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

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SECTION A. General description of project activity

A.1. Title of the project activity:

NISCO Converter Gas Recovery and Utilization for Power Generation Project

Version: 1.0

Date: July 14, 2008

PDD Revision History

Version: 1.0, July 14, 2008, GSP Version

A.2. Description of the project activity:

NISCO Converter Gas Recovery and Utilization for Power Generation Project (referred to as the project hereinafter) will recover the converter gas (LDG) produced by two 120-ton converters（no.1 and no.2）of Nanjing Iron and Steel United Co., Ltd (NISCO) in steel production process for electricity generation. The electricity generated by the project will be supplied to NISCO with an annually net supply of 138GWh, replacing the equivalent amount of electricity that otherwise would be purchased by NISCO from the East China Power Grid (ECG), which is dominated by coal-fired power plants. The expected emission reductions from the project are estimated at 124,987 tCO_2e per year for a fixed ten-year crediting period.

The project will contribute to the sustainable development of China in following aspects.

- It will promote the integrated resource utilization and thus reduce the waste of energy sources.
- The generated electricity will displace some electricity generated by coal-fired power plants and reduce the associated environmental pollution from coal combustion; meanwhile, it will alleviate the electricity shortage in that region.
- The successful running of the project will encourage other steel producers in the same area or in the vicinage to utilize the surplus gas for power generation and promote sustainable development in local area as well as the whole country.

A.3. 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)

People's Republic of China (host)	Nanjing Iron & Steel United Co., Ltd (project owner)	No
Republic of Italy	International Bank for Reconstruction and Development (World Bank) as the trustee of the Italian Carbon Fund	Yes

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

People's Republic of China

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

Jiangsu Province

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

Nanjing City

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

The project is located in the iron production area of NISCO. NISCO is located in the Yanjiang Industry Development Zone in the north of Nanjing City, at 32°12´ N, 118°44´ E, close to the Nanjing Yangtze Bridge on the west, no.2 Yangtze Bridge on the east, the Ning-lian highways on the north and the Yangtze River on the south.


Map of China
Locations of provinces, autonomous regions and municipalities.
Heilongjiang
Jilin
Liaoning
BEIJING
Tianjin
Hebei
Xinjiang
Gansu
Inner Mongolia
Ningxia
Qinghai
Shanxi
Shandong
Jiangsu
Henan
Shaanxi
Tibet
Sichuan
Hubei
Anhui
Zhejiang
Chongqing
Jiangxi
Hunan
Guizhou
Fujian
Yunnan
Guangxi
Taiwan
Guangdong
Hong Kong
Islands of South China Sea
Hainan
Islands of South China Sea
Jiangsu Province


S H A N D O N G
Y E L L O W S E A
Lianyungang
Xuzhou
Batan
Gaogou
Suqian
J I A N G S U
Huai'an
Yancheng
Xinghua
Dongtai
Project Site
Zhenjiang
Nanjing
Nantong
Changzhou
Wuxi
Suzhou

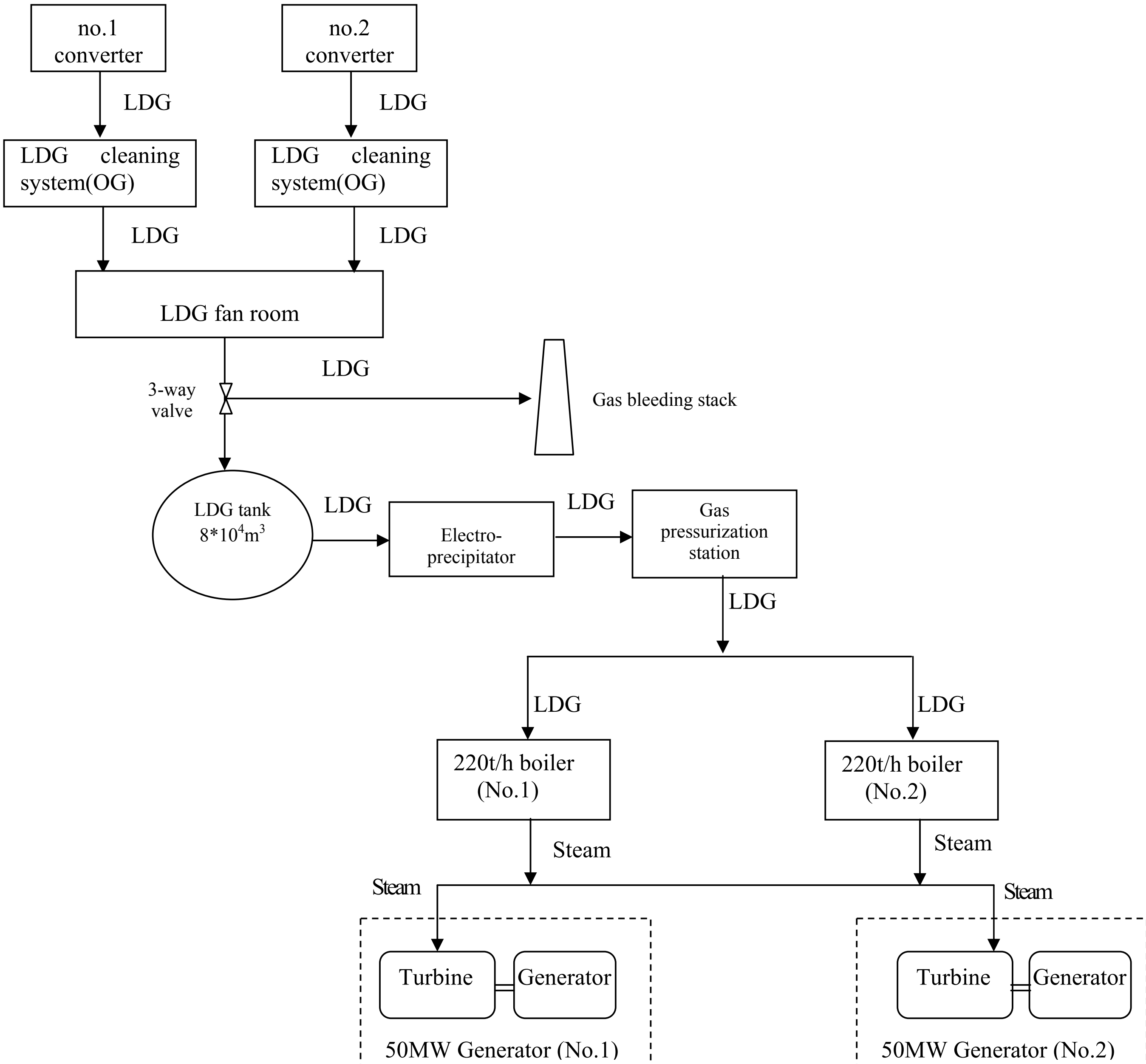
A.4.2. Category(ies) of project activity:

Sectoral scope 1: Energy industries (renewable - / non-renewable sources) and Sectoral scope 4: Manufacturing industries

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

The project will recover LDG produced by two 120-ton converters of NISCO in steel-making process for electricity generation.

The detailed process flow diagram of the project is shown below.


no.1 converter
no.2 converter
LDG
LDG
LDG cleaning system(OG)
LDG cleaning system(OG)
LDG
LDG
LDG fan room
LDG
3-way valve
Gas bleeding stack
LDG tank 8*10^{4}m^3
LDG
Electro-precipitator
LDG
Gas pressurization station
LDG
LDG
LDG
220t/h boiler (No.1)
220t/h boiler (No.2)
Steam
Steam
Steam
Steam
Turbine
Generator
50MW Generator (No.1)
Turbine
Generator
50MW Generator (No.2)

LDG generated by the two 120t converts after dedusting will be sent to the LDG tank. The LDG coming out of the tank will be then sent to two 50MW power plants (including two 220t/h boilers and two steam- turbine generators). When the LDG is enterred into two 220t/h gas boilers for burning, the steam with high pressure and temperature will be generated and entered into the turbine and make work. As a result, the power will then be generated by the generator with coaxial coupling.

The LDG will be blended with blast furnace gas (BFG) and coke-oven gas (COG) to provide fuel to run the two 50MW power plants. In absence of this project, BFG and COG still contribute to power generation, but at a lower capacity. The recovered LDG can bring net supply of 138GWh annually and meet the generator capacity of 21.3MW.

The models and performance data of the major equipment for the project are shown in following table.

Equipment name	Major performance data	Manufacturer	Equipment model
Boiler	Rated capacity: 220t/h Rated pressure:9.8MPa Rated temperature:540℃	Hangzhou boiler Group Co.,Ltd	—
Steam turbine	Rated capacity:50MW	Nanjing Turbine & Electric Machinery (Group) Co., Ltd.	N50-8.83-3
Generator	Rated capacity: 60MW	Nanjing Turbine & Electric Machinery (Group) Co., Ltd.	QFW-60-2

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

The annual emission reductions of the project activity are estimated to be 124,987 tCO_2e, and 1,249,870tCO_2e during the 10-year crediting period.

