimed for minimum of the following time periods:
> The remaining lifetime of equipments currently being used; and
> Credit period."

In this project activity, all the equipments are new installation and the lifetime is greater than the credit period of 10 years. Hence the credit period is 10 years.

"Waste gas/pressure that is released under abnormal operation (emergencies shut down) of the plant shall not be accounted for."

Any waste gas/pressure is released under abnormal operation of plant shall not been accounted for.

"Cogeneration of energy is from combined heat and power and not combined cycle mode of electricity generation."

Cogeneration of energy is from combined heat and power. In this case, the proposed project activity generates electricity only.

Based on the above analysis, it can therefore be concluded that the project activity meets all the applicability conditions required by methodology ACM0012.

B.3. Description of the sources and gases included in the project boundary

According to ACM0012, *"The geographical extent project boundary shall include the following:*

1. *The industrial facility where waste gas/heat/pressure is generated (generator of waste energy);*
2. *The facility where process heat in element process/steam/electricity are generated (generator of process heat/steam/electricity). Equipment providing auxiliary heat to the waste heat recovery process shall be included within the project boundary; and*
3. *The facility/s where the process heat in element process/steam/electricity is used (the recipient plant(s)) and/or grid where electricity is exported. If applicable."*

In terms of the proposed project, the waste heat is generated during the process of sulphuric acid production, and the waste heat is recovered by the heat recovery systems, in the form of steam, and then exported to the turbine and generator. The electricity generated by the proposed project activity will be used in Towlions Company and the possible surplus power will be sold to the Grid. Hence, the geographical extent project boundary shall include the sulphuric acid production facility which generates the waste heat, the waste heat recovery systems, the turbine and generator and all the power plants physically connected to East China Power Grid.

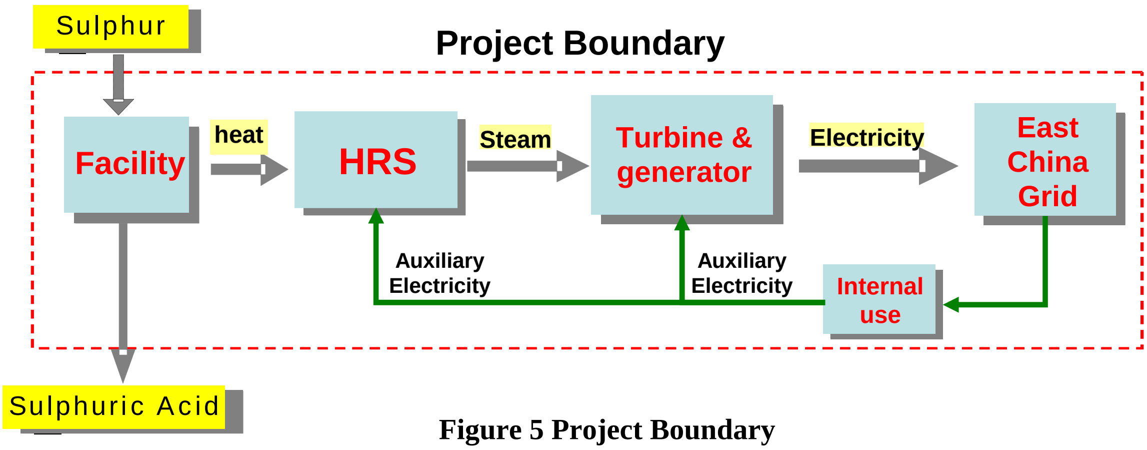

Figure 5 Project Boundary

The following table B.1. illustrates which emission sources are included and which are excluded from the project boundary for determination of both baseline and project emissions.

Table B.1 Emission sources included in the project boundary

Summary of gases and sources included in the project boundary and justification explanation where gases and sources are not included.				
	Source	**Gas**	**Included?**	**Justification / Explanation**
Baseline	Electricity generation, grid or conservative captive source	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Fossil fuel consumption in boiler for thermal energy	CO_2	Excluded	There is no fossil fuel consumption in boiler for thermal energy
		CH_4	Excluded	Not applicable.
		N_2O	Excluded	Not applicable.
	Fossil fuel consumption in conservative cogeneration plant	CO_2	Excluded	There is no fossil fuel consumption in conservative cogeneration plant
		CH_4	Excluded	Not applicable.
		N_2O	Excluded	Not applicable.
	Baseline emissions from generation of steam used in the flaring process, if any	CO_2	Excluded	There is no steam used in the flaring process.
		CH_4	Excluded	Not applicable.
		N_2O	Excluded	Not applicable.
Project Activity	Supplemental fossil fuel consumption at the project plant	CO_2	Excluded	There is no supplemental fossil fuel consumption at the project plant.
		CH_4	Excluded	Not applicable.
		N_2O	Excluded	Not applicable.
	Supplemental electricity consumption.	CO_2	Included	Main emission resource
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Project emissions from cleaning of gas	CO_2	Excluded	Cleaning of gas is not required in the project activity.
		CH_4	Excluded	Not applicable.
		N_2O	Excluded	Not applicable.

B.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:

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According to ACM0012, The baseline scenario is identified as the most plausible baseline scenario among all realistic and credible alternative(s).
Realistic and credible alternatives should be determined for:

- Waste gas/heat/pressure use in the absence of the project activity; and
- Power generation in the absence of the project activity; and
- Steam/heat generation in the absence of the project activity

An assessment of all these alternatives is required to be carried out in order to arrive at the baseline scenario i.e. the most likely scenario in absence of the proposed project activity. The GHG performance of the proposed project activity and its associated emission reductions will be evaluated with respect to the baseline scenario.

The proposed project activity will generate electricity only, so according to the methodology, the baseline should be only generation of electricity.

Step 1: Define the most plausible baseline scenario for the generation of heat and electricity using the following baseline options and combinations.

For the use of waste gas:
W1 Waste gas is directly vented to atmosphere without incineration;
W2 Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere (waste pressure energy is not utilized);
W3 Waste gas/heat is sold as an energy source;
W4 Waste gas/heat/pressure is used for meeting energy demand.

Specific analysis on the four alternative scenarios in absence of the project activity show as follows:

As to W1 "*Waste gas is directly vented to atmosphere without incineration*", the proposed project activity utilizes waste heat from sulphuric acid production process not waste gas, this option is not applicable and should be excluded from baseline scenarios.

As to W2 "*Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere (waste pressure energy is not utilized)*", waste heat from sulphuric acid production process will be cooled in the cooling water and released to the atmosphere without utilization prior to the implementation of the project activity. Hence this option is possible baseline scenario.

As to W3 "*Waste gas/heat is sold as an energy source*", waste heat is a kind of chemical reaction heat and cannot be sold as an energy source without installation of heat recovery systems, in addition, waste heat is a by-product of sulphuric acid production line, if there is no further incentive such as CDM, the project owner would not focus on the waste heat. Hence, W3 shall be excluded.

As to W4 "*Waste gas/heat/pressure is used for meeting energy demand*", since the energy requirement of the industrial facility has been met and there is no other energy demand on site or nearby residential use, the waste heat used for power generation is surplus. Therefore, this option should be excluded from the baseline scenarios.

Based on the above analysis, it is concluded that, for the use of waste heat, W2 "waste heat is released to the atmosphere" is possible baseline scenario.

For power generation:
P1 Proposed project activity not undertaken as a CDM project activity;
P2 On-site or off-site existing/new fossil fuel fired cogeneration plant;
P3 On-site or off-site existing/new renewable energy based cogeneration plant;
P4 On-site or off-site existing/new fossil fuel based existing captive or identified plant;
P5 On-site or off-site existing/new renewable energy based existing captive or identified plant;
P6 Sourced Grid-connected power plants;
P7 Captive Electricity generation from waste gas (if project activity is captive generation with waste gas, this scenario represents captive generation with lower efficiency than the project activity.);
P8 Cogeneration from waste gas (if project activity is cogeneration with waste gas, this scenario represents cogeneration with lower efficiency than the project activity).

Specific analysis about the eight alternatives is as follows:

As to P1 "*Proposed project activity not undertaken as a CDM project activity*", Implementation of the project activity without CDM, significant barriers are expected for this kind of new technology that is presented in details in *Investment Analysis* and *Barrier Analysis* stated in Section B.5. Therefore, the P1 cannot be considered as a credible alternative.

As to P2 "*On-site or off-site existing/new fossil fuel fired cogeneration plant*", the proposed project activity generates electricity only, hence this option is not applicable and should be excluded.

As to P3 "*On-site or off-site existing/new renewable energy based cogeneration plant*", the proposed project activity generates electricity only, hence this option is not applicable and should be excluded.

As to P4 "*On-site or off-site existing/new fossil fuel based existing captive or identified plant*", there is no existing fossil fuel based captive plant or identified plant which can directly provide electricity to TFC. Furthermore, this alternative should be eliminated from the following consideration because it does not comply with the national regulations upon prohibiting small scale coal-fired power plant. To provide the same output as the proposed project activity, the capacity of coal power plant will be less than 50 MW then the project will be categorized as the small scale coal power plant. According to Chinese regulations, coal-fired power plants of less than 135MW are prohibited for construction in the areas covered by the large grids such as provincial grids[1], and the fossil fuel power units with less than 100MW is strictly regulated for installation. Therefore coal-fired power plants of 50MW are strictly forbidden[2]. Thus, this option is excluded.

As to P5 "*On-site or off-site existing/new renewable energy based existing captive or identified plant*", the project site lacks of renewable resources for electricity generation on-site or off-site. There is no on-site or off-site existing renewable energy based existing captive or identified plant. And it is impossible to establish captive power plants based on renewable energy in the local area. Therefore this option cannot

[1] http://www.gov.cn/gongbao/content/2002/content_61480.htm
[2] http://www.china5e.com/laws/index2.htm?id=200407120032

be considered as baseline scenario.

As to P6 "*Sourced Grid-connected power plants*", as common practice, TFC purchases electricity from the East China Power Grid for meeting energy demands of industrial production. And in this case, the proposed project activity provides power mainly for in-house demand, so this option is possible baseline scenario.

As to P7 "*Captive Electricity generation from waste gas (if project activity is captive generation with waste gas, this scenario represents captive generation with lower efficiency than the project activity.)*", this option is not viable because of lower efficiency, as the same investment with lower output would be much more economically unattractive since the proposed project activity is not economically attractive as stated in the following section B.5. Furthermore, the operating cost for running an inefficient system would have faced investment related barriers to implement this option, hence it should be excluded.

As to P8 "*Cogeneration from waste gas (if project activity is cogeneration with waste gas, this scenario represents cogeneration with lower efficiency than the project activity)*", since the proposed project activity is not cogeneration of energy, this option is not applicable and should be excluded

To sum up, the most plausible scenarios matrix obtained from the combinations of the alternatives are presented in the following table B.2.

Table B.2: Possible combinations of baseline scenarios matrix

scenario	Baseline options		description
	Power generation	Waste heat use	
1.	P6	W2	Waste heat is released to the atmosphere and the electricity is obtained from the East China Power Grid.

Step 2: Identify the fuel for the baseline choice of energy source taking into account the national and/or sectoral policies as applicable.

In this case, the identified baseline scenario is "sourced from the grid-connected power plants", and thus step 2 is not applicable.

Step 3: Step 2 and/or step 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" (Version 04, EB36) shall be used to identify the most plausible baseline scenarios by eliminating non-feasible options (e.g. alternatives where barriers are prohibitive or which are clearly economically unattractive).

The determination of the most likely scenarios (baseline scenario) from the alternatives identified as in step 1 is made in section B.5., Please refer to that section.

Step 4: If more than one credible and plausible alternative scenario remain, the alternative with the lowest baseline emissions shall be considered as the most likely baseline scenario.

Since there is one credible and plausible scenario remains, this step is not applicable.

Based on the above analysis, the baseline scenario matrix of the proposed project activity is:

Table B.3. Combination of baseline scenarios

scenario	Baseline options		description
	Power generation	Waste heat use	
1.	P6	W2	Waste heat is released to the atmosphere and the electricity is obtained from the East China Power Grid.