Years	Annual estimation of emission reductions in tonnes of CO_2e
2008	62,494
2009	124,987
2010	124,987
2011	124,987
2012	124,987
2013	124,987
2014	124,987
2015	124,987

2016	124,987
2017	124,987
2018	62,494
Total estimated reductions (tonnes of CO2e)	1,249,870
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO2e)	124,987

A.4.5. Public funding of the project activity:

The public funds involved in the project exclude existing ODA. The sovereign Annex I participants of the project confirm that any public funding used to purchase emission reductions from this project does not result in a diversion of ODA and is separate from and is not counted towards its financial obligations as a Party included in Annex I.

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:

- ACM0012 "Consolidated baseline methodology for GHG emission reductions for waste gas or waste heat or waste pressure based energy system", Version 02, EB 35.
- The additionality of the project has been justified using the "Tool for the demonstration and assessment of additionality", Version 05, EB 39.
- The "Tool to calculate the emission factor for an electricity system", Version 01, EB 35.
- For more information please refer to the UNFCCC CDM-Executive Board website under the following link: *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:

The project activity meets the applicability criteria of the selected methodology ACM0012, as tabulated below:

Methodology applicability criteria	Project activity in accordance with the applicability criteria
The proposed project activity utilizes waste gas as an energy source for generation of electricity, so the consolidated methodology ACM0012 is applicable in general.	
If project activity is use of waste pressure to generate electricity, electricity generated using waste gas pressure should be measurable.	This applicability condition is not relevant, as the project does not involve the use of waste pressure.

Energy generated in the project activity may be used within the industrial facility or exported outside the industrial facility. The electricity generated in the project activity may be exported to the grid.	This applicability condition is satisfied because electricity generated in the project will be used within NISCO.
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.	This applicability condition is met because electricity in the proposed project activity is generated by the owner of the converters, NISCO, producing the waste gas (LDG) within the industrial facility at NISCO.
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.	This applicability condition is met because in China, there are no regulations that constrain the facility from using the fossil fuels prior to the implementation of the project activity.
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.	This applicability condition is met because this project is a new facility, which should be covered by the methodology.
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 applicability condition is not applicable because this project is a new facility.
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 with recipient plant that the emission reductions would not be claimed by recipient plant for using a zero-emission energy source.	The credits are claimed by the owner of electricity generator using waste gas, i.e., NISCO.
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.	The baseline scenario is releasing the waste gas (LDG) into atmosphere and purchasing electricity from the East China Power Grid (ECG). The equipment (i.e. converter and LDG gas recovery facility) is a new facility and its designed lifetime is 15 years. The credit period of this project is chosen to be 10 years. Therefore, the credits can be claimed for 10 years.
Waste gas / pressure that is released under abnormal operation (emergencies shut down) of the plant shall not be accounted for.	The project will meet this applicability condition because the waste gas released under abnormal operation will not be accounted for.
Cogeneration of energy is from combined heat and power and not combined cycle mode of electricity generation.	This applicability condition is not relevant because the proposed project activity is generation of electricity only.

In summary, the project activity meets all the applicability conditions required by methodology ACM0012 (Version 2) - 'Consolidated baseline methodology for GHG emission reductions for waste gas or waste heat or waste pressure based energy system'.

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

For the purpose of determining baseline and project activity emissions, the table below illustrates which emission sources and GHG are included in the project boundary:

	Source	Gas	Included?	Justification / Explanation
Baseline	Electricity generation, East China Power Grid (ECG)	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative
		N_2O	Excluded	Excluded for simplification. This is conservative
Project Activity	Supplemental electricity consumption	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
	Project emissions from cleaning of gas	CO_2	Included	Waste gas cleaning is required and leads to emissions related to the electricity generation of the cleaning in the project.

The project boundary includes the project, two converters where the waste gas is generated and all power plants physically connected to the East China Power Grid (ECG), which includes Jiangsu Province, Anhui Province, Fujian Province, Zhejiang Province and Shanghai.

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

This section discusses the plausible baseline scenarios, and selects the baseline scenario on the basis of a barrier analysis. More information can be found in Section B.5.

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

According to the methodology and the conditions at the project site, all alternatives to the project activity have been listed below, taking into account disposal and utilization of the waste gas and electricity generation.

Step 1a The realistic and credible alternatives to waste gas utilization may include:

	Baseline Scenario	Comments	Conclusion
W1	Waste gas is directly vented to atmosphere without	It is not applicable as there is a higher CO content in the waste gas (i.e.LDG)	It is not a plausible

	incineration.	which shall be flared before vented to atmosphere[1].	baseline scenario.
W2	Waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere (waste pressure energy is not utilized).	The baseline scenario is applicable because it is the common practice in the Chinese iron & steel plants and it meets all current legal and regulatory requirements in China that the waste gas is released to the atmosphere after incineration.	It is an applicable baseline scenario
W3	Waste gas/heat is sold as an energy source.	It is not applicable because the substantial technological barriers and safety concerns (as detailed in section B.5) makes the recovery of waste gas extremely difficult and dangerous in absence of the proposed project.	It is not a plausible baseline scenario.
W4	Waste gas/heat/pressure is used for meeting energy demand.	It is not applicable because the substantial technological barriers and safety concerns (as detailed in section B.5) make the recovery of waste gas extremely difficult and dangerous in absence of the proposed project.	It is not a plausible baseline scenario.

Step 1b The realistic and credible alternatives for power generation may include:

	Baseline Scenario	Comments	Conclusion
P1	Proposed project activity not undertaken as a CDM project activity.	This alternative meets all legal and regulatory requirements in China. But this alternative will face significant technological barriers and safety concerns (as detailed in section B.5).	It is not a plausible baseline scenario.
P2	On-site or off-site existing/new fossil fuel fired cogeneration plant.	It is not applicable, because the proposed project activity does not supply heat energy.	It is not a plausible baseline scenario.
P3	On-site or off-site existing/new renewable energy based cogeneration plant.	The analysis is same with baseline scenario P2.	It is not a plausible baseline scenario.
P4	On site or off site existing/	According to China power	It is not a

[1] Safety Code for Gas of Industrial Enterprise,GB6222-2005,issued by General Administration of Quality, Inspection and Quarantine of the People's Republic of China & Standardization Administration of the People's Republic of China.

	new fossil fuel based existing captive or identified plant.	regulations, the installation of coal-fired power plants of less than 135MW is not permitted without special permission in areas covered by large grids[2] and the installation of thermal power units with less than 100 MW is under tight control[3]. Because the generation capacity of the project is amount to 21.3MW, building a new 21.3MW thermal-fired power plant is not feasible under current legal framework in the PRC. So this alternative is not applicable	plausible baseline scenario.
P5	On site or off site existing/new renewable energy based existing captive or identified plant.	As it is unable to obtain the wind, hydro and other renewable sources on site, the alternative is not feasible.	It is not a plausible baseline scenario.
P6	Sourced Grid-connected power plants.	This meets all the legal and policy requirements, and is common practice in iron & steel companies in the PRC.	It is an applicable baseline scenario
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.).	It is not applicable because the substantial technological barriers and safety concerns (as detailed in section B.5) make the recovery of waste gas extremely difficult and dangerous in absence of the proposed project.	It is not a plausible baseline scenario.
P8	Cogeneration from waste gas (if project activity is cogeneration with waste gas, this scenario represents cogeneration with lower efficiency than the project activity).	It is not applicable, because the proposed project activity does not supply heat energy.	It is not a plausible baseline scenario.

From the above analysis, it is concluded that the baseline scenarios applicable to the project activity are W2 (i.e. waste gas is released to the atmosphere after incineration or waste heat is released to the atmosphere) and P6 (i.e. sourced Grid-connected power plants).

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

The energy source in the plausible baseline scenario combination identified in step 1 is sourced Grid

[2] Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135MW or below, Issued by State Council Office, decree No. 2002-6

[3] The Temporary Stipulation of the Construction Management of Small Scale Units of Fuel-fired Power Generation of August 1997

connected power plants.

The major fuel for power generation in East China Grid is coal which is available in abundance in the host country, China and there is no supply constraint.

Step 3: Use Step 2 and/or step 3 of the latest approved version of the "Tool for the demonstration and assessment of additionality" to identify the most plausible baseline scenarios by eliminating non-feasible options.

The alternative P1 is not feasible due to prohibitive technical barriers. Please refer to Section B5 for details.

Based on the analysis above, most of the alternatives are excluded and only the combination W2 and P6 remains, which shall be considered as the most likely baseline scenario.

Baseline options	Description
For the use of waste gas	W2: Waste gas is released to the atmosphere after incineration.
For power generation	P6: Sourced Grid-connected power plants.

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):

The project activity is not a part of baseline and this is demonstrated in following steps using the "Tool for the demonstration and assessment of additionality", Version 05.