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 CDM project activity (assessment and demonstration of additionality):

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According to ACM0012, the "Tool for the demonstration and assessment of additionality (version 04)" is applied to demonstrate the additionality of the project activity versus the baseline scenario. The processes are as follows:

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

Sub-step1a.Define alternatives to the project activity:

Alternatives to the use of waste gas:

W1 Waste gas is directly vented to atmosphere without incineration;
W2 Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere (waste pressure energy is not utilized);
W3 Waste gas/heat is sold as an energy source;
W4 Waste gas/heat/pressure is used for meeting energy demand.

Alternatives to power generation:

P1 Proposed project activity not undertaken as a CDM project activity;
P2 On-site or off-site existing/new fossil fuel fired cogeneration plant;
P3 On-site or off-site existing/new renewable energy based cogeneration plant;
P4 On-site or off-site existing/new fossil fuel based existing captive or identified plant;
P5 On-site or off-site existing/new renewable energy based existing captive or identified plant;
P6 Sourced Grid-connected power plants;
P7 Captive Electricity generation from waste gas (if project activity is captive generation with waste gas, this scenario represents captive generation with lower efficiency than the project activity.);
P8 Cogeneration from waste gas (if project activity is cogeneration with waste gas, this scenario represents cogeneration with lower efficiency than the project activity).

As stated in B.4.,
For the use of waste gas, since the proposed project activity recovers and utilizes the waste heat from the

sulphuric acid production process and there is no other energy demand, alternative option W1, W3, W4 are excluded and W2 is considered to be the most likely alternative to the use of waste heat.

For the alternatives to power generation, alternative options P2, P3, P8 are excluded because the proposed project activity generates electricity only, not cogeneration of energy.P7 is excluded due to lower efficiency is not viable. Option P5 is not considered to be the possible alternative as the project site lacks of wind resource, hydro or other renewable resources. Therefore, options P1, P4, P6 remain.

Sub-step1b.Enforcement of applicable laws and regulations:

Section B.4 has demonstrated that alternative option P4 does not conform to the relevant regulations which specifies the construction of 50 MW fossil fuels based captive power plant is prohibited. So alternative option P4 should be excluded.

Based on the above analysis, alternative options W2+P1 and W2+P6 are remaining and they all comply with Chinese legal and regulatory requirement. Alternative option W2+P1 is not the only alternative of the project activity and the following steps will show that the proposed project in the absence of CDM is not economically feasible (step 2) and also faces some barriers (step 3).

Step 2: investment analysis

The purpose of investment analysis is to determine whether the proposed project activity is financially less attractive than other alternatives without the revenue from the sales of CERs. The investment analysis was done in the following steps:

Sub-step2a: Determine appropriate analysis method:

The "Tool for the Demonstration and Assessment of Additionality" recommends three investment analysis methods including simple cost analysis (option 1), investment comparison analysis (option 2) And benchmark analysis (option 3).

The project activity generates financial and economic benefits through the sales of electricity as well as the revenues from the CDM and therefore option 1 "simple cost analysis" is not appropriate. Option 2 "investment comparison analysis" is applicable when other alternative options are available, in this case, the alternative (b) of the project activity "Sourced the grid-connected plants" is not of an investment project, so it is not appropriate.

Since option 1,2 are not appropriate, the project will use the option 3 benchmark analysis.

Sub-step2b: Option 3-Apply benchmark analysis:

TFC is a fine chemicals company belonging to fine chemicals industry. Considering that all the waste heat is recovered from sulfuric acid production process, power generation absolutely relies on the production lines. No one would be interested in the project which has that high risks from the operation process and marketing of chemical productions. The situation above lead to that there is only one potential project developer, in this case, TFC itself. Therefore, the project will undertake a benchmark analysis, identifying the equity internal rate of return (equity IRR) as the indicator to judge whether the proposed project is financially attractive.

With reference to "The economic analysis method and parameters for project construction (version 03)"[3], the equity IRR (after tax) for an investment project in the fine chemicals industry is 15%

The equity IRR of the proposed project is calculated and compared as follows.

Sub-step2c: Calculation and comparison of financial indicators:

Table B.4. Main parameters for calculation of financial indicators

Items	Unit	Value	Reference
Capacity	MW	50	Feasibility study report
Capital in cash	10000 Yuan	9659.01	Feasibility study report
Annual running costs (commissioned)	10000 Yuan	3320.22	Feasibility study report
Net power supply	MWh/year	300128	Feasibility study report
Electricity Tariff(including VAT)	Yuan/kWh	0.35	Feasibility study report
Value Added Tax (VAT)	%	6%	Feasibility study report
Income tax	%	25%	Feasibility study report
Lifetime of project	Year	15	Feasibility study report

The financial indicators (equity IRR) with and without income from CERs are listed in the following table. Without CERs revenue, the IRR of the proposed project is lower than the benchmark IRR and the proposed project is financially unacceptable because of its low profitability. While considering CERs revenue, the financial acceptance will be changed, the IRR of the proposed project is higher than the benchmark and then the proposed project is financially acceptable.

Table B. 5.Comparison of equity IRR with and without income from CERs

Items	**Unit**	**Without income from CERs**	**Benchmark**	**With income from CERs**
Equity IRR	%	11.18	15%	21.63%

Sub-step 2d. Sensitivity analysis.

The objective of this sub step is to show the conclusion regarding the financial attractiveness is robust to reasonable variations of the critical assumptions.

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[3] Issued by the National Development and Reform Commission and the Ministry of Construction, published by China Planning Publishing House.

Three factors are considered in following sensitivity analysis:

1) total investment
2) electricity price
3) running costs

We assumed that the above three factors are varied in the range of ±10% in the critical assumptions, the IRR of the proposed project (without income from selling CERs) would be varied to different extent, as shown in Table B.6 and figure 6 below.

Table B.6. Results of the sensitivity analysis-impact of variations in critical assumptions on IRR

Critical assumption	-10%	0%	+10%
Total Investment	12.15%	11.18%	10.30%
Electricity price	7.32%	11.18%	14.90%
Running costs	12.69%	11.18%	9.65%

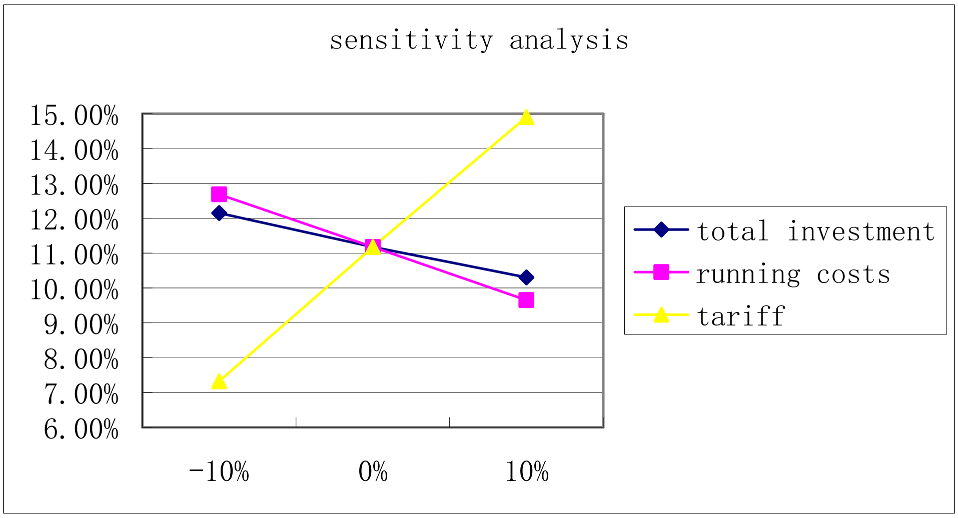

Figure 6. Sensitivity analysis graph

According to table B.6:

As shown in the sensitivity analysis, when the sensitive factors are varied in the reasonable range of ±10%, the equity IRR of the project remains lower than the benchmark. Therefore, the project remains economically and financially unattractive to the project owner.

Besides the financial barriers, the proposed project activity would meet many barriers in the implementation process. The detailed analysis is in Step 3. Barrier analysis

Step 3. Barrier analysis.

The objective of this step is to identify barriers that prevent the implementation of this type of proposed project activity but do not prevent the implementation of at least one of the alternatives identified in Step1.

Sub-step 3a Identify barriers that would prevent the implementation of type of the proposed project activity.

Technical Barriers:

There are more strict demands of the sulphuric acid production procedures than usual operation owing to the applied HRS technology as the following table B.7.:

Table B.7 Parameter and Requests Comparison

The third phase of Sulphuric Acid Production	Parameter and Demands	Routine Project Without HRS	Project activity With HRS
SO_3 gas combines with water in HRS Tower	The range of sulfuric acid concentration	Wider (About98%, Easy to control	Narrow (99.0%-99.7%)[4], Hard to control
	Temperature Demand	Lower temperature（90℃-100℃）, Weak causticity;	Higher temperature（225℃[5]）, Strong causticity[6];
	Demands for the staff	Familiar with operation and maintenance of Routine equipments from domestic.	Familiar with the new technology, rich experience at the production process, ability to identifying, analysis and disposal of the malfunction.

As showed in Table B.7 above, the technical parameter of SO_3 absorbing must be controlled between 99.0%-99.7%, which is narrower than routine project operation, and the temperature must be controlled above 200 ℃, comparing to 90℃-100℃ of routine demand. It is hard to manipulate in practice. Furthermore, if the technical parameter is not controlled in this range, the HRS will be damaged in few minutes, since the sulphuric acid comes out strong causticity with low concentration and in high temperature. Some industry experts point out that *the HRS requests the very narrow range at which the concentration sulfuric acid was controlled, any warp shall bring on the equipment totally destroyed.*[7] In addition, tremendous loss would be broken out resulted from stopping Sulfuric acid production in order to eliminate HRS trouble.

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[4] Monsanto Operation Manual---Section10 Acid Heat Recovery System
[5] Monsanto Operation Manual---Section10 Acid Heat Recovery System
[6] Monsanto Operation Manual---Section10 Acid Heat Recovery System
[7] ‘Waste Heat recovery and utilization from sulphuric acid production’ Mr. Yu Xiangdong Nanjing Chemical Design Institute ’Sulphuric Acid’ Volume 3 2000

Although HRS equipment is made of the '310 stainless steel', which is more adapt to the strong causticity materials, it also contains high risk on operation. Table C1 shown in annex 5 below is supplied by MECS, and 11 times incidents occurred on 8 units HRS in the last 8 years all over the world during its operation. While there are only about 30 units HRS in the world ever since from 1987, the frequency of incident is high.

Thus it can be seen that applying to new technology should implement higher and stricter criteria, and going with high risk. It is also need to bear high operation and maintenance fee for investors. It is hard to attract investors in sulfuric acid field.
Referring to table B.7 above, new technical criteria brings on the demand of experienced engineers. More accurate management and lots of extra work should be done during the running period. Although experts from MECS have made some basic training for TFC' engineers, they have just known the basic operational principle because the technology is patent of MECS. TFC still lacks of experienced engineers, who are familiar with operating the advanced equipments, and could identify incidents risk, deal with the emergency situation. So the extra expense enhances the financial burden in the same time. Therefore, if there is no CDM revenue, the enterprise could not conquer these technical barriers.

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity):

The baseline scenario is that TFC doesn't recover the waste heat, and the electricity provided by the project activity will be supplied by East China Power Grid. There is no need for extra investment and new technology application, so the barriers which mentioned above could not influence the identified baseline scenario.

Step 4. Common Practice Analysis

Sub-step 4a. Analyse other activities similar to the proposed project

In China, most of sulphuric acid product lines are installed in fertilizers company, where the production of phosphates needs plenty of heat consumption. Some companies use traditional techniques to recover heat from sulphuric acid lines, in the form of steam, for meeting energy demands of industrial facilities, and the surplus heat is released to the atmosphere in the cooling water.

In the proposed project activity, the steam for power generation is surplus and there are no other uses in TFC. On the other hand, as stated in the section A.4.3 and the above Barrier analysis, HRS has essential distinctions from traditional techniques and as it stands now, HRS still face high risks at the time of its investment as well as understanding for technological requirements. So the similar to the proposed project activity is identified as the activity with HRS technology.

Till the time of preparation for the PDD, there are two similar project activities in operation adopting HRS technology in China: one is TFC and the other is Hubei Yihua Group. TFC installed HRS systems from MECS upon its first 1.0 million tonnes sulphuric acid production facility (hereinafter "TFC I HRS Project") in 2005, and Hubei Yihua Group installed MECS HRS to recover waste heat from sulfuric acid facility for cogeneration in 2006. Besides them, Sinochem Chongqing Fuling Chemicals Company is negotiating with MECS upon import of HRS technology and the project has not started yet. All the three project activities have applied for CDM registration.

Sub-step 4b. Discuss any similar options that are occurring

As stated in Sub-step 4a, there is no similar project activity as the proposed project activity in China. No further discussion in this sub-step is necessary.

Based on the above analysis and demonstration, the proposed project is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>
The baseline emissions for the year *y* shall be determined as per the methodology ACM0012/Version 02.

Baseline Emissions

$$BE_y = BE_{En,y} + BE_{flst,y}$$

Where:

BE_y	Total baseline emissions during the year *y* in tons of CO_2
$BE_{En,y}$	Baseline emissions from energy generated by project activity during the year *y* in tons of CO_2
$BE_{flst,y}$	Baseline emissions from generation of steam, if any, using fossil fuel, that would have been used for flaring the waste gas in absence of the project activity (tCO_2e per year), calculated as per equation (1c). This is relevant for those project activities where in the baseline steam is used to flare the waste gas.

The proposed project will not use the steam for flaring the waste gas, hence $BE_{flst,y}$ is zero.

Therefore, $BE_y = BE_{En,y}$

According to the methodology, baseline emissions have two scenarios. In this case, the electricity is obtained from the grid in the baseline scenario, so baseline emissions for scenario 1 is applicable.

Baseline emissions for Scenario 1

Scenario 1 represents the situation where the electricity is obtained from a specific existing power plant or from the grid and heat from a fossil fuel based element process (e.g. steam boiler, hot water generator, hot air generator, hot oil generator).

NOTE: If the project activity is either *generation of electricity only* or *generation of heat only*, then one of the two sub-sections below shall be used for estimating baseline, depending on the type of energy generated by the project activity. Further, in case project activity is use of waste pressure to generate electricity then only section a) below is used.

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y}$$

Where:

$BE_{Elec,y}$	Are baseline emissions from electricity during the year *y* in tons of CO_2

$BE_{Ther,y}$	Are baseline emissions from thermal energy (due to heat generation by element process) during the year *y* in tons of CO_2

a) Baseline emissions from electricity ($BE_{Elec,y}$) that is displaced by the project activity:

$$BE_{Elec,y} = f_{cap} * f_{wg} * \sum_{j}\sum_{i}((EG_{i,j,y} * EF_{Elec,i,j,y}))$$

Where:

$BE_{Elec,y}$	Are baseline emissions due to displacement of electricity during the year y in tons of CO_2.
$EG_{i,j,y}$	Is the quantity of electricity supplied to the recipient *j* by generator, which in the absence of the project activity would have been sourced from *i*th source (*i* can be either grid or identified source) during the year *y* in MWh,
$EF_{Elec,i,j,y}$	Is the CO_2 emission factor for the electricity source i (i=gr (grid) or i=is (identified source)), displaced due to the project activity, during the year *y* in tons CO_2/MWh
f_{wg}	Fraction of total electricity generated by the project activity using waste gas. This fraction is 1 if the electricity generation is purely from use of waste gas. If the boiler providing steam for electricity generation uses both waste and fossil fuels, this factor is estimated using equation (1d). If the steam used for generation of the electricity is produced in dedicated boilers but supplied through common header, this factor is estimated using equation (1d/1e). NOTE: For project activity using waste pressure to generate electricity, electricity generated from waste pressure use should be measurable and this fraction is 1.
f_{cap}	Energy that would have been produced in project year y using waste gas/heat generated in base year expressed as a fraction of total energy produced using waste gas in year y. The ratio is 1 if the waste gas/heat/pressure generated in project year y is same or less then that generated in base year. The value is estimated using equation (1f), or (1f) and (1f-1).

Since the proposed project activity generates electricity only, the heat baseline emissions are excluded, namely, $BE_{ther,y}$ is zero. Hence

$$BE_{En,y} = BE_{Elec,y}$$

Baseline emissions from electricity that is displaced by the project activity is calculated as follows:

The methodology points out that if the displaced electricity for recipient is supplied by a connected grid system, the CO_2 emission factor of the electricity $EF_{elec,gr,i,y}$ shall be determined following the guidance provided in the “Tool to calculate the emission factor for an electricity system”, version 1, EB 35.

As stated in the section B.4, the most reliable baseline alternative is “Sourced from the grid-connected plants”, the emission factor of the substituted electricity should be calculated according to “Tool to calculate the emission factor for an electricity system”.

In accordance with the calculating steps and formulas provided in “Tool to calculate the emission factor for an electricity system”, the emission reductions of the project activity are calculated as follows:

Calculation of EF $_{elec,i,j,y}$ (abbreviated as EFy)

According to "Tool to calculate the emission factor for an electricity system", the baseline emission factor (EF_y) is calculated as a combined margin (CM) of $EF_{OM,y}$ and $EF_{BM,y}$, based on the following six steps:

Step 1: Identify the relevant electric power system

According to the announcement of Grid Boundary by DNA of China, *East China Power Grid covers five provinces (Shanghai, Jiangshu, Zhejiang, Anhui and Fujian)*[8], the project activity is located in Jiangsu Province and it is appropriate to select the East China Power Grid as project system boundary.

Step 2: Select an operating margin (OM) method

Calculation of OM emission factor should be based on one of the following four methods:

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

Each method is analyzed as below:

Method (c): Dispatch data analysis OM

If the dispatch data is available, method (c) should be the first choice. This method requires the dispatch order of each power plant and the dispatched electricity generation of all the power plants in the power grid during every operation hour period. Since the dispatch data, power plants operation data are considered as confidential materials and only for internal usage not available publicly. Thus, method (c) is not applicable for the proposed project activity.

Method (b): Simple adjusted OM

The application of simple adjusted OM method requires the annual load duration curve of the power grid and the load data of every hour data during the whole year on the basis of the time order. As mentioned above, the dispatch data and detailed load curve data were not available publicly.
Therefore, method (b) is not applicable for the proposed project as well.

Method (d): Average OM

Method (d) will only be used when (1) low-cost/must run resources constitute more than 50% of total grid generation and detailed data to apply method (b) is not available, and (2) where detailed data to apply option (c) above is unavailable. From 2001 to 2005, the low-cost/ must run resources constitute less than 50% of total amount grid generation output. (See Table B.9). Hence method (d) is not applicable for the project activity.

Method (a): Simple OM

The simple OM method can only be used where 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 normal for

[8] http://cdm.ccchina.gov.cn/web/index.asp

hydroelectricity production. Low operating cost and must run resources typically include hydro, geothermal, wind, low-cost biomass, nuclear and solar generation. If coal is obviously used as must-run, it should also be included in this list, i.e. excluded from the set of plants. From 2001 to 2005, the low cost must run resources constitute less than 50% of total amount grid generation output. (See Table B.9). Therefore, method (a) is applicable for the project.

Table B.9. 2001-2005 East China Power Grid Electricity Generation[9]

Year	Installed capacity (MW)					Electricity generation(GWh)				
	Total	Hydro	Thermal	Others	% low cost/ must run	Total	Hydro	Thermal	Others	% low cost/ must run
2001	71939.1	12555	59021	363.1	17.96%	327014	34999	289436	2579	11.49%
2002	76025.5	13165.1	61120.2	1740.2	19.6%	367814	37835	324204	5775	11.86%
2003	81096.7	13602.5	65036.5	2457.7	19.8%	429127	31982	382112	15033	10.96%
2004	96970.5	14417.8	79424.1	3128.6	18.09%	487986	25556	440292	22138	9.77%
2005	123613.3	16069.4	104076.6	3467.3	15.8%	5723.33	442.37	5056.63	224.33	11.65%

Source: China Electric Power Yearbook (editions 2002, 2003, 2004, 2005 and 2006)

In conclusion, method (a) is the only reasonable and feasible method among the four methods for calculating the Operating Margin emission factor ($EF_{OM,y}$) of the East China Power Grid.

Step 3: Calculate the operating margin emission factor according to the selected method

According to the "Tool to calculate the emission factor for an electricity system", the Simple OM emission factor ($EF_{OM, simple, y}$) is calculated as the generation-weighted average CO_2 emissions per unit net electricity generation (tCO2/MWh) of all generating power plants serving the system, not including low-operating cost and must-run power plants/units, It may be calculated:

- Option A: Based on data on fuel consumption and net electricity generation of each power plant/unit, or
- Option B: Based on data on net electricity generation, the average efficiency of each power unit and the fuel type used in each power unit, or
- Option C: 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 A should be preferred and must be used if fuel consumption data is available for each power plant/unit. In other cases, option B or option C can be used. For the purpose of calculating the simple OM, Option C should only be used if the necessary data for option A and option B is not available and can only be used if only nuclear and renewable power generation are considered as low-cost/must-run power sources and if the quantity of electricity supplied to the grid by these sources is known. So in the proposed project activity, Option C is used and the simple OM emission factor is calculated based on the net electricity supplied to the grid by all power plants serving the system, not including low-cost/must-run

[9]Numbers are calculated on the basis of data for Shanghai,Jiangsu,Zhejiang, Anhui and Fujian. Low cost / must run resources in Table B.9 are composed of "Hydro" and "Others". The category "Others" is mainly composed of wind power and is therefore included as part of low cost / must run.

power plants/units, and based on the fuel types and total fuel consumption of the project electricity system, as follows:

$$EF_{OM,simple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y}$$

Where:

$FC_{i,y}$	is the amount of fossil fuel type i consumed in the project electricity system in year y (mass or volume unit)
$NCV_{i,y}$	is net calorific value (energy content) of fossil fuel type I in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$	is the CO2 emission factor of fossil fuel type i in year y (tCO2/GJ)
EG_y	is the 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	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. As for the proposed project, data of the three most recent years is available and then will be used.

For this approach (simple OM) to calculate the operating margin, the subscript m refers to the power plants/units delivering electricity to the grid, not including low-cost/must-run power plants/units, and including electricity imports to the grid. Electricity imports should be treated as one power plant m.

In the project activity, the data of net calorific values of the fuels is from the China Energy Statistical Yearbook and the data of emission factors of the fuels are from IPCC 2006 default.

The simple OM emission factor of the proposed project is calculated based on the electricity generation mix of the East China Power Grid, excluding low operating cost/must run power plant, such as wind power, hydropower etc. The data on installed capacity and electricity output of different power generation technology options are from the *China Electric Power Yearbook* (2002~2006, published annually). The data on different fuel consumptions for power generation in the East China Grid are from the Energy Balance Table of Shanghai, Jiangsu, Zhejiang, Anhui and Fujian in year 2001- 2005 from the China Energy Statistical Yearbook (2000-2006 Edition). Therefore, the Simple OM Emission Factor of proposed project is an ex-ante emission factor, based on 3-year average of the most recent statistics available at the time that the PDD was developed.

The adding part of electricity power into the East China Power Grid comes from the Central China Power Grid and the quantity of electricity exported to the East China Grid is keeping increasing in the recent three years, hence this part of electricity has been taken into account. While calculating, average emission factor of the Central China Power Grid is regarded as emission factor of this part of electricity input.

Based on these data, (see annex 3) the Simple OM Emission Factor ($EF_{OM,simple,y}$) is:

$$EF_{OM} = 0.9422 \text{ tCO}_2\text{/MWh}$$

Step4: Identify the cohort of power units to be included in the build margin

The sample group m consists of 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 (in MWh) and that have been built most recently, and if 20% falls on part capacity of a plant, that plant is fully included in the calculation. The latter method will be used in the proposed project.

"Tool to calculate the emission factor for an electricity system" allows project participants to choose between two given options for calculating the Build Margin for the project, one is ex-ante calculation, and the other is annual ex-post updating in the first crediting period. For this project the first option is chosen. The Build Margin Emission Factor therefore is based ex-ante on the most recent information available on plants already built at the time of PDD submission.