Since the period of "the 10th Five-year Plan" (the years 2000-2005), the iron and steel industry has been developed rapidly in China. The structural reform will be given priority for the industry in China and also the adjustment of product mix and the technical development will be accelerated to satisfy the higher requirement of rapid development and industrial upgrading in each economic organization on the variety and quality of steel products. In the period of "the 10th Five-year Plan", domestic demand on flat products such as plate will be kept a stronger potential, however, there is a short of production capacity, for which the government has established the relevant policies to promote steel company to handle the trouble due to insufficient production capacity[4].

With adequate market investigation, a plate production line is intended for NISCO. The construction of the plate line will increase the production capacity for plate, especially for special plate in China and also the increasingly higher requirement of domestic consumers on quality and variety of plate or special plate can be satisfied. Accompanied with the construction of the plate line, NISCO intended to use the recovered LDG for power generation. However, there were serious technological barriers which have influence on the confidence of NISCO's decision maker for the project. At the moment that NISCO was evaluating technical design of LDG gas cleaning system and making the investment decision, the National Planning Commission advised NISCO to obtain the financial support from CDM project. The benefit from emission reductions in LDG recovery for power generation makes NISCO's decision maker intensify the confidence on the project.

[4] http://www.china.com.cn/ch-15/15p3/18.htm, Structural adjustment is the development focus of Chinese steel and iron industry in the Tenth Five-Year Plan

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

Sub-step 1a. Define alternatives to the project activity

The possible alternatives to the CDM project activity include:

Alternatives 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.

Alternative W1: As there is a higher CO content in the waste gas (i.e. LDG) which must be flared before vented to atmosphere, alternative W1 is not a possible alternative.

Alternative W3: As the waste gas can't be used in absence of the proposed project, alternative W3 is not a possible alternative.

Alternative W4: There is no more energy demand than electricity demand at NISCO as there is sufficient steam supply already, alternative W4 is not a possible alternative.

Alternatives 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).

Alternative P2: Due to the proposed project activity does not supply heat energy, alternative P2 is not a possible alternative.

Alternative P3: Due to the proposed project activity does not supply heat energy, alternative P3 is not a possible alternative.

Alternative P5: As it is unable to obtain the wind, hydro and other renewable sources on site or off-site, alternative P5 is not a possible alternative.

Alternative P7: Due to applying an assumed lower efficiency steam-turbine generator than the proposed project couldn't completely utilize the surplus LDG thus impossible to gain the same amount of electricity as the proposed project, alternative P7 is not a possible alternative.

Alternative P8: Due to the project does not supply heat energy, alternative P8 is not a possible alternative.

Sub-step 1b. Consistency with mandatory laws and regulations:

Alternative W2: It is a common practice in the Chinese iron & steel plants and it meets all current legal and regulatory requirements in China that the waste gas is released to the atmosphere after incineration. Therefore, W2 is a possible alternative.

Alternative P1: It meets all legal and regulatory requirements in China. But this alternative will face significant technological barriers. Please refer to Step 3 for details.

Alternative P4: According to China power regulations, the installation of coal-fired power plants of less than 135MW is not permitted without special permission in areas covered by large grids[5] and the installation of thermal power units with less than 100 MW is under tight control[6]. For this reason, building a new21.3MW thermal-power plant is not feasible under current legal framework in the PRC. Therefore, alternative P4 should be excluded.

Alternative P6: This meets all the legal and policy requirements, and is common practice in iron & steel companies in the PRC. Therefore, alternative P6 is a possible alternative.

In conclusion, alternative W2, P1 and P6 are consistent with current laws and regulations. Therefore, W2, P1 and P6 are possible alternatives.

Step 2. Investment analysis

This step is intentionally skipped and the document proceeds to Step 3 Barrier analysis.

Step 3. Barrier analysis

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

1. Investment barriers

During the period of "the 10th Five-year Plan" (the years 2000-2005), the iron and steel industry has grown rapidly in China, in which domestic demand on flat products has increased dramatically. However, there is shortage of production capacity. In 1999, the long products accounted for 59.84% [7]of domestic steel products, but the main demand of manufacturing industry is flat products. The flat products only account for 30% of steel products compared with the ratio of 50% for overseas major steel producers. The ratio has been up to 60% in developed countries. To strengthen the international competitiveness and satisfy the domestic demand, the ratio of flat products has to be increased, for which the government has established the relevant policies to promote steel company to handle the trouble due to insufficient production capacity[8].

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[5] Notice on Strictly Prohibiting the Installation of Fuel-fired Generators with the Capacity of 135MW or below, Issued by State Council Office, decree No. 2002-6

6 The Temporary Stipulation of the Construction Management of Small Scale Units of Fuel-fired Power Generation of August 1997

[7]http://www.metal.citic.com/iwcm/UserFiles/img/cd/jszl/jszl02-008.pdf, The Tenth Five-Year Plan of Steel And Iron Industry and Demand Trend of Low Alloyed Steels

[8] http://www.china.com.cn/ch-15/15p3/18.htm, Structural adjustment is the development focus of Chinese steel and iron industry in the Tenth Five-Year Plan

The priority of NISCO, as an enterprise, is to produce the hard-to-get products and to obtain the economic benefit. With an adequate market investigation, a plate production line is intended for NISCO to meet the increasingly higher demand of domestic consumers on quality and variety of plate, especially on those of special plate and also ensure NISCO's position in the market. The existing main production equipment includes small-sized blast furnace, converter and rolling mill, which can't meet the requirement for production of aforesaid high value-added products. Thus, the investment of NISCO is emphasized on upgrading production equipment and constructing the production line for hard-to-get products such as plate of market.

The project which recovers LDG for power generation does not contribute to increasing variety and quality of products so it doesn't fit into NISCO's landscape of investment priorities.

Moreover, the main business of NISCO has been iron and steel production and as a result, NISCO is not familiar with power-generation technology. And the project is the "first of its kind" in east China to use LDG for power generation. Therefore, there are a great amount of potential risks in the implementation of the project.

With the significant risks in mind, NISCO's management were very hesitant to make up its mind to invest in the project at the beginning.

2. Technological barriers

The project faces technological barriers due to the physical characteristics of the LDG and the lack of experience in utilizing LDG for electricity generation.

There is a very high CO content in LDG, i.e. normally about 40~70%. The LDG is explosive, flammable and toxic for personnel and then the mentioned accidents may be occurred in case of improper recovery and usage of the gas. The LDG is generated intermittently and then can't be alone used as the fuel of boiler. In the project, the LDG, BFG and COG recovered will be mixed and used for fuel gas-steam power generator unit. The large caloric fluctuation among the aforesaid fuels increases the uncertainty and technical risk of the project.

The recovery and utilization of LDG will highly depend on the de-dusting efficiency of LDG recovery system. The LDG can't be utilized by users if the LDG contains high dust concentration while the gas cleaning system is provided with low efficiency[9]. Due to the aforesaid reason the improved LDG cleaning and recovery technology (improved OG technology) developed by CERI will be applied in the project. It is the first application of this technology in the steel plant in East China, which increase the uncertainty and technical risk of the project.

For NISCO, the LDG was released to atmosphere after burning before the project is constructed thus few personnel were familiar with the technology of LDG recovery and utilization in power generation. Therefore, technical support of experts will be required during the construction and operation period of the project. The operators shall be subject to strict training so as to master the nature of LDG, understand the process flow of recovery of LDG for power generation and then familiar with the operation and maintenance of the project. In the meanwhile, a strict technology manage procedure must be applied to ensure safety operation. However, NISCO is short of the operation and management experience related to the recovery of LDG for power generation. The initial investment and operation cost may be increased due to the mentioned factors.

3. Barriers due to prevailing practice

This project will adopt improved LDG cleaning and recovery technology (improved OG technology),

[9] Status and management of energy in iron and steel industry, Wang Weixing, The Chinese Society for Metals

which is developed by Capital Engineering & Research Incorporation Ltd. (CERI). Application of such technology is the "first of its kind" in east China. The project owner has no experience before in operating and managing such kind of project. The revenues gained from CERs can be used as part of the investment return for project to minimize the risk of project and then intensify the confidence of the project owner in the project.

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

In NISCO, the waste LDG will be flared and vented to the atmosphere in absence of the proposed project and the electricity will be otherwise purchased from the grid. It is consist with mandatory laws and regulations and is also a common practice in iron & steel companies. Releasing the waste gas after flaring and purchase the equivalent amount of electricity will not bring such technical barriers to NISCO.

Step 4. Common practice analysis

Sub-step 4a. Analyze other activities similar to the proposed project activity:

Until the end of 2003, there was no enterprise which recovered LDG for power generation in the iron & steel industry in China.

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

There's no activity in China similar to this project.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

1. Baseline emissions

The baseline emission for the year y is calculated as follows:

$$BE_y = BE_{En,y} + BE_{flst,y} \quad (1)$$

Where:

BE_y are total baseline emissions during the year y in tons of CO_2

$BE_{En,y}$ are 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 (t CO_2 per year). This is relevant for those project activities where in the baseline steam is used to flare the waste gas.

Because no steam is used for flaring of waste gas in absence of the project, $BE_{flst,y}$ is zero, the following equation holds: $BE_y = BE_{En,y}$

Because the baseline of the proposed project is that the electricity is obtained from the grid, baseline emissions are calculated as follows according to ACM0012:

$$BE_{En,y} = BE_{Elec,y} + BE_{Ther,y} \quad (2)$$

Where:

$BE_{Elec,y}$ are baseline emissions from electricity during the year y in tons of CO2

$BE_{Ther,y}$ are baseline emissions from thermal energy (due to heat generation by element process) during the year y in tons of CO2

The proposed project activity is generation of electricity only, therefore, $BE_{Ther,y}$ is zero.

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

Baseline emissions from electricity ($BE_{Electricity,\ y}$) that are displaced by the project activity can be calculated as follows:

$$BE_{Elec,y} = f_{cap} * f_{wg} * \sum_j \sum_i (EG_{i,j,y} * EF_{Elec,i,j,y}) \qquad (3)$$

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 either be grid or identified source) during the year y in MWh, and

$EF_{Elec,i,j,y}$ is the CO2 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 (6).

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 than that generated in base year.

For the project is implemented in a new facility, f_{cap} is estimated as follows:

$$f_{cap} = \frac{Q_{WG,BL}}{Q_{WG,y}} \qquad (4)$$

$$Q_{WG,BL} = Q_{BL,product} \times q_{wg,product} \qquad (5)$$

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.

In the project， all of the waste gas (LDG) is recovered for power generation according to the *Feasibility Study* ,thus f_{cap} =1.During the operation period of the project, f_{cap} will be calculated based on the monitoring data.

The CO_2 emission factor of the electricity $EF_{elec,gr,i,y}$ **(abbreviated as EF_y)**is determined following the guidance provided in the "Tool to calculate the emission factor for an electricity system" , 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 (ECG) covers five provinces (Jiangsu Province, Anhui Province, Fujian Province, Zhejiang Province and Shanghai.)[10]The project activity is located in Jiangsu Province, so it is appropriate to select ECG 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.

According to "Tool to calculate the emission factor for an electricity system",the simple OM method can be used where low-cost/must resources constitute less than 50% of total grid generation in average of the five most recent years; the average OM method can only be used where low-cost/must run resources constitute more than 50% of total gird generation. In the case of the project activity, from publicly available historical data, the ratios of electricity generated by hydro and other renewable energy as well as nuclear power plants within the ECG against the total electricity generated in the ECG over the past five years is as follows: 11.49%, 11.86%, 10.96%, 9.77%and 11.94%[11] for2001, 2002, 2003, 2004 and 2005 respectively. Hence the low-cost/ must run resources constitute less than 50% of total amount grid generation output and method (a) is applicable for the project.

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 (tCO_2/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.

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

[11] China Electric Power Yearbook, 2002-2006

For it is not available to obtain the plant specific generation data in China, Option C is adopted. $EF_{OM,y}$ is calculated by the formula as follow:

$$EF_{OM,simple,y} = \frac{\sum_i FC_{i,y} \times NCV_{i,y} \times EF_{CO2,i,y}}{EG_y} \quad (6)$$

Where:

$FC_{i,y}$	is 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 CO_2 emission factor of fossil fuel type i in year y (tCO_2/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 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*.
The Simple OM Emission Factor ($EF_{OM,y}$) of the proposed project is calculated ex-ante using a 3-year(2003-2005) weighted average, based on the most recent statistics available at the time of PDD submission. This allows the Simple OM to be fixed for the crediting period. The *OM* emission factor is 0.9421tCO_2/MWh.
Details of the calculation are provided in Annex 3.

<u>Step4: Identify the cohort of power units to be included in the build margin</u>

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

(a) the set of five power units that have been built most recently

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

In China, it is not possible to obtain the public data for non plant specific generation data. Taking notice of such situation, the Executive Board accepts the following deviation in methodology application:

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

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

The Executive Board suggested that project participants use the following alternative solutions in absence of data[12]: Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, for each fuel type in estimating the fuel consumption to estimate the build margin. For the estimation of the operating margin the average emission factor for the grid for each type can be used.

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

Option 1. For the first crediting period, calculate the build margin emission factor ex-ante based on the most recent information available on units already built for sample group m at the time of CDM-PDD submission to the DOE for validation. For the second crediting period, the build margin emission factor should be updated based on the most recent information available on units already built at the time of submission of the request for renewal of the crediting period to the DOE. For the third crediting period, the build margin emission factor calculated for the second crediting period should be used. This option does not require monitoring the emission factor during the crediting period.

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

For this project, option 1 is used.

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:

$$EF_{BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} \qquad (7)$$

Where:

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

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

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

m is power units included in the build margin

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

According to “Tool to calculate the emission factor for an electricity system” and the deviation accepted by Executive Board which is mentioned in Step 4,BM is calculated following three sub-steps:

Sub-step 1: Calculate the proportions of the corresponding CO_2 emissions of the solid fuel, liquid fuel and gas fuel to the total emission by the energy information available of the last year;

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[12] DNV letter to the CDM Executive Board; Request for Guidance: Application of AM0005 and AMS-I-D in China dated 07/10/2005 available on line at http://cdm.unfccc.int/UserManagement/FileStorage/6POIAMGYOEDOTKW25TA20EHEKPR4DM

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

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

$$\lambda_{Gas} = \frac{\sum_{i \in GAS,j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}} \quad (10)$$

Where:

$F_{i,j,y}$ is the fuel *i* consumed by the province *j* in the year y (in a mass or volume unit)

$COEF_{i.j.y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2/tce), taking into account the carbon content and the percent oxidation of the fuel in year y

Coal, Oil and *Gas* are the footnotes of the solid fuel, liquid fuel and gas fuel respectively.

Sub-step 2: Calculate the fossil fuel-fired power generation emission factors ($EF_{Thermal}$) of the grids based on the emissions of the best technology commercially available:

$$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} \quad (11)$$

Where:

$EF_{Coal,Adv}$, $EF_{Oil,Adv}$ and $EF_{Gas,Adv}$ *is* emission factor of coal, oil, gas-fired power generation of the best technology commercially available in China was selected.

Sub-step 3: Calculate EF_{BM} of East China Power Grid based on following equation:

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

Where*:*

CAP_{Total} is the increased in installed capacity of the NCPG during the most recent years, which represents 20% of the total installation (MW);

$CAP_{Thermal}$ is the increased installed capacity of fossil fuel-fired power plants of the East China Power Grid during the same period (MW).

Please refer to Annex 3 for details.

Based on these data, the build margin emission factor (EF_{BM}) of the East China Power Grid is 0.8672tCO_2e/MWh.

<u>Step 6. Calculate the combined margin emission factor EF_y</u>

The combined margin emissions factor is calculated as follows:

$$EF_{grid,y} = w_{OM} \times EF_{OM,y} + w_{BM} \times EF_{BM,y} \quad (13)$$

Where:

$EF_{grid,BM,y}$	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	Weighting of operating margin emissions factor (%)
w_{BM}	Weighting of build margin emissions factor (%)

According to "Tool to calculate the emission factor for an electricity system", w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period

The fixed credit period is adopted in the project, therefore, EF_y=$EF_{OM,y}$×0.5+ $EF_{BM,y}$×0.5=0.90465tCO_2/MWh.

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

Because the direct measurement of the energy generated using the waste gas is not possible as other fossil fuel(s) along with waste gas are used for energy generation in the proposed project, the procedure specified below is applied according to ACM0012. The relative share of the total generation from waste gas is calculated by considering the total electricity produced the amount and caloric values of the other fuels and of the waste gas used, and the average efficiency of the plants where the energy is produced.

The fraction of energy produced by using the waste gas in the project activity is calculated as follows:

$$f_{WG} = \frac{\left(\frac{\sum_{h=1}^{8760} Q_{WG,h} * NCV_{WG}}{Hr} \right)}{EG_{tot,y}} \quad (14)$$

Where:

$Q_{WG,h}$	is amount of WG recovered (Nm3/h) in hour h
NCV_{WG}	is Net Calorific Value of Waste Gas/heat (TJ/Nm3
H_r	is Average heat rate (1/efficiency) as calculated in equation 1d-1 below.

The average heat rate is given as:

$$H_r = \frac{\sum_{h=1}^{8760} \sum_{i=1}^{I} Q_{i,h} \times NCV_i}{EG_{tot,y}} \quad (15)$$

Where:

Qi,h	is amount of individual fuel (waste gas and other fuel(s)) i consumed at the energy generation unit during hour h (Nm3/h)

NCVi is Net Calorific Value annual average for each individual consumed fuel and the waste gas/heat (TJ/Nm3)

EGtot,y is total annual energy produced at the power or cogeneration plants. (TJ/year)

2. 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.

$$PE_{y} = PE_{AF,y} + PE_{EL,y} \quad (16)$$

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 equipment.