Step5: Calculation the Build Margin emission factor ($EF_{BM,y}$ ***)***

According to "Tool to calculate the emission factor for an electricity system", $EF_{BM,y}$ is determined by the formula as follow:

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

Where:

$EF_{BM,y}$	is Build margin CO2 emission factor in year y (tCO2/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 CO2 emission factor of power unit m in year y (tCO2/MWh)
m	is Power units included in the build margin
y	is Most recent historical year for which power generation data is available

As plant specific fuel consumption and electricity generation data is not publicly available in China, EB guidance[10] is used to calculate EF_{BM} . While the request for deviation was submitted relating to AM0005, the guidance has also widely been used for "Tool to calculate the emission factor for an electricity system"as this replaces reference to ACM0002 which directly replaces AM0005 and all OM and BM calculations in these two methodologies are the same:

- Use capacity additions for estimating the build margin emission factor for grid electricity.
- Use weighting estimated using installed capacity in place of annual electricity generation.

[10] The EB guidance was given in a response letter entitled "Several projects in China (application of approved methodology AM0005), see http://cdm.unfccc.int/UserManagement/FileStorage/AM_CLAR_QEJWJEF3CFBP1OZAK6V5YXPQKK7WYJ. The guidance can be used for "Tool to calculate the emission factor for an electricity system" (EB 35)

- Use the efficiency level of the best technology commercially available in the provincial/regional or national grid, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin (BM).

The calculation of the Build Margin for the proposed project makes use of aggregated data to identify the 20% most recent capacity additions (sample group). This is identified by direct comparison of the total installed capacity on East China Power Grid in the most recent year for which data is available, in this case 2005, with historical data from preceding years until the 20% addition is reached. BM is determined by selecting the year since which the new capacity additions are equal to or greater than 20%.

The percentage is calculated as follows:

$$\left[(C_{2005} - C_n)/C_{2005}\right]*100\%$$

Where:

C_{2005}	is the capacity in 2005 (most recent year for which published data are available)
C_n	is the capacity in the preceding year n

Statistical data available in China shows installed capacities of thermal, hydro and other plant. No subdivision of capacity by fuel type, such as coal, oil and gas, is available. However, coal-fired plants dominate East China Power Grid with other fuels mostly used for start-ups only. The BM, therefore, is calculated from the capacity of thermal power plant and the CO2 emission factor of the best commercially available coal-fired thermal power plant ($EF_{Thermal}$) in China.

To be conservative, this CO_2 emissions factor is discounted further for the share of emissions from other fuels, i.e. discounted by 3.29% compared to the best available technology for coal-fired plant.

$$EF_{BM} = \left[C_{Thermal}/(C_{2005} - C_n)\right]* EF_{Thermal}$$

Where:

$C_{Thermal}$	is the thermal power plant capacity amongst the sample group with the capacity $(C_{2005} - C_n)$
$EF_{Thermal}$	is the CO_2 emissions factors of the thermal power plant with the best available technology, discounted for the share of non-coal fuels among thermal plant.

In conclusion, the procedure to be used for calculating the build margin using the most recent additional capacity follows steps below:

- Using the latest statistical data available (from the China Electric Power Yearbook 2006) determine the year from which the added generation capacity is equal to or just exceeds 20% of the capacity of the latest statistic year 2005. The year selected is 2004, since which about 21.55% capacity has been added
- Of the added capacity since 2004 92.53% is thermal capacity.
- The best commercially available thermal power plant is taken from the National Study on China Climate Change, stating that the expected best efficiency of thermal plant in 2010 will be 320 gram of standard coal consumption per kWh electricity generation.
- The best available technology emissions factor is calculated from this efficiency and the NCV of standard coal. Emission factor of the best available technology is calculated as 0.886 tCO2e/MWh.

The emission factor is calculated as follows:

$$EF_{bat} = 320 * NCV * EF_{CO2} * OXID$$

Where:

NCV	is the net calorific value (energy content) per mass or volume unit of standard coal, (TJ/ mass or volume unit)
OXID	is the oxidation factor of standard coal (see 2006 IPCC Guidelines for default values)
EF_{CO2}	is the CO_2 emission factor per unit of energy of standard coal (tCO2e/TJ).

This value is discounted for the coal share in total thermal plant emissions of 96.71%(see Table A8 in Annex 3), i.e. assuming oil and gas emissions are zero.

The resulting emissions factor is 0.8569 tCO_2e/MWh.

The Build Margin emissions factor is now calculated as the percentage of thermal plant additions and thermal plant emissions factor.

Based on the formula above, the BM emission factor of East China Power Grid for the proposed project in the crediting period is calculated as:

$$EF_{BM} = 0.7929 \text{ tCO2/MWh.}$$

The details of EF_{BM} calculation are given in Annex 3.

Step 6. Calculate the combined margin emission factor EF_y

Based on "Tool to calculate the emission factor for an electricity system", the baseline emission factor EF_y should be calculated as the weighted average of the Operating Margin emission factor (EF_{OM}) and the Build Margin emission factor (EF_{BM}), where the weights W_{OM} and W_{BM} , are 50%(i.e. $W_{OM} = W_{BM}$ = 0.5) by default, and (EF_{OM}) and (EF_{BM}) are calculated as described in Step 3 and 5.

$$EF_y = 0.5*0.9422+0.5*0.7929=0.8675 \text{ (tCO}_2\text{e/MWh)}$$

The value of EF_y calculated ex-ante will be used and won't be updated during the fixed crediting period.

Calculation of the energy generated (electricity and/or steam) in units supplied by waste gas/heat and other fuels

The proposed project activity utilizes the waste heat for power generation and no other fuels will be used.

All the waste heat is to be used in the project activity, so f_{wg} equals 1.

Capping of baseline emissions

As an introduction of element of conservativeness, this methodology requires that baseline emissions should be capped irrespective of planned/ unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuels type and quantity resulting into increase in waste gas generation. In case of planned expansion a separate CDM project should be registered for additional capacity. The cap can be estimated using the two methods described below. Project proponents shall use method 1 to estimate the cap if data is available. In case of project activities using waste pressure to generate electricity or is implemented in a new facility, method 2 shall be used.

Method-1: The baseline emissions are capped at the maximum quantity of waste gas flared/combusted or waste heat released into the atmosphere under normal operation conditions in the 3 years previous to the project activity.

Method-2: The manufacturer's data for the industrial facility shall be used to estimate the amount of waste gas/heat/pressure the industrial facility generates per unit of product generated by the process that generates waste gas/heat/pressure (either product of departmental process or product of entire plant, whichever is more justifiable and accurate). In case any modification is carried out by project proponent or in case the manufacturer's data is not available for an assessment should be carried out by independent qualified/certified external process experts such as a chartered engineer on a conservative quantity of waste gas generated by plant per unit of product manufactured by the process generating waste gas/heat/pressure. The value arrived based on above sources of data, shall be used to estimate the baseline cap (f_{cap}). The documentation of such assessment shall be verified by the validating DOE. The basis for using the capped value, (including manufacturer's design document/letter and the expert's analysis) should be provided to DOE during validation.

The industrial facility is new, so Method-2 is applied and under this method, following equations should be used to estimate f_{cap}.

$$f_{cap} = \frac{Q_{wg,bl}}{Q_{wg,y}} \quad (1f) \qquad Q_{wg,bl} = Q_{bl,product} \times q_{wg,product} \quad (1f\text{-}1)$$

Where:

$Q_{WG,BL}$	Quantity of waste gas generated prior to the start of the project activity estimated using equation 1f-1. (Nm^3)
$Q_{BL,product}$	Production by process that most logically relates to waste gas generation in baseline. This is estimated based on 3 years average prior to start of project activity.
$q_{wg,product}$	Amount of waste gas/heat/pressure the industrial facility generates per unit of product generated by the process that generates waste gas/heat/pressure.

The proposed project activity recovers the waste heat from the process of sulphuric acid production and the waste heat cannot be monitored directly before the heat recovery systems because of no medium for the reaction heat. Furthermore, the manufacturer's specification and external experts' assessment are both on the basis of the heat recovery systems and the value is estimated in a conservative way, in the form of steam, at the exit of heat recovery systems.

According to the feasibility study report, in theory, the rating production capacity of sulphuric acid is 1,000,000 tons per year, and the amount of steam the industrial facility generates per unit of sulphuric acid generated by the process that generates waste heat is 2.18 tonnes per year, which will be used in the (1f-1)&(1f) to estimate f_{cap}. During the calculation of emission reductions in the PDD, f_{cap} chooses 1.

Over the 10 years' crediting period, the value of f_{cap} will be updated ex post when the $Q_{wg,y}$ is monitored and its value is available for calculating f_{cap} as per the equation (1f) above.

Project Emissions

Project Emissions include emissions due to combustion of auxiliary fuel to supplement waste gas and electricity emissions due to consumption of electricity for cleaning of gas before being used for generation of heat/energy/electricity. Project emissions have been estimated as per methodology ACM0012/Version 02

$$PE_y = PE_{AF,y} + PE_{EL,y}$$

Where:

PE_y	Project emissions due to project activity
$PE_{AF,y}$	Project activity emissions from on-site consumption of fossil fuels by the cogeneration plant(s), in case they are used as supplementary fuels, due to non-availability of waste gas to the project activity or due to any other reason.
$PE_{EL,y}$	Project activity emissions from on-site consumption of electricity for gas cleaning

NOTE: In case the electricity was consumed in gas cleaning equipment in baseline as well, project emissions due to electricity consumption for gas cleaning can be ignored.

1) Project emissions due to auxiliary fossil fuel

These emissions are calculated by multiplying the quantity of fossil fuels *(* $FF_{i,y}$ *)* used by the recipient plant(s) with the CO_2 emission factor of the fuel type *i (* $EF_{CO2,i}$ *)*, as follows:

$$PE_{AF,y} = \sum FF_{i,y} \cdot NCV_i \cdot EF_{CO2,i}$$

Where:

$PE_{AF,y}$	The emissions from the project activity in year y due to combustion of auxiliary fuel in tonnes of CO_2
$FF_{i,y}$	The quantity of fossil fuel type *i* combusted to supplement waste gas in the project activity during the year *y*, in energy or mass units
NCV_i	The net calorific value of the fossil fuel type *i* combusted as supplementary fuel, in TJ per unit of energy or mass units, obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors

$EF_{CO2,i}$	The CO_2 emission factor per unit of energy or mass of the fuel type *i* in tons CO_2 obtained from reliable local or national data, if available, otherwise taken from the country specific IPCC default factors

$PE_{AF,y}=0$, as no auxiliary fuel is consumed due to the project activity

2) Project emissions due to electricity consumption of gas cleaning equipment

Project emissions are calculated by multiplying the CO_2 emission factor for electricity ($EF_{CO2,EL,y}$) by the total amount of electricity used as a result of the project activity ($EC_{PJ,y}$). The source of electricity may be the grid or a captive power plant.

Project emissions from consumption of additional electricity by the project are determined as follows:

$$PE_{EL,y} = EC_{PJ,y} \times EF_{CO2,EL,y}$$

Where:

$PE_{EL,y}$	Project emissions from consumption of electricity in gas cleaning equipment of project activity (t CO_2/yr)
$EC_{PJ,y}$	Additional electricity consumed in year y as a result of the implementation of the project activity (MWh)
$EF_{CO2,EL,y}$	CO2 emission factor for electricity consumed by the project activity in year y (t CO2/MWh)

Although there are no gases cleaning equipments involved in the project activity, auxiliary equipments need to consume the electricity, which leads to project emissions. All the auxiliary equipments are covered in the tables listed in Annex 4, so here $EC_{PJ,y}$ is calculated on the basis of the five auxiliary electricity consumption in the Annex 4, namely from EG_{AUX1} to $EG_{AUX5.}$ And all the additional electricity consumed is purchased from the East China Power Grid.
The methodology points out that if electricity is purchased from the grid, the CO_2 emission factor for electricity ($EF_{CO2,EL,y}$) may be determined by one of the following options:

- Use a default emission factor of 1.3 t CO_2/MWh;
- Use the combined margin emission factor, determined according to the latest approved version of "Tool to calculate the emission factor for an electricity system";
- Use the approach described in small-scale methodology AMS.1.D if the quantity of electricity used by the project activity is less than 60 GWh/yr.

The combined margin emission factor has been calculated in the above part of this section, so it will be used to estimate the project emissions as a result of the proposed project activity.

Leakage

In accordance with ACM0012, no leakage is considered.