For there are no fossil fuels consumed in the project, $PE_{AF,y}$ is zero.

Project emissions due to electricity consumption of gas cleaning equipment

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

$$PE_{EL,y} = EC_{PJ,y} \times EF_{CO2,EL,y} \quad (17)$$

Where:

$PE_{EL,y}$ Project emissions from consumption of electricity in gas cleaning equipment of project activity (tCO2/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)

For the electricity is purchased from the grid, the CO2 emission factor for electricity (*EFCO2,EL,y*) is determined according to "Tool to calculate the emission factor for an electricity system".

As the project is concerned, electricity consumed for gas cleaning facilities is comprised of two parts: electricity consumed by electro-precipitators and electricity consumed by gas pressurization devices.

According to the tool, the electricity was consumed in gas cleaning equipment in baseline as well; project emissions due to electricity consumption for gas cleaning can be ignored. So the electricity consumed by fans and OG system is ignored.

3. Leakage

No leakage is considered, according to ACM0012.

4. Emission Reduction

The emission reductions by the project activity during a given year *y* are calculated as follows:

$$ER_y = BE_y - PE_y \tag{18}$$

Where:

ER_y are the total emissions reductions during the year *y* in tons of CO_2

PE_y are the emissions from the project activity during the year *y* in tons of CO_2

BE_y are the baseline emissions for the project activity during the year *y* in tons of CO_2.

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

Data / Parameter:	$F_{i,j,y}$
Data unit:	t/m^3
Description:	Amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*
Source of data used:	China Energy Statistical Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Governmental official data.
Any comment:	-

Data / Parameter:	$EF_{CO2,i}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor per unit of energy of the fuel *i*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Chapter 2 Stationary Combustion, Table 2-3
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The country specific values of fuel CO_2 emission factor in China are not available. IPCC default values are used instead.
Any comment:	-

Data / Parameter:	*Installed Capacity*
Data unit:	MW
Description:	*Installed Capacity of ECG*
Source of data used:	China Electric Power Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Governmental official data.
Any comment:	-

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	Electricity generation of power plant j in year y
Source of data used:	China Electric Power Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Governmental official data.
Any comment:	-

Data / Parameter:	NCV_i
Data unit:	TJ/t(m^3)
Description:	Net calorific value (energy content) per mass or volume unit of fuel *i*
Source of data used:	China Energy Statistical Yearbook
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	Governmental official data.
Any comment:	-

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of the fuel *i*
Source of data used:	2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 2 Energy, Chapter 2 Stationary Combustion, Table 2-3
Value applied:	See Annex 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	The country specific values of oxidation factors in China are not available. As such IPCC default values are used instead.
Any comment:	-

Data / Parameter:	$FC_{Adv, coal}$
Data unit:	%
Description:	The coal consumption of power supply with the best thermal power technology commercially available.
Source of data used:	The statistics by State Electricity Regulatory Commission (SERC) on newly built thermal plants in 10th "Five-Year Plan" period 2000-2005. http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf
Value applied:	35.82
Justification of the choice of data or description of measurement methods and procedures actually applied :	It follows the EB guidance and is conservative.
Any comment:	-

Data / Parameter:	$FC_{Adv, Oil}$， $FC_{Adv, Gas}$
Data unit:	%
Description:	The coal consumption of power supply with the best oil and gas fired power plant technology commercially available.
Source of data used:	The statistics by State Electricity Regulatory Commission (SERC) on newly built thermal plants in 10th "Five-Year Plan" period 2000-2005. http://cdm.ccchina.gov.cn/WebSite/CDM/UpFile/File1374.pdf
Value applied:	47.67
Justification of the choice of data or description of measurement methods and procedures actually applied :	It follows the EB guidance and is conservative.
Any comment:	-

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

1. Calculate the baseline emission BE_y

In the project， $BE_y = BE_{En,y} = BE_{Elec,y} + BE_{Ther,y} = f_{cap} * f_{wg} * \Sigma\Sigma (EG_{i,j,y} * EF_{Elec,i,j,y})$

1.1**Calculate** f_{wg}

Total annual energy supplied by the power plants: $EG_{i,j,y}$ ＝$EG_{tot,y}$ = (i.e. electricity generated in power plant supplied by BFG,COG and LDG) ＝$6.05829X10^8$kWh/a;

Amount of waste gas (LDG) consumed at the power plant: Q_{LDG}= 32870Nm^3/h

Average power plant efficiency: H_r＝11254 kJ/kWh;

Net Calorific Value annual average for waste gas (LDG): NCV_{WG} =NCV_{LDG}=7527 kJ/Nm^3;

Full load working hours of the power plant:6500h/a.

According to formula (4)and (5),f_{wg}=0.236;

1.2 **Calculate** BE_y

In the project, f_{cap} =1；

f_{wg} =0.236；

$EF_{Elec,i,j,y}$ =$EG_{tot,y}$=$6.05829X10^8$kWh/a；

$EF_{Elec,i,j,y}$=$EF_{OM,y}$/2+ $EF_{BM,y}$/2=0.90465tCO_2/MWh；

Therefore, $BE_{Elec,y}$= 129,273 tCO_2.

2. Calculate the Project emission PE_y

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

2.1 Calculate $EC_{PJ,y}$

$EC_{PJ,y}$ is comprised of electricity consumed by electro-precipitators and electricity consumed by gas pressurization devices.

(1)Electricity consumed by electro-precipitators

Two sets of electro-precipitators will be installed. Electricity consumed by no.1 electro-precipitator is 504,576 kWh/a, and that of no.2 is378,432kWh/a.Thus,electricity consumed by electro-precipitators is 883,008 kWh/a.

(2) Electricity consumed by gas pressurization devices

Two sets of the same gas pressurization device will be installed. For each gas pressurization machine, electricity consumed is 1,927,200 kWh/a. Thus, electricity consumed by two sets of the same gas pressurization devices is 3,854,400 kWh/a.

Therefore, $EC_{PJ,y}$=883,008 kWh/a+3,854,400 kWh/a＝4,737,408 kWh/a=4,737.408 MWh/a;

PE_y= = $EC_{PJ,y} \times EF_{CO2,EL,y}$=4,737.408 MWh/a×0.90465tCO_2/MWh=4,286t/a

3. Leakage

There is no leakage in the project, namely: $L_y=0$.

4. Emission Reductions

Then estimated annual emission reductions in tonnes of CO_2 in the project activity are:

$ER_y = BE_y - PE_y - L_y$ =129,273 tCO_2e -4,286tCO_2e=124,987 tCO_2e.

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

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	2,143	64,637	0	62,494
2009	4,286	129,273	0	124,987
2010	4,286	129,273	0	124,987
2011	4,286	129,273	0	124,987
2012	4,286	129,273	0	124,987
2013	,4,286	129,273	0	124,987
2014	4,286	129,273	0	124,987
2015	4,286	129,273	0	124,987

2016	4,286	129,273	0	124,987
2017	4,286	129,273	0	124,987
2018	2,143	64,637	0	62,494
Total (tonnes of CO_2e)	42,860	1,292,730	0	1,249,870

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

B.7.1. Data and parameters monitored:

Data / Parameter:	E_1
Data unit:	MWh
Description:	Electricity supplied by no.1 generator(the quantity of electricity consumed by no.1 generator for the operation had already been subtracted)
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	605,829(together with E_2)
Description of measurement methods and procedures to be applied:	Use ammeter A1; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The ammeter will be adjusted every 5 years by NISCO who passed measuring management system certification issued by the government.
Any comment:	-

Data / Parameter:	E_2
Data unit:	MWh
Description:	Electricity supplied by no.2 generator(the quantity of electricity consumed by no.2 generator for the operation had already been subtracted)
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	605,829(together with E_1)

Description of measurement methods and procedures to be applied:	Use ammeter A2; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The ammeter will be adjusted every 5 years by NISCO who passed measuring management system certification issued by the government.
Any comment:	-

Data / Parameter:	E_{1-2}
Data unit:	MWh
Description:	Electricity consumed by no.1 &no.2 generator for start-up
Source of data to be used:	Monitored by 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:	Use ammeter A1-2; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The ammeter is periodically adjusted by NISCO who passed measuring management system certification issued by the government.
Any comment:	-

Data / Parameter:	E_3
Data unit:	MWh
Description:	Electricity consumed by the facility in the LDG tank area (include electro-precipitator, gas pressurization station and etc.)
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions insection B.5	4,737(together with E_4)
Description of measurement methods and procedures to be applied:	Use ammeter A3; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The ammeter will be adjusted every 5 years by NISCO who passed measuring management system certification issued by the government.
Any comment:	-