Calculation of Emission Reductions

Emission reductions due to the project activity during the year *y* are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y	Total emissions reductions during the year *y* in tons of CO_2
PE_y	Emissions from the project activity during the year *y* in tons of CO_2
BE_y	Baseline emissions for the project activity during the year *y* in tons of CO_2 applicable for scenario 2.

According to the description above, we achieve that,

$$BE_y = (EG_y - EC_{pj,y}) * EF_y$$

Where:

EG_y	is net quantity of electricity supplied to the East China Grid during the year *y* in MWh
$EC_{PJ,y}$	is electricity consumed by the waste heat recovery systems during the year y in MWh,
EF_y	is the combined margin emission factor, determined according to the latest approved version of “Tool to calculate the emission factor for an electricity system”, in t CO_2/MWh.

The estimated baseline emissions (see Section A.4.4) are based on expected power generation and an ex ante calculation of the emission factor, the estimated project emissions are based on expected power consumed by the auxiliary equipments and an ex ante calculation of the emission factor, and both the baseline and project emissions will hence be revised during the implementation of the project activity on the basis of actual power supply and power consumed by the auxiliary equipments by the method of monitoring as per the monitoring methodology ACM0012. The emission factor, however, is left unchanged during these calculations of actual emission reductions.

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

Data / Parameter:	$Q_{WG,BL}$
Data unit:	(Nm^3)Tonne
Description:	Quantity of waste gas generated prior to the start of the project activity.
Source of data used:	Feasibility study report
Value applied:	2,180,000
Justification of the choice of data or description of measurement methods and procedures actually applied:	For industrial facility, it is determined by either of two method 1) Direct measurements of amount of the waste gas for at least *three years* prior to the start of the project activity 2), Estimated based on information provided by the technology supplier and the external expert on the waste gas/heat/pressure generation per unit of product and volume or quantity of production. (Please refer equation 1f-1.) **The industrial facility is new and method-2 is used.**
Any comment:	In this proposed project activity, waste heat is used to generate electricity, not waste gas. And waste heat is measured in the form of

	steam (tonne).

Data / Parameter:	$Q_{BL,product}$
Data unit:	Tons/yr
Description:	Plant or departmental. Production process which most logically relates to waste gas generation in baseline. This is estimated based on 3 years average prior to start of project activity. (Tons/yr or m^3/yr or other relevant unit).
Source of data used:	Project Proponents
Value applied:	1,000,000
Justification of the choice of data or description of measurement methods and procedures actually applied:	The rated capacity of sulphuric acid production.
Any comment:	

Data / Parameter:	$q_{wg,product}$
Data unit:	tonne/Ton acid
Description:	Specific waste gas production per unit of product (departmental or plant product which most logically relates to waste gas generation) generated as per manufacturer's or external expert's data. This parameter should be analyzed for each modification in process which can potentially impact the waste gas quantity. (m^3/Ton or m^3/m^3 or other relevant units)
Source of data used:	Feasibility study report
Value applied:	2.18
Justification of the choice of data or description of measurement methods and procedures actually applied:	Experts' assessment
Any comment:	

Data / Parameter:	NCV_i
Data unit:	TJ/t(ce), TJ/m^3(ce)
Description:	Net calorific value per mass or volume unit of a fuel *i*.
Source of data used:	China Energy statistic Yearbook
Value applied:	Please refer to annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data comes from an official statistic.
Any comment:	

Data / Parameter:	$OXID_i$
Data unit:	
Description:	oxidation factor of the fuel *i*
Source of data used:	2006 IPCC Guideline for National Greenhouse Gas Inventories.
Value applied:	100
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is based on IPCC default value because the national specific value is unavailable.
Any comment:	

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor per unit of energy of the fuel *i*.
Source of data used:	2006 IPCC Guideline for National Greenhouse Gas Inventories.
Value applied:	Please refer to annex 3.
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is based on IPCC default value because the national specific value is unavailable.
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

Step 1: Baseline Emission

According to the feasibility study report, annual power generation is 375,000 MWh.
Application of the formulae presented in Section B6.1 to the baseline data presented in Annex 3 yields the following results:

$EF_{OM,y}$ of the East China Grid is 0.9422 tCO_2e/MWh;

$EF_{BM,y}$ of the East China Grid is calculated as 0.7929 tCO_2e/MWh;

EF_y of the East China Grid is 0.8675 tCO_2e/MWh;

The annual emission reductions BE_y are thus calculated to be 325,313 tCO_2e. (Details referred to Annex3)

Step 2: Project Emission

According to the rated power of the equipments of waste heat recovery systems and auxiliary equipments, the power consumed by these equipments amounts to 74,873 MWh per year.

EF_y of the East China Grid is 0.8675 tCO_2e/MWh;

The annual emission reductions PE_y are thus calculated to be 64,952 tCO_2e. (Details referred to Annex4)

Step 3: Leakage

According to ACM0012, there is no leakage for the proposed project activity.

Step 4: Emission Reductions

In a given year, the emission reductions by the project activity (ER_y) is equal to baseline GHG emissions (BE_y) minus project direct emissions and leakages during the same year:

$$ER_y = 325313-64952= 260,361 \text{ tCO2e}$$

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

>>

Table B. 10 The estimation of the emission reductions in crediting period

Year	**Estimation of project activity emissions (tonnes of CO_2e)**	**Estimation of baseline emissions (tonnes of CO_2e)**	**Estimation of leakage (tonnes of CO_2e)**	**Estimation of overall emission reductions (tonnes of CO_2e)**
2008(Sept.1st-Dec.31st)	21,651	108,438	0	86,787
2009	64,952	325,313	0	260,361
2010	64,952	325,313	0	260,361
2011	64,952	325,313	0	260,361
2012	64,952	325,313	0	260,361
2013	64,952	325,313	0	260,361
2014	64,952	325,313	0	260,361
2015	64,952	325,313	0	260,361
2016	64,952	325,313	0	260,361
2017	64,952	325,313	0	260,361
2018(January 1st – August 31st)	43,302	216,876	0	173,574
Total (tonnes of CO_2e)	649,520	3,253,130	0	2,603,610

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

B.7.1 Data and parameters monitored:

Data / Parameter:	NCV_i

Data unit:	TJ/NM^3 or ton
Description:	Net calorific value of the fossil fuel *i*
Source of data to be used:	China Energy Statistic Yearbook
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Yearly
QA/QC procedures to be applied:	No QA/QC necessary for this data item.
Any comment:	

Data / Parameter:	$Q_{WG,y}$
Data unit:	Tonne (Nm^3)
Description:	Quantity of waste gas used for energy generation during year y (Nm^3)
Source of data to be used:	Monitoring records of the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Two flow meters Q1&Q2 will be installed at the entrance to the steam turbines to monitor the waste heat used for electricity generation and the quantity of waste heat for energy generation is the sum of value of the two meters. Monitoring frequency: continuously The data will be electronically recorded monthly and in paper. The data will be archived electronically and kept for two years after the end of the last crediting period.
QA/QC procedures to be applied:	The flow meters should be calibrated by the qualified institution or entity every year. During the time of calibration and maintenance, alternative flow meters should be used for monitoring
Any comment:	In the proposed project activity, waste heat is used for the electricity generation, not waste gas. So Qwg,y in this case means the quantity of waste heat used for the electricity generation and it will be used for estimation of f cap.

Data / Parameter:	$EF_{elec,i,j,y}$
Data unit:	tCO_2 / MWh
Description:	CO_2 emission factor for the electricity source i (i=gr (grid) or i=is (identified source)), displaced due to the project activity, during the year *y* in tons CO_2/MWh
Source of data to be used:	Please refer to Annex 3
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Yearly
QA/QC procedures to be applied:	
Any comment:	For the grid (gr) the guidance provided in the “Tool to calculate the emission factor for an electricity system” shall be used.

Data / Parameter:	$EF_{CO2,is,j}$
Data unit:	Tonnes CO_2 / TJ
Description:	CO_2 emission factor per unit of energy of the fossil fuel used in the baseline generation source i (i=is) providing energy to recipient j.
Source of data to be used:	IPCC 2006
Value of data applied for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	Yearly
QA/QC procedures to be applied:	No QA/QC necessary for this data item
Any comment:	IPCC guidelines/Good practice guidance provide for default values where local data is not available.

Data / Parameter:	$EG_{i,j,y}$
Data unit:	MWh
Description:	Quantity of electricity supplied by the project activity during the year *y*

	in MWh
Source of data to be used:	Parameters of equipments
Value of data applied for the purpose of calculating expected emission reductions in section B.5	300,128
Description of measurement methods and procedures to be applied:	Measurement equipment: the electronic electricity meter Accuracy degree: 1. Measurement methods: Online continuous measurement, the value of electricity generation can be accumulated and saved by the electricity meter and shown on DCS. Recording frequency: Monthly. The recorded data will be archived in electronic way, and will be kept in Credit period + 2 yrs. Emergency measures: Data can not be measured because of calibration or the electricity meter is out of order in the crediting period, then emergency measures should be taken. Please refer to section B.7.2 for detail information.
QA/QC procedures to be applied:	QA/QC for Monitoring Equipment: Calibration procedure: Both main meter and backup meter are calibrated by qualified institution or entity once a year. A calibration report will be provided by the qualified institution or entity and kept by TFC. CDM manager is responsible for regular calibration of the meter. QA/QC for Data: (1) TFC cannot unseal electricity meters in the absence of the qualified institution or entity(or its authorized delegates) (2) TFC will arrange operators recording the data monthly. (3) The running parameters of generators can be used to verify (4) Sales records and purchase receipts are used to ensure the consistency.
Any comment:	Data shall be measured at the recipient plant(s) and at the generation plant for cross check. Sales records shall be used for verification. DOEs shall verify that total energy supplied by the generator is equal to total electricity received by recipient plant(s). There are six meters: one meter EG_{GEN} is installed to measure the power generation and the other five meters EG_{aux1-5} is installed to measure the power consumed by auxiliary equipments. And the net power supply $EG_{i,j,y}$ equals to the difference between value of EG_{GEN} .and EG_{aux1-5}.

Data / Parameter:	$EC_{PJ,y}$

Data unit:	MWh
Description:	Additional electricity consumed in year *y*, for gas cleaning equipment, as a result of the implementation of the project activity.
Source of data to be used:	Parameters of equipments
Value of data applied for the purpose of calculating expected emission reductions in section B.5	74,873
Description of measurement methods and procedures to be applied:	Measurement equipment: the electronic electricity meter Accuracy degree: 1. Measurement methods: Online continuous measurement, the value of electricity generation can be accumulated and saved by the electricity meter and shown on DCS. Recording frequency: Monthly. The recorded data will be archived in electronic way, and will be kept in Credit period + 2 yrs. Emergency measures: Data can not be measured because of calibration or the electricity meter is out of order in the crediting period, then emergency measures should be taken. Please refer to section B.7.2 for detail information.
QA/QC procedures to be applied:	QA/QC for Monitoring Equipment: Calibration procedure: Both main meter and backup meter are calibrated by qualified institution or entity once a year. A calibration report will be provided by the qualified institution or entity and kept by TFC. CDM manager is responsible for regular calibration of the meter. QA/QC for Data: (1) TFC cannot unseal electricity meters in the absence of the qualified institution or entity(or its authorized delegates) (2) TFC will arrange operators recording the data monthly. (3) The running parameters of generators can be used to verify (4)
Any comment:	There are five electricity meters for monitoring the auxiliary consumption of electricity by the proposed project activity: EG_{aux1}, EG_{aux2}, EG_{aux3}, EG_{aux4}, EG_{aux5}. Detailed tables are specified in Annex 4 monitoring information.

Data / Parameter:	$EF_{CO2,EL,y}$
Data unit:	tCO_2/MWh
Description:	CO_2 emission factor for electricity consumed by the project activity in year *y*
Source of data to be used:	Choose between the following options: • Use a default emission factor of 1.2 t CO2/MWh;

	• Use the combined margin emission factor, determined according to the latest approved version of "Tool to calculate the emission factor for an electricity system"; • Use the approach described in small-scale methodology AMS.1.D if the quantity of electricity used by the project activity is less than 15 GWh/yr
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Use the combined margin emission factor, determined according to the latest approved version of "Tool to calculate the emission factor for an electricity system"
Description of measurement methods and procedures to be applied:	Monitoring frequency: annual
QA/QC procedures to be applied:	
Any comment:	Only applicable if electricity is purchased from the grid and if the grid emission factor is calculated ex-post on an annual basis

B.7.2 Description of the monitoring plan:

>>

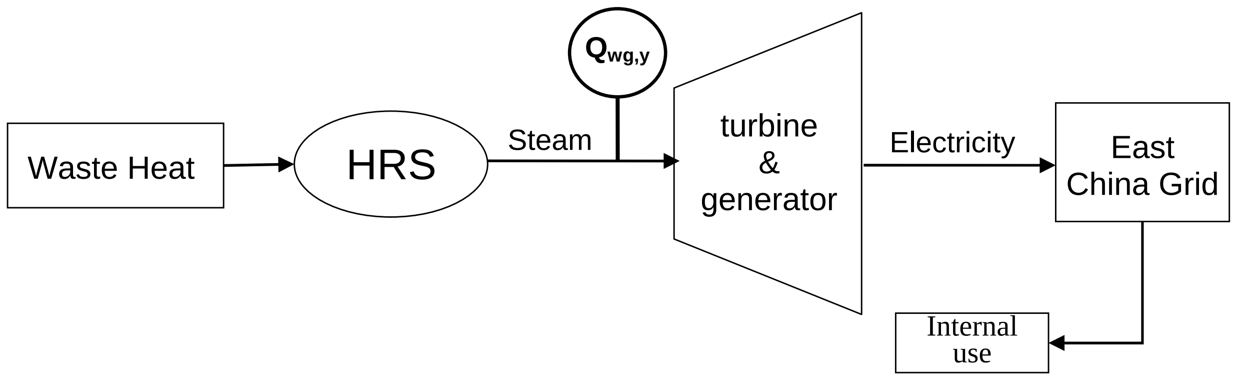

Figure 7 Monitoring Sketch 1

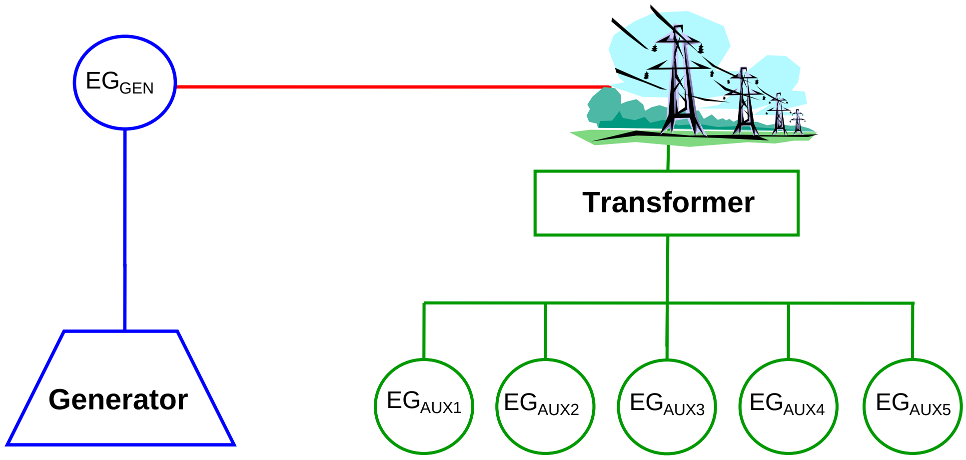

Figure 8 Monitoring Sketch 2

1. Monitoring Targets

(1) Monitoring of quantity of waste heat used for energy generation by the project activity (Meter $Q_{wg,y}$)

As illustrated in Figure 7, The quantity of waste heat used for power generation by the proposed project activity is measured by the meter $Q_{wg,y}$, sum of value of Q1 and Q2 which are the two main flow meters. There is another backup flow meter used to monitor quantity of waste heat by the project activity. The flow meters, calibrated by qualified institution or entity and maintained by TFC, are installed at the entrance to the turbine. All the metering equipments will be properly calibrated and checked annually for accuracy. During the time of calibration and maintenance, alternative flow meters which are calibrated will be used for monitoring. The data will be archived electronically and kept for two years after the end of the last crediting period.

(2) Monitoring of Electricity generation by the project activity(EG_{GEN})

There are one main and one backup electricity meters used to monitor electricity supplied by the proposed project. The main meter is installed in the transformer station of TFC. Both the main measurement system equipments and the backup measurement equipments will be operated and maintained by TFC. The data recorded by meters will be monitored by the DCS and will be saved into a database. And paper record will be recorded every 2 hours. The data on the meter EG_{GEN} means the electricity generation by the proposed project activity. The data will be archived electronically and kept for two years after the end of the last crediting period.

(3) Monitoring of Auxiliary Electricity Consumption(EG_{AUX})

Auxiliary electricity includes energy consumed by all equipments in the project boundary in a conservative way. 5 electricity meters (detailed information in Annex4) are installed by project owner in the transformer station of TFC. And the data can be monitored by the DCS and will be saved into a database. And paper record will be recorded every 2 hours. The data will be archived electronically and kept for two years after the end of the last crediting period.

2. Monitoring Procedures

(1) Measurement

The accumulate data for $Q_{wg,y}$, EG_{GEN} and EG_{aux} will be measured by 8 meters, which are also shown on DCS online. The accumulate data of 8 meters the will be recorded will be saved in a database and recorded in paper.

(2) Identification

The trained operators will identify whether the data on DCS is reasonable within 24 hours. And they will frequently inspect the power plant, focusing on the meter. The process will be recorded and provided to DOE on Verification. If the operators find out the data isn't credible, emergency plan will be used. The method of data identification and the detailed procedure are defined on CDM Operational Manual.

3. Quality Assurance and Quality Control

(1) For measurement equipments——Calibration of Meters

All of the metering equipments will be calibrated once a year by qualified institution or entity. After calibration, calibration reports (F-2) will be provided by the qualified institution or entity and kept by the project owner. The process of Meter calibration should be reported (F-3).One electricity metering equipment and one flow meter which have been calibrated will be prepared for replacement of each meter equipment in case any of them doesn't work.

The metering equipments shall have sufficient accuracy so that error resulting from such equipment shall not exceed +0.5% of full-scale rating.

Calibrations of meters are in the charge of CDM manager.

(2) For Monitoring Process——Computer Execution with Human Supervision

The Monitoring Process will be executed by computer and supervised by operators, in order to avoid artificial errors. The operation report form (F-4) would be archived. The procedures of copying data will be defined in CDM Operational Manual. If the abnormal situation happens, the emergency plan will be started up.

(3) For Emergency Situation——Backup Meters and Conservative Method

When the main meter is on calibration or out of work, the data during the calibration or malfunction period is measured by backup meter in Control Center. The starting time and the ending time should be recorded carefully; and the report (F-5) needs to be archived and provided to DOE.

When the backup meter in Control Center is on calibration or out of work, a new calibrated meter should replace it. The starting time and the ending time should be recorded carefully; and the report (F-5) needs to be archived and provided to DOE.

When the auxiliary electricity meter is on calibration, it should be replaced by the calibrated meter in time. The starting time and the ending time should be recorded carefully; and the report (F-5) needs to be archived and provided to DOE.

If the main electricity meter is out of work, the monitoring data is not available during the malfunction period, the value assessed by the project owner and qualified institution or entity which calibrates the meters, or the lowest value of recorded data over the period of fully operating time during the current month or last month, if the data is available, is used for emission reductions calculation as conservative consideration. The starting time and the ending time of the malfunction period should be recorded carefully; and the report (F-5) needs to be archived and provided to DOE.

If the auxiliary electricity meter is out of work, the monitoring data is not available during the malfunction period, the value assessed by the project owner and qualified institution or entity which calibrates the meters, or the largest amount consumed by auxiliary equipments is used for emission reductions calculation as conservative consideration. The starting time and the ending time of the malfunction period should be recorded carefully; and the report (F-5) needs to be archived and provided to DOE.

(4) For Human Resource Management——Training Plan

According to the monitoring methodology ACM0012 and the monitoring plan, the training course is designed and conducted appropriately by CDM consultant. Relevant documentation (F-6) or other materials such as: background of CDM, contents of PDD and monitoring plan, practical requirements for monitoring, worksheet(excel) containing monitoring data and calculations etc. should be archived and provided to DOE for verification.

The contents and procedures of quality assurance and quality control is an on-going process which will be updated in the crediting period.

4. Operational and Management Structure

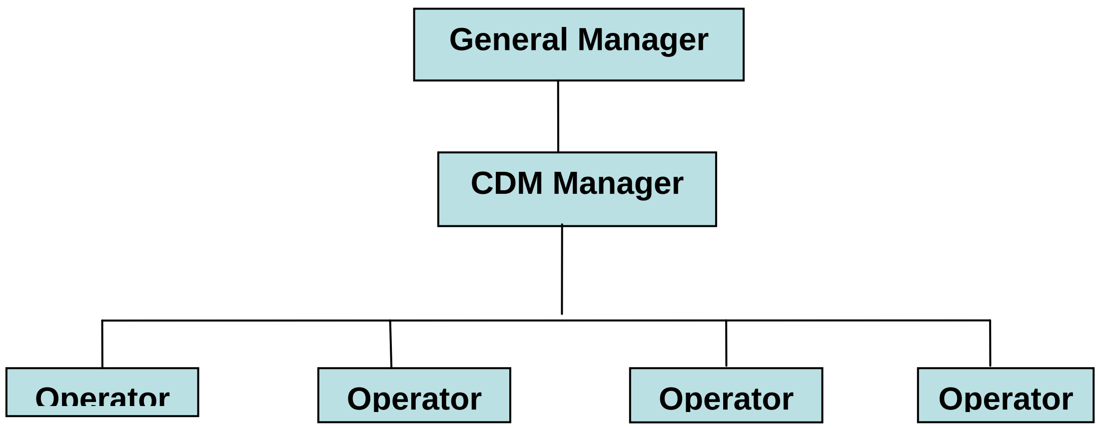

Figure 9 Management Structure

(1) Responsibility of General Manager:

All the affairs related to CDM project monitoring is managed by general manager.

(2) Responsibility of CDM Manager:

In charge of Meters calibration and training affairs; Check the daily operation report forms; Archive emergency situation disposal report

(3) Responsibility of operator:

Four operators take turns to work in the Control Center during 24 hours.

In charge of data supervision, identification, and achievement; Executive emergency plan; Draft operation report forms and emergency situation disposal report.

5. Verification

It is expected that the verification of emission reductions generated from the Project will be done annually. The Table B.11 below outlines the key documents relevant to monitoring and verification of the emission reductions from the Project. With all these documents compiled, the Project owner will sign a verification service agreement with specific DOE.

Table B.11. List of the key documents relevant to monitoring and verification

I.D. No.	Document Title	Main Content	Source
F-1	PDD, including the electronic spreadsheets and supporting documentation (assumptions, estimations, measurement, etc)	Calculation procedure of emission reduction and monitoring items	TFC , or directly download from UNFCCC website
F-2	Meter calibration Report	Equipments and national and industry standards	Changzhi Technique Supervision Bureau
F-3	Process Report for calibration	Starting time and ending time of calibration, Reasons for maintenance and calibration and the precision after maintenance and calibration	TFC

F-4	Operation Report Forms	The data of seven meters per 2 hours, abnormal situation.	TFC
F-5	Emergency situation disposal report	the process of the event and the disposal method	TFC
F-6	Relative materials about training	the training plan, training materials, training report or test paper	TFC
F-7	Monitoring report	CO2 emission reduction calculation	TFC or CDM consultant

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

Date of completion of the current version of baseline study and monitoring methodology: 21/11/2007.

The name of the responsible person/ entity:

Mr. Tao Kanghua, Shanghai Yangtze Delta Investment Consulting Co., Ltd. (CDM Service Center), which is not the project participant.
Address: Room 1608, Building No.5, West Jianguo Road, Lane 91, Shanghai, 200020, P.R.China
Tel: +8621-51532186
Email: khtaoc@163.com

Ms. María Elena Fernández Ibáñez, Zero Emissions Technologies, S.A.
Address: 2 Buhaira Avenue, 41018, Seville, Spain
Tel: +34 954 937 111 FAX: +34 647 812 610
e-mail: elena.fernandez@zeroemissions.abengoa.com

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:

>>
15/10/2007 (It is the starting date of the construction of new sulphuric acid facility)

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

>>
15 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:

>>Not applicable

C.2.1.2. Length of the first crediting period:

>>Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
01/09/2008

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

>>

D.1. Documentation on the analysis of the environmental impacts, including transboundary impacts:

>>
The project activity has developed and passed full Environmental Impact Assessment (EIA) in line with the requirements of the Chinese Government. All the documents related to EIA of the project activity will be submitted to DOE for validation. No adverse impacts including trans-boundary impacts are arising due to the project activity.