Data / Parameter:	E_4
Data unit:	MWh
Description:	Electricity consumed by the facility in LDG tank area (include electro-precipitator, gas pressurization station and etc.)
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4,737(together with E_3)
Description of measurement methods and procedures to be applied:	Use ammeter A4; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The ammeter will be adjusted every 5 years by NISCO who passed measuring management system certification issued by the government.
Any comment:	-

Data / Parameter:	Q_{LDG}
Data unit:	Nm^3/h
Description:	The flow rate of LDG used for electric power generation
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	32,870
Description of measurement methods and procedures to be applied:	Use flow meter Q1; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The meter will be calibrated once a year and all the staff to be involved in the calibration work have already been accredited by Nanjing Municipal Measurement and Test Institute.
Any comment:	-

Data / Parameter:	Q_{BFG}
Data unit:	*N*m³/h
Description:	The flow rate of BFG used for electric power generation
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	160,972
Description of measurement methods and procedures to be applied:	Use flow meter Q2; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The meter will be calibrated once a year and all the staff to be involved in the calibration work have already been accredited by Nanjing Municipal Measurement and Test Institute.
Any comment:	-

Data / Parameter:	Q_{COG1}
Data unit:	Nm³/h
Description:	The flow rate of COG used for electric power generation(to no.1boiler)
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	26,422(together with Q_{COG2})
Description of measurement methods and procedures to be applied:	Use flow meter Q31; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The meter will be calibrated once a year and all the staff to be involved in the calibration work have already been accredited by Nanjing Municipal Measurement and Test Institute.
Any comment:	-

Data / Parameter:	Q_{COG2}
Data unit:	Nm³
Description:	The flow rate of COG used for electric power generation(to no.2 boiler)
Source of data to be used:	Monitored by the project owner

Value of data applied for the purpose of calculating expected emission reductions in section B.5	26,422 (together with Q_{COG1})
Description of measurement methods and procedures to be applied:	Use flow meter Q32; the project owner is responsible for periodic adjustment of the ammeter.
QA/QC procedures to be applied:	The meter will be calibrated once a year and all the staff to be involved in the calibration work have already been accredited by Nanjing Municipal Measurement and Test Institute.
Any comment:	-

Data / Parameter:	NCV_{LDG}
Data unit:	TJ/ Nm^3
Description:	The net calorific value of LDG for electric power generation
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	7527
Description of measurement methods and procedures to be applied:	Calorific value of the LDG will be measured with LGA---200C Semiconductor Laser In-line Meter produced by Hangzhou Changju Science and Technology Company, and the gas will be sampled from the pipeline after the compressor.
QA/QC procedures to be applied:	The meter will be calibrated once a year by Nanjing Municipal Measurement and Test Institute.
Any comment:	-

Data / Parameter:	NCV_{BFG}
Data unit:	TJ/ Nm^3
Description:	The net calorific value of BFG for electric power generation
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3056
Description of measurement methods and procedures to be	Calorific value of the blast furnace gas will be measured with GC---960 Gas Chromatograph produced by Shanghai Huaai Chromatographic

applied:	Technology Company. And the gas will be sampled from the gas storage and distribution center.
QA/QC procedures to be applied:	The meter will be calibrated once a year by Nanjing Municipal Measurement and Test Institute.
Any comment:	-

Data / Parameter:	NCV_{COG}
Data unit:	TJ/ Nm^3
Description:	The net calorific value of COG for electric power generation
Source of data to be used:	Monitored by the project owner
Value of data applied for the purpose of calculating expected emission reductions in section B.5	17,900
Description of measurement methods and procedures to be applied:	Calorific value of the coke oven gas will be measured with GC---920 Gas Chromatograph produced by Shanghai Huaai Chromatographic Technology Company, and the gas will be sampled from the gas storage and distribution center.
QA/QC procedures to be applied:	The meter will be calibrated once a year by Nanjing Municipal Measurement and Test Institute.
Any comment:	-

B.7.2. Description of the monitoring plan:

NISCO has received a management system certification issued by the government.

The monitoring will be managed by the Energy Centre of NISCO.

1. Organization of the Monitoring Activities

Energy Management Division of the Energy Center will be responsible for the management of the organization and implementation of the monitoring. It will record and archive the monitoring data, provide in accordance with relevant requirements monitoring data reports and relevant detection reports.

Gas Operation Section of the Energy Center will be responsible for the monitoring of calorific values of LDG (waste gas), BFG and COG, and provide to the Energy Management Division with caloric value data. Energy Management Division of the Energy Center will be responsible for the monitoring of the quantity of LDG, BFG and COG used for generation, as well as electricity supplied and consumed by the project

2. Monitoring spot

The monitoring plan in this project will be carried out as per methodology ACM0012. The location of monitoring spots is shown in the chart below.

Spot of monitoring:

A1: Electricity supplied by no.1 50MW Generator (the quantity of electricity consumed by no.1 generator for the operation had already been subtracted), E_1;

A2: Electricity supplied by no.2 50MW Generator (the quantity of electricity consumed by no.2 generator for the operation had already been subtracted), E_2;

A1-2: Electricity consumed by no.1 &no.2 generator for startup,E1-2;

A3,A4: Electricity consumed by the facility in LDG tank area(include electricity consumed for gas cleaning equipment such as electro-precipitators, gas pressurization devices and etc.),E_3,E_4;

Q1: Quantity of LDG (waste gas) used for electricity generation, Q_{LDG};

Q2: Quantity of BFG used for electricity generation, Q_{BFG};

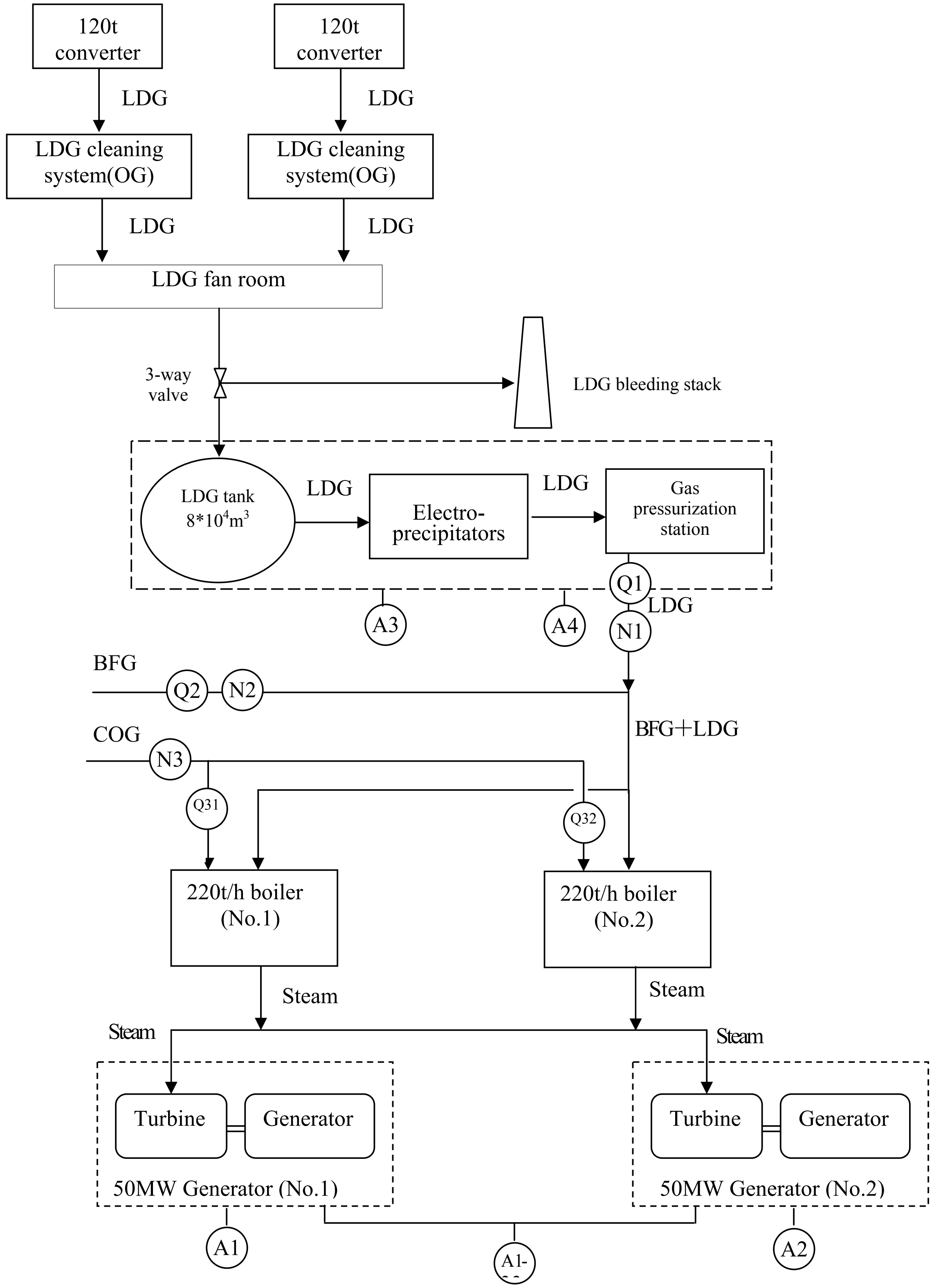
Q31: Quantity of COG used for electricity generation which is entered into no.1 boiler, Q_{COG1};

Q32: Quantity of COG used for electricity generation which is entered into no.2 boiler, Q_{COG2};

N1: Net calorific value of LDG (waste gas), NCV_{LDG};

N2: Net calorific value of BFG, NCV_{BFG};

N3: Net calorific value of COG, NCV_{COG}.