During the construction of the project activity, Manifold elements have been thought over, such as location, layout, vane and so on. So its benefits to the environment improvement would be as follows:

- The project activity will provide the East China Grid clean energy resource; thereby successfully reduce the consuming of the non-renewable resource (such as coal, oil, natural gas etc.) and the consequent emission of GHG.
- With the implementation of international advanced technology, the project activity will recover waste heat more effectively, which will avoid pollution caused by emission of waste heat.

- **During Construction Phase：**

1. Dust control: Dust will be suppressed by regular water sprinkling and suitable road surface treatment to ease traffic flow.
2. Noise control: Construction with big noise will be avoided during the night. And the noise caused by the activity will be restricted to be within the range of the permission of industry standard.
3. Water pollution control: Effluent will be disposed before discharge.

- **During Operational and Maintenance Phase**

1. Air pollution: waste gases such as SO_2 will be discharged in line with <standard on environmental air quality>. The utilizing of the waste heat will greatly reduce thermal pollution.

2. Noise pollution: Turbines, pumps and other equipments will be designed and specified with a view to minimize noise pollution. Adequate measures have been adopted in the project activity to ensure noise levels are maintained well within permissible industrial norms.
3. Water pollution. 97.1 percent of industrial water is reused in the process of production. Industrial sewage will be neutralized and then sent to Chemical park sewage disposal plant with living sullage.
4. Solid waste: Parts of solid wastes are recovered to be raw materials and the remained will be innocuously disposed in solid waste disposal center.
5. Ecology impacts. There are no endangered species located in and around the plant area. There are also no landscape conservation zone and cultural relic. Therefore, it will have no impact on ecology.
6. Working security. The company's operations are managed with high safety level systems. This includes equipment shutdown procedure, use of personal protection equipments like safety helmets, , emergency response plan, mock drills, training on use of fire fighting equipment etc. For ensuring safety of the workmen all moving parts of all machinery and exposed parts of machines would be provided with guards.
7. Social impact. The project activity has obvious socio-economic benefits creating employment opportunities and other ancillary businesses in the area. The development of economy on site will also be promoted by this project activity.

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:

>>

The EIA study on the project has revealed that there are no significant environmental risks and the net impacts under environmental pollution category are positive as all necessary and good measures for abatement have been adopted.

SECTION E. Stakeholders' comments

>>

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

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From Sept. 14th 2007 to Sept.18th 2007, the project owner conducted interviews and received comments from local stakeholders. A one-page questionnaire was designed to be easily filled in with the following sections:

1. Project introduction
2. Basic information and education level
3. The stakeholders identified with the project are as follows:

- Inhabitants of local community
- Employees of TFC
- Jiangsu Environmental Protection Bureau
- Jiangsu Economy and Trade Committee
- Zhangjiagang Free Trade Zone Administration Committee
- Jingang Town Beiyin Village Villagers Committee

4. Key questions:
    - How do you get the information about this project?
    - Do you know the environment problems that the project activity will bring to?
    - What possible negative impacts will the project activity bring to your habitations?
    - Whether does the project increase the noise in the local?
    - Whether does the project affect to the air nearby?
    - What are the possible negative impacts?
    - Whether is the waste heat recovery project favourable or harmful?
    - Do you support the construction of the project?

The survey had a 100% response rate (50 questionnaires returned out of 50) ,among the respondents, Education level: Middle school 30%, Senior High school 16%, technical Secondary School 14%, College level 24%, university 16%.

E.2. Summary of the comments received:

>>
After collecting the questionnaires, the following are the key findings:

1. When asked for how get the information about this project, 62% get information from Paper, TV, broadcast. 22% from drumbeating and 16% from folk.
2. When environment problems are mentioned, 38% know clearly, 60% know few, and 2% don’t know.
3. When asked for the negative impact for habitation, 50% think that it has no impact for their habitations, 38% think that it has a few impacts, and 12% think that it has impacts to their habitation but can put up with them.
4. When asked for the noise increased, 72%persons think that the noise does not increase, and 28% think that the noise increases a little.
5. When ask for the impacts for air, 82% persons think that there is almost no change in air, and 18% don’t pay attention to it.
6. When the project’s positive impacts on the local residents are mentioned, 72% think that the project will propel the development of the local economic, 72% think that it will increase the local employment opportunities, and 32% think that the project will reduce the emission of CO_2 to protect environment.
7. 70% persons support the project activity; 30% support the project activity strongly.

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

>>
According to the comments received from the stakeholders of the project activity, local villagers show worries in a certain extent about possible noise and air pollution. Corresponding to these comments, TFC will take the measures as follows:

The noise caused by the activity will be restricted to be within the range of the permission of industry standard. Turbines, pumps and other equipments will be designed and specified with a view to minimize noise pollution; while the nearest local inhabitants live away from the power plant 1,500 meters. So the operational sound would not influence the local Inhabitants.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding from Annex I countries

Annex 3
BASELINE INFORMATION

OM Calculation

The following tables summarize the numerical results from the equations listed in the “Tool to calculate the emission factor for an electricity system”. The information listed in the tables includes data, data sources and the underlying computations.
Table A1~A3 listed the basic data of the East China Power Grid in the year 2003, 2004 and 2005, including installed capacities, annual electricity generation under various electricity generation technologies.

TableA1 The fossil-fired electricity generation of East China Grid in 2003

Province	Fossil-fired power (MWh)	The proportion of Electricity use by plant (%)	Electricity of Fossil-fired power (MWh)
Shanghai	69444000	5.14	65874578.4
Jiangsu	133277000	5.9	125413657
Zhejiang	83089000	5.31	78676974.1
Anhui	54156000	6.06	50874146.4
Fujian	42146000	5.07	40009197.8
Sum			360848553.7

Data source: China Electric Power Yearbook 2004

TableA2 The fossil-fired electricity generation of East China Grid in 2004

Province	Fossil-fired power (MWh)	The proportion of Electricity use by plant (%)	Electricity of Fossil-fired power (MWh)
Shanghai	71127000	5.22	67414170.6
Jiangsu	163545000	5.93	153846781.5
Zhejiang	95255000	5.68	89844516
Anhui	59875000	6.03	56264537.5
Fujian	50490000	6.07	47425257
Sum			414795262.6

Data source: China Electric Power Yearbook 2005

TableA3 The fossil-fired electricity generation of East China Grid in 2005

Province	Fossil-fired power (MWh)	The proportion of Electricity use by plant (%)	Electricity of Fossil-fired power (MWh)
Shanghai	74606000	5.05	70838397
Jiangsu	211429000	5.96	198827831.6
Zhejiang	108110000	5.59	102066651
Anhui	62918000	5.9	59205838
Fujian	48600000	4.57	46378980
Sum			477317697.6

Data source: China Electric Power Yearbook 2006

TableA4 Energy consumption and CO_2 emissions of East China Grid in 2003

Fuel Type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Sum	CO_2 emission （tc/TJ）	average low Caloric value （MJ/t,km^3,tce）	CO_2 emission（tCO_2e）
	A	B	C	D	E	F	G=B+C+D+E+F	H	J	K=G*H*J*44/12/10^2
raw coal	Mtons	2618	6417.74	3442.4	2669.67	1754	16901.81	25.8	20908	334300359.1
clean coal	Mtons						0	25.8	26344	0
other washed coal	Mtons						0	25.8	8363	0
coke	Mtons						0	29.2	28435	0
coke-oven gas	108m3	1.99	0.06				2.05	12.1	16726	152125.7577
other coal gas	108m3	66.34					66.34	12.1	5227	1538454.895
crude oil	Mtons						0	20	41816	0
gasoline	Mtons							18.9	43070	0
diesel oil	Mtons	1.26	14.71	13.99			29.96	20.2	42652	946463.8034
fuel oil	Mtons	95.49	0.76	174.48		18.89	289.62	21.1	41816	9369683.521
LPG	Mtons						0	17.2	50179	0
refinery gas	Mtons	0.49	0.96				1.45	15.7	46055	38442.87608
natural gas	108m3						0	15.3	38931	0
other petroleum products	Mtons	18.91	5.3	15.04			39.25	20	38369	1104387.717
other parched products	Mtons						0	25.8	28435	0
other energy	Mtons standard coal	5.68		7.08			12.76	0	0	0
									total	347449917.70

Data source：China Energy Statistic Yearbook 2004, 2006 IPCC

Total emission of the Central China Power Grid (tCO2e)：	276371085	
Total electricity supply of the Central China Power Grid (MWh)：	346613868	
Emission factor of the Central China Power Grid (tCO_2e/MWh)：	0.797345722	
Electricity importation from Central China Power Grid MWh：	13756040	
Electricity importation from Shanxi Yangcheng plant：	10705870	
Emission factor of the Yangcheng plangt：	0.949780	coal consumption: 343gce/kWh

Total emission (tCO2e): 368586453.8
Total electricity supply (MWh): 385310463.7
$EF_{(03)}$: 0.956596014

Table A5 Energy consumption and CO_2 emissions of East China Grid in 2004

Fuel Type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Sum	CO_2 emission（tc/TJ）	average low Caloric value（MJ/t,km^3,tce）	CO_2 emission（tCO_2e）
	A	B	C	D	E	F	G=B+C+D+E+F	H	J	K=G*H*J*44/12/10^2
raw coal	Mtons	2779.6	7601.9	4008.9	2906.2	2183.7	19480.3	25.8	20908	385300230.3
clean coal	Mtons						0	25.8	26344	0
other washed coal	Mtons		5.46			4.63	10.09	25.8	8363	79826.00582
coke	Mtons						0	29.2	28435	0
coke-oven gas	108m3	2.59					2.59	12.1	16726	192197.9085
other coal gas	108m3	72.46					72.46	12.1	5227	1680380.49
crude oil	Mtons						0	20	41816	0
gasoline	Mtons						0	18.9	43070	0
diesel oil	Mtons	2.69	27.17	6.23			36.09	20.2	42652	1140116.11
fuel oil	Mtons	58.52	55.07	202.89		23.26	339.74	21.1	41816	10991147.99

LPG	Mtons				0	17.2	50179	0
refinery gas	Mtons	0.77	0.55		1.32	15.7	46055	34996.2734
natural gas	108m3		0.14		0.14	15.3	38931	30576.4074
other petroleum products	Mtons	21.22	1.37	24.89	47.48	20	38369	1335957.421
other parched products	Mtons				0	25.8	28435	0
other energy	Mtons standard Coal	6.43		15.48	21.91	0	0	0
							total	400785428.93

Data source：China Energy Statistic Yearbook 2005, 2006 IPCC

Total emission of the Central China Power Grid (tCO2e)：	346035809.7	
Total electricity supply of the Central China Power Grid (MWh)：	418261666.3	
Emission factor of the Central China Power Grid (tCO_2e/MWh)：	0.827318967	
Electricity importation from Central China Power Grid MWh：	26933850	
Electricity importation from Shanxi Yangcheng plant：	11649610	
Emission factor of the Yangcheng plangt：	0.944241481	coal consumption: 341gce/kWh

Total emission (tCO2e): 434068358.9
Total electricity supply (MWh): 453378722.6
$EF_{(04)}$: 0.957407874

Table A6 Energy consumption and CO_2 emissions of East China Grid in 2005

Fuel Type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Sum	CO_2 emission （tc/TJ）	average low Caloric value （MJ/t,km^3,tce）	CO_2 emission （tCO_2e）
	A	B	C	D	E	F	G=B+C+D+E+F	H	J	K=G*H*J*44/12/10^2
raw coal	Mtons	2847.31	9888.06	4801.52	3082.9	2107.69	22727.48	25.8	20908	449526099.6
clean coal	Mtons						0	25.8	26344	0
other washed coal	Mtons						0	25.8	8363	0
coke	Mtons			0.03			0.03	29.2	28435	913.3322
coke-oven gas	108m3	1.68	1.38		1.71		4.77	12.1	16726	353970.6654
other coal gas	108m3	83.72	24.97	0.06	30		138.75	12.1	5227	3217675.863
crude oil	Mtons			27.01			27.01	20	41816	828263.4507
gasoline	Mtons						0	18.9	43070	0
diesel oil	Mtons	1.25	16	4.52		1.67	23.44	20.2	42652	740491.0398
fuel oil	Mtons	59.39	13.22	153.22		7.45	233.28	21.1	41816	7546991.823
LPG	Mtons						0	17.2	50179	0
refinery gas	Mtons	0.57	0.83				1.4	15.7	46055	37117.25967
natural gas	108m3	1.09	1.85	0.62			3.56	15.3	38931	777514.3596
other petroleum products	Mtons	21	8.38	34.8			64.18	20	38369	1805849.775
other parched products	Mtons						0	25.8	28435	0
other energy	Mtons standard coal	12.36		15.29			27.65	0	0	0
									total	464834887.2

ºData source：China Energy Statistic Yearbook 2006, 2006 IPCC		
Total emission of the Central China Power Grid (tCO2e)：	360323575	
Total electricity supply of the Central China Power Grid (MWh)：	466644030	
Emission factor of the Central China Power Grid (tCO_2e/MWh)：	0.772159402	
Electricity importation from Central China Power Grid MWh：	160410000	
Electricity importation from Shanxi Yangcheng plant ：	77244000	
Emission factor of the Yangcheng plangt：	0.938703407	coal consumption: 339gce/kWh

Total emission (tCO2e): 661206182.8
Total electricity exportation (MWh): 714971697.6
$EF_{(05)}$: 0.924800499

According to consolidated baseline methodology “Tool to calculate the emission factor for an electricity system”, the Simple OM emission factors of the East China Power Grid in the year 2003, 2004 and 2005 were calculated in A4~A6 above. The Simple OM emission factor of the Project is the weighted average value of the Simple OM emission factors in the year 2003, 2004 and 2005, i.e. $EF_{OM, simple, y}$=0.942201101 tCO2e/MWh.

Table A7 Resume $EF_{OM, simple, y}$ calculations

	2003			2004			2005		
	electricity exportation	emissions factor	CO2 emissions	electricity exportation	emissions factor	CO2 emissions	electricity exportation	emissions factor	CO2 emissions
	MWh	tCO_2/MWh	tCO_2	MWh	tCO_2/MWh	tCO_2	MWh	tCO2/MWh	tCO_2
fossil-fired power generation of East China grid	360.848.554		347.449.918	414.795.263		400.785.429	477.317.698		464.834.887
import from central china grid	13.756.040	0,797345722	10.968.320	26.933.850	0,827318967	22.282.885	160.410.000	0,772159402	123.862.090
import from Yangcheng plant	10.705.870	0,949780000	10.168.221	11.649.610	0,944241481	11.000.045	77.244.000	0,938703407	72.509.206
sum	385.310.464		368.586.454	453.378.723		434.068.359	714.971.698		661.206.183
EFOM,y (tCO_2e/MWh)		0,956596014			0,957407874			0,924800499	
$EF_{OM, simple, y}$ (tCO_2e/MWh)	0,942201101								

BM Calculation

The conservative calculation of the build margin emission factor of the East China Power Grid has been explained in Section B in the PDD. The data, sources and calculation process of the build margin emission factor and combined emission factor of the East China Power Grid are shown in Table A8 and Table A9. According to the China Energy Statistic Yearbook 2006 and Table A8 below, λ_{coal}=96.71%, λ_{Oil} =2.35%, λ_{Gas} =0.94%(λ is the ratio of CO2 emission by burning coal, oil, gas to the total emission), it obviously shows that the amount of gas-fired and oil-fired power is very small. We consider the EF_{coal} as the $EF_{thermal}$ for facilitation, at the same time, in the conservative consideration, the 600 MW sub-critical coal-fired power generator should multiply the λ_{coal}

Table A8 Energy consumption and CO_2 emissions of East China Grid in 2005

Fuel Type	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Sum	CO_2 emission (tc/TJ)	average low Caloric value (MJ/t,km^3,tce)	CO_2 emission (tCO_2e)	
	A	B	C	D	E	F	G=B+C+D+E+F	H	J	K=G*H*J*44/12/10^2	
raw coal	Mtons	2847.31	9888.06	4801.52	3082.9	2107.69	22727.48	25.8	20908	449526099.6	
clean coal	Mtons						0	25.8	26344	0	
other washed coal	Mtons						0	25.8	8363	0	
coke	Mtons			0.03			0.03	29.2	28435	913.3322	
subtotal										449527013	96.71%
crude oil	Mtons			27.01			27.01	20	41816	828263.4507	
gasoline	Mtons						0	18.9	43070	0	
diesel oil	Mtons	1.25	16	4.52		1.67	23.44	20.2	42652	740491.0398	
fuel oil	Mtons	59.39	13.22	153.22		7.45	233.28	21.1	41816	7546991.823	
other petroleum products	Mtons	21	8.38	34.8			64.18	20	38369	1805849.775	
subtotal										10921596.09	2.35%
coke-oven gas	108m3	1.68	1.38		1.71		4.77	12.1	16726	353970.6654	
other coal gas	108m3	83.72	24.97	0.06	30		138.75	12.1	5227	3217675.863	
LPG	Mtons						0	17.2	50179	0	
refinery gas	Mtons	0.57	0.83				1.4	15.7	46055	37117.25967	
natural gas	108m3	1.09	1.85	0.62			3.56	15.3	38931	777514.3596	

subtotal	4386278.147	0.94%

Table A9 capacity additions used to determine the Build Margin of East China Grid from 2003 to 2005

	Installed capacity in 2003 (MW)	Installed capacity in 2004 (MW)	Installed capacity in 2005 (MW)	New capacity additions (MW)	Share of new capacity(%)
Fossil-fired power	65036.5	79424.1	104076.6	24652.5	92.53%
Hydro power	13602.5	14417.8	16069.4	1651.6	6.20%
Nuclear power	2406	3056	3066	10	0.04%
Others(Wind)	51.7	72.6	401.3	328.7	1.23%
Sum	81096.7	96970.5	123613.3	26642.8	
Share of installed capacity in 2004 (%)	65.61%	78.45%	100.00%		

Data source: China Electric Power Yearbook 2004-2006.

Table A10. Calculation of build margin emission factor and combined emission factor of the East China Grid

	Change in installed capacity (2005 compared to 2003, MW)	**Best commercially available power generation technology in China (600 MW sub-critical coal-fired power generator)**
Hydro power	1651.6	**Coal consumed by power generation:** 320 gCe/KWh **Emission factor:** 0.8861 tCO_2e/MWh
Fossil fuel-fired power	24652.5	
Other	338.7	
Total	26,642.8	
Fuel-fried electricity capacity share	0.9253	
Build margin emission factor in the East China Grid (tCO_2e/MWh)		0.7929
Combined emission factor in the East China Grid (tCO_2e/MWh)		0.8675

The share of fossil fuel-fired power generation capacity addition during 2003~2005 accounts 0.9253, therefore the build margin emission factor of the East China Power Grid is calculated as 0.9671×0.9253×0.8861=0.7929 tCO2e/MWh.

Annex 4

MONITORING INFORMATION

Table B1. Auxiliary Electricity Meters' list

Auxiliary Electricity	Objects of Measurement
(EG_{AUX1})	High Pressure Boiler Feed-water Pump A
(EG_{AUX2})	High Pressure Boiler Feed-water Pump B (for backup)
(EG_{AUX3})	Electricity-consumed by HRS and other related Equipments
(EG_{AUX4})	Circulating-water Pump
(EG_{AUX5})	Generator units.

Table B2. EG_{AUX1}

Electricity meter 2	Electricity-consumed by High Pump Boiler Feed-water Pump A
Equipments	Rated Power（MW）
High Pump Boiler Feed-water Pump A	**0.9**
Total	**0.9**
Running time in one year(h)	**7500**
EG_{AUX1}(MWh)	**6750**

Table B3. EG_{AUX2}

Electricity meter 3	Electricity-consumed by High Pump Boiler Feed-water Pump B
Equipments	Rated Power（MW）
High Pump Boiler Feed-water Pump B (Spare)	**0.9**
Total	**0.9**
Running time in one year(h)	**0**
EG_{AUX2}(MWh)	**0**

Table B4. EG_{AUX3}

Electricity meter 4	Electricity-consumed by Other Electricity-consumed Equipments in the Sulfuric Acid Unit
Equipments	Rated Power（MW）
Main Compressor Main Lube Oil Pump	**0.0185**
Drying Tower Acid Circulation Pump	**0.28**
Final Tower Acid Circulation Pump	**0.28**
HRS Acid Circulation Pump	**0.25**
Sulfur Burner Feed Pump	**0.022**
Treated Water Transfer Pump	**0.045**
IP Boiler Feedwater Pump	**0.075**
WHB Chemical Feed Pump	**0.0011**
WHB Chemical Tank Agitator	**0.00037**
HRS Boiler Chemical Feed Pump	**0.0011**
HRS Boiler Chemical Tank Agitator	**0.00037**
Lighting	**0.03**
UPS	**0.015**
HVAC for Electrical Room/MCC	**0.04**
Total	**1.058**
Running time in one year(h)	**7,500**
EG_{AUX3}(MWh)	**7,935**

Table B5. EG_{AUX4}

Electricity meter 6	Circulating-water Pump
Equipments	Rated Power（MW）
Cooling Water Circulation Pump 1	**0.9**
Cooling Water Circulation Pump 2	**0.9**
Cooling Water Circulation Pump 3	**0.9**
Fan of Cooling 1	**0.185**
Fan of Cooling 2	**0.185**
Fan of Cooling 3	**0.185**
Fan of Cooling 4	**0.185**
Fan of Cooling 5	**0.185**
Total	**3.625**
Running time in one year(h)	**7500**
EG_{AUX4}(MWh)	**27,188**

Table B6. EG_{AUX5}

Electricity meter 6	
Equipments	consumption
Turbine & generator units	**50*8.8%=4.4**
Running time in one year(h)	**7500**
EG_{AUX5}(MWh)	**33,000**

Table B7. EG_{AUX} in calculation of project emission

Auxiliary Electricity	EG_{AUX1}	EG_{AUX3}	EG_{AUX4}	EG_{AUX5}	EG_{AUX}
MWh	**6750**	**7935**	**27,188**	**33,000**	**74,873**

Annex 5

Table C1 HRS Incidents Record

Time of Incident	Cause of Incident	Equipment Damaged
July 1990	HRS boiler failed during initial start up.	Boiler, preheater, heater, circulation pump, drain pumps, piping, significant metal loss in pump boot.
April 1992	Failure of u-bend in economizer ahead of HRS tower, filled economizer and duct and surged blower.	Boiler corroded and leaking, towers damaged, heaters/preheater damaged, circulation pump lost, lost drain pump, leaking piping
March 1993 August 1993 July 1996	March 1993 , Leak in HP boiler August 1993, Leak in HP boiler July 1996, Leak in HRS boiler	
March 1995	Not determined, the source may have been a leak in the boiler. Leak developed on restart after turnaround.	Boiler 235 plugged tubes, lost drain pump.
June 1997	Leaking HRS heater tube. Suspect tube had been previously plugged as a precaution form eddy current tests, indicating fault in tube.	Leaking tube in boilers, many tube less than 60% of design wall thickness. Heaters/preheater damaged lost drain pumps, pipe between heater/preheater needed to be replaced.
July 1997	Leaking boiler's tube. Suspect tube had been previously plugged as a precaution form eddy current tests, indicating fault in tube.	Hole in boilers' tube sheet; boiler was repaired and put back in operation. Lost drain pumps.
October 1997	Leaking Waste Heat Boiler after the sulphur burner filled plant with steam. Circulation pumps were stopped. When pumps were restarted, the cold acid rapidly condensed/absorbed the steam, which created a vacuum and collapsed the tower.	Mist Eliminator housing, Mist Eliminators, Converter Shell.
Start-up date 28 Feb 1998 Incident date 2 Sep 1998	Leak in previously plugged preheater tube.	11 preheater tubes, acid pipe form preheater to FAT, HRS pump casing, lost 5 out of 13 mm on tower bottom and pump boot