120t converter
120t converter
LDG
LDG
LDG cleaning system(OG)
LDG cleaning system(OG)
LDG
LDG
LDG fan room
3-way valve
LDG bleeding stack
LDG tank $8*10^4m^3$
LDG
Electro-precipitators
LDG
Gas pressurization station
Q1
LDG
N1
A3
A4
BFG
Q2
N2
BFG+LDG
COG
N3
Q31
Q32
220t/h boiler (No.1)
220t/h boiler (No.2)
Steam
Steam
Steam
Steam
Turbine
Generator
50MW Generator (No.1)
Turbine
Generator
50MW Generator (No.2)
A1
A2

3. Quality assurance and quality control measures

Gas flow meter will be calibrated once a year and all the staff to be involved in the calibration work have already been accredited by Nanjing Municipal Measurement and Test Institute.

Caloric value analysers will be calibrated once a year by Nanjing Municipal Measurement and Test Institute.

Ammeters will be calibrated every 5 years and all the staff to be involved in the calibration work have already been accredited by Nanjing Bureau of Quality and Technical Supervision.

4. Data storage

All data collected as part of monitoring plan should be archived electronically and be kept at least for 2 years after the end of the last crediting period.

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):

The application of the baseline study and monitoring methodology was completed on March 1, 2008, by Capital Engineering & Research Incorporation Ltd. (CERI), Mitsubishi Research Institute and Dr. Duan Maosheng of Tsinghua University. The contact information is provided below:

Tel: 8610-83587982

Fax: 8610-83587982

E-mail: liurong@ceri.com.cn

None of Capital Engineering & Research Incorporation Ltd. (CERI), Mitsubishi Research Institute and Dr. Duan Maosheng is a project participant.

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:

20/11/2006 (start of operation)

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

15 years and 0 month

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

C.2.1. Renewable crediting period:

>> Not applicable

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

C.2.1.2. Length of the first crediting period:

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/10/2008 or the date of registration, which ever is later

C.2.2.2. Length:

10 years and 0 month

SECTION D. Environmental impacts

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

The environment impact assessment report for the project has been approved by the State Environment Protection Administration of China.

Waste gas

In the project, the surplus LDG of steel plant will be recovered and used for power generation. Since there is little dust (<7 mg/Nm^3) and NOx (<200mg/Nm^3) contents in the waste gas generated during LDG burning, no treatment system like fume deducting system is required. The waste gas will be exhausted to the air through a stack of 120m high, which is in accordance with the national standard on environment protection.

Waste water

In the project, little of drainage from the indirect circulating water system will be sent to the comprehensive industrial water cleaning station of NISCO and then recycled. Therefore, no waste water will be drained and then no any influence will be occurred to local water resource.

Noise

In the project, the main noise source will include boiler, steam turbine generator, ID fan, blower, water pump and cooling tower. NISCO pays attention to the control to noise source and then low-noise-level equipment will be provided. The equipment will be located in shop building for sound insulation and also some other sound-insulation and sound-absorption measures will be taken to control the noise level within the stipulated range of standard. For the project, the power plant will be located in the plant area of

NISCO adjacent to the bank of Shitou River. The noise generated in normal operation will not have influence on the environment through the sound-insulation and range attenuation measures.

In conclusion, environmental impacts arising from the project are considered insignificant.

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 environment impact assessment report for the project has been approved by the State Environment Protection Administration of China. The project is a project characterized by resource comprehensive utilization and will bring other environmental benefits as well.

SECTION E. Stakeholders' comments

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

This project aiming at resource comprehensive utilization and environmental protection will have little impact on the dwellers in the surrounding areas. To find out stakeholders attitude towards the proposed project, 35 questionnaires were distributed to the residents from neighbouring communities to the project, the 30 recycled, which return-ratio 86%.

The content of the questionnaire is shown below.

1. Where did you hear about the proposed project? □Newspaper □TV or broadcast □Internet □Friends
2. What do you think of the local environment? □Very satisfied □Satisfied □Accepted □Dissatisfied
3. Do you think which is the main factor that influences on the local economics? □Power supply □Means of transportation □Natural resource □Human resource □Others □Unaware
4. Do you think which is the main factor that affected the local environment? □SO_2 □Water pollution □Noise □Dust □Others □Unaware
5 Before/after the construction of the project, how do you think about the local environmental pollution? □Worse □No change □Better □Unaware
6. What improvement will be made in your opinion on the local environment by construction of the project? □Atmospheric environment □Water environment □Noise □Waste solid
7. Do you think that construction of the project is benefit to the local economics? □Very positive □Positive □Negative □Very negative □Unaware
8. Are you for or against the project? □For □Against

9. What will be the impact on your own life quality and your family in terms of the project?
10. What suggestion and requirement do you have for this project regarding environmental protection?

E.2. Summary of the comments received:

A summary of the consulted stakeholders' comments is provided in the follow table.

sex	Male		female
	46.7%		53.3%
age	18-30	31-55	> 56
	26.7%	60%	13.3%
Education level	Junior middle school	Senior middle school	Above college
	6.7%	86.6%	6.7%

The contents from the questionnaire are summarized as follows:

No.	Content	Alternatives	Amount	Share (%)
1	Where did you hear about the proposed project?	Newspaper	15	50
		TV or broadcast	7	23.3
		Internet	0	0
		Friends	8	26.7
2	What do you think of the local environment?	Very satisfied	6	20
		Satisfied	14	46.7
		Accepted	10	33.3
		Dissatisfied	0	0
3	Do you think which is the main factor that influences on the local economics?	Power supply	8	26.7
		Means of transportation	8	26.7
		Natural resource	6	20
		Human resource	4	13.3
		Others	0	0
		Unaware	4	13.3
4	Do you think which is the main factor	SO_2	4	13.3

	that affected the local environment?	Water pollution	9	30
		Noise	3	10
		Dust	14	46.7
		Others	0	0
		Unaware	0	0
5	Before/after the construction of the project, how do you think about the local environmental pollution?	Worse	0	0
		No change	20	66.7
		Better	6	20
		Unaware	4	13.3
6	What improvement will be made in your opinion on the local environment by construction of the project?	Atmospheric environment	25	83.3
		Water environment	1	3.3
		Noise	3	10
		Waste solid	1	3.3
7	Do you think that construction of the project is benefit to the local economics?	Very positive	10	33.3
		Positive	18	60
		Negative	0	0
		Very negative	0	0
		Unaware	2	13.3
8	Are you for or against the project?	For	30	100
		Against	0	0

The results show that 28 out of 30 people (accounting for 93.3%) think the project will have a positive impact on the local economics. No one thinks that construction of the project will be harmful to the local environment. All of the respondents support the proposed project.

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

All survey respondents support the project. No modification of the project is needed. Meanwhile, NISCO will strictly implement measures required by the EIA to achieve the project's environmental, social and economic benefits.

In addition, NISCO will maintain regular communication with the stakeholders during the operating periods.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Nanjing Iron & Steel United Co., LTD.
Street/P.O.Box:	Dachang District
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FAX:	+86 25 84816649
E-Mail:	wxf@nansteel.com
URL:	-
Represented by:	Liu Yuejian
Title:	Department Manager
Salutation:	Mr.
Last Name:	Liu
Middle Name:	-
First Name:	Yuejian
Department:	Development & Planning Department
Mobile:	-
Direct FAX:	+86 25 57793497
Direct tel:	+86 25 57074718
Personal E-Mail:	-

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	International Bank for Reconstruction and Development (World Bank) as the trustee of the Italian Carbon Fund
Street/P.O.Box:	1818 H Street, NW
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State/Region:	D.C.
Postcode/ZIP:	20433
Country:	United States of America
Telephone:	+1 202 473 9198
FAX:	+1 202 522 7432
E-Mail:	ibrd-carbonfinance@worldbank.org
URL:	www.carbonfinance.org
Represented by:	Joelle Chassard
Title:	Manager, Carbon Finance Unit
Salutation:	Ms.
Last Name:	Chassard
Middle Name:	-
First Name:	Joelle
Department:	ENVCF
Mobile:	-
Direct FAX:	+1 202 522 7432
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Personal E-Mail:	-

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Ministry of Environment, Republic of Italy
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City:	Rome
State/Region:	-
Postcode/ZIP:	00147
Country:	Republic of Italy
Telephone:	+39 06 5722 8101
FAX:	-
E-Mail:	PIA-SDG@minambiente.it
URL:	www.italiancarbonfund.org
Represented by:	Corrado Clini
Title:	General Director
Salutation:	Mr.
Last Name:	Clini
Middle Name:	-
First Name:	Corrado
Department:	Department for Environmental Research and Development
Mobile:	-
Direct FAX:	-
Direct Telephone:	+39 06 5722 8101
Personal E-Mail:	-

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The public funds involved in this project exclude existing ODA.

The sovereign Annex I participants of this project confirm that any public funding used to purchase emission reductions from this project does not result in a diversion of ODA and is separate from and is not counted towards its financial obligations as a Party included in Annex I.

Annex 3

BASELINE INFORMATION

Table A3-1: Electricity Generation from Fossil Fuels of East Power Grid in 2001

Province	Total Electricity Generation （MWh)	Electricity Generation from Fossil Fuels （MWh)	Fossil Fuels Stations Service Power Consumption Rate （%）	Electricity Supply from Fossil Fuels （MWh)
Shanghai	57697000	57697000	5.54	54500586
Jiangsu	104120000	104062000	6.39	97412438
Zhejiang	78817000	65691000	6.06	61710125
Anhui	41742000	40816000	6.60	38122144
Fujian	44639000	21170000	7.30	19624590
Total				271369884

Data source：China Electric Power Yearbook 2002

Table A3-2: Electricity Generation from Fossil Fuels of East Power Grid in 2002

Province	Total Electricity Generation （MWh)	Electricity Generation from Fossil Fuels （MWh)	Fossil Fuels Stations Service Power Consumption Rate （%）	Electricity Supply from Fossil Fuels （MWh)
Shanghai	61648000	61648000	5.44	58294349
Jiangsu	116876000	116716000	6.09	109607996
Zhejiang	88921000	69287000	5.95	65164424
Anhui	47060000	45703000	6.36	42796289
Fujian	53308000	30850000	6.68	28789220
Total				304652277

Data source: China Electric Power Yearbook 2003.

Table A3-3: Electricity Generation from Fossil Fuels of East Power Grid in 2003

Province	Total Electricity Generation （MWh)	Electricity Generation from Fossil Fuels （MWh)	Fossil Fuels Stations Service Power Consumption Rate （%）	Electricity Supply from Fossil Fuels （MWh)
Shanghai	69444000	69444000	5.14	65874578.4
Jiangsu	133677000	133277000	5.9	125413657
Zhejiang	109220000	83089000	5.31	78676974.1
Anhui	55715000	54156000	6.06	50874146.4
Fujian	61071000	42146000	5.07	40009197.8
Total				360848553.7

Data source: China Electric Power Yearbook 2004.

Table A3-4: Electricity Generation from Fossil Fuels of East Power Grid in 2004

Province	Total Electricity Generation （MWh)	Electricity Generation from Fossil Fuels （MWh)	Fossil Fuels Stations Service Power Consumption Rate （%）	Electricity Supply from Fossil Fuels （MWh)
Shanghai	71134000	71127000	5.22	67414170.6
Jiangsu	163901000	163545000	5.93	153846781.5
Zhejiang	125883000	95255000	5.68	89844516
Anhui	61102000	59875000	6.03	56264537.5
Fujian	65966000	50490000	6.07	47425257
Total				414795262.6

Data source: China Electric Power Yearbook 2005.

Table A3-5: Electricity Generation from Fossil Fuels of East Power Grid in 2005

Province	Total Electricity Generation （MWh)	Electricity Generation from Fossil Fuels （MWh)	Fossil Fuels Stations Service Power Consumption Rate （%）	Electricity Supply from Fossil Fuels （MWh)
Shanghai	74626000	74606000	5.05	70,838,397
Jiangsu	212000000	211429000	5.96	198,827,832
Zhejiang	143782000	108110000	5.59	102,066,651
Anhui	64224000	62918000	5.9	59,205,838
Fujian	77700000	48600000	4.57	46,378,980
Total				477,317,698

Data source: China Electric Power Yearbook 2006.

Table A3-6 Calculation of simple OM emission factor of East China Grid in 2003

		Shang hai	Jiangsu	Zhejiang	Anhui	Fujian	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km^3)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D	E	F=A+B+C +D+E	G	H	I	J=F*G*H*I* 44/12/10000(mass unit) J=F*G*H*I* 44/12/1000(volume unit)
Raw coal	10000 t	2618	6417.74	3442.4	2669.67	1754	16901.81	25.8	100	20908	334300359.13
Cleaned coal	10000 t						0	25.8	100	26344	0
Other washed coal	10000 t						0	25.8	100	8363	0
Coke	10000 t						0	29.5	100	28435	0
Coke oven gas	10^8m^3	1.99	0.06				2.05	12.1	100	16726	152125.76
Other gas	10^8m^3	66.34					66.34	12.1	100	5227	1538454.90
Crude oil	10000 t						0	20	100	41816	0
Gasoline	10000 t							18.9	100	43070	0.00
Diesel oil	10000 t	1.26	14.71	13.99			29.96	20.2	100	42652	946463.80
Fuel oil	10000 t	95.49	0.76	174.48		18.89	289.62	21.1	100	41816	9369683.52
LPG	10000 t						0	17.2	100	50179	0.00
Refinery gas	10000 t	0.49	0.96				1.45	18.2	100	46055	44564.35
Natural gas	10^8m^3						0	15.3	100	38931	0
Other petroleum products	10000 t	18.91	5.3	15.04			39.25	20	100	38369	1104387.72
Other coking products	10000 t						0	25.8	100	28435	0
Other energy	10000 tce	5.68		7.08			12.76	0	100	0	0.00
Total											347456039.18

Date source：2006 IPCC Guidelines for National Greenhouse Gas Inventories. China Energy Statistical Yearbook 2004.

Table A3-7 Calculation of simple OM emission factor of East China Grid in 2004

		Shang hai	Jiangsu	Zhejiang	Anhui	Fujian	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km^3)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D	E	F=A+B+C +D+E	G	H	I	J=F*G*H*I* 44/12/10000(mass unit) J=F*G*H*I* 44/12/1000(volume unit)
Raw coal	10000 t	2779.6	7601.9	4008.9	2906.2	2183.7	19480.3	25.8	100	20908	385300230.33
Cleaned coal	10000 t						0	25.8	100	26344	0.00
Other washed coal	10000 t		5.46			4.63	10.09	25.8	100	8363	79826.01
Coke	10000 t						0	25.8	100	28435	0.00
Coke oven gas	$10^8 m^3$	2.59					2.59	12.1	100	16726	192197.91
Other gas	$10^8 m^3$	72.46					72.46	12.1	100	5227	1680380.49
Crude oil	10000 t						0	20	100	41816	0.00
Diesel oil	10000 t						0	18.9	100	43070	0.00
Fuel oil	10000 t	2.69	27.17	6.23			36.09	20.2	100	42652	1140116.11
LPG	10000 t	58.52	55.07	202.89		23.26	339.74	21.1	100	41816	10991147.99
Refinery gas	10000 t						0	17.2	100	50179	0.00
Natural gas	$10^8 m^3$	0.77	0.55				1.32	18.2	100	46055	40568.93
Other petroleum products	10000 t		0.14				0.14	15.3	100	38931	30576.41
Other coking products	10000 t	21.22	1.37	24.89			47.48	20	100	38369	1335957.42
Other energy	10000 tce						0	25.8	100	28435	0.00
Other energy	10000 tce	6.43		15.48			21.91	0	100	0	0.00
Total											400791001.59

Date source：2006 IPCC Guidelines for National Greenhouse Gas Inventories. China Energy Statistical Yearbook 2005.

Table A3-8 Calculation of simple OM emission factor of East China Grid in 2005

		Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km^3)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D	E	F=A+B+C +D+E	G	H	I	J=F*G*H*I* 44/12/10000(mass unit) J=F*G*H*I* 44/12/1000(volume unit)
Raw coal	10000 t	2847.31	9888.06	4801.52	3082.9	2107.69	22727.48	25.8	100	20908	449526099.64
Cleaned coal	10000 t						0	25.8	100	26344	0.00
Other washed coal	10000 t						0	25.8	100	8363	0.00
Coke	10000 t			0.03			0.03	25.8	100	28435	806.99
Coke oven gas	$10^8 m^3$	1.68	1.38		1.71		4.77	12.1	100	16726	353970.67
Other gas	$10^8 m^3$	83.72	24.97	0.06	30		138.75	12.1	100	5227	3217675.86
Crude oil	10000 t			27.01			27.01	20	100	41816	828263.45
Gasoline	10000 t						0	18.9	100	43070	0.00
Diesel oil	10000 t	1.25	16	4.52		1.67	23.44	20.2	100	42652	740491.04
Fuel oil	10000 t	59.39	13.22	153.22		7.45	233.28	21.1	100	41816	7546991.82
LPG	10000 t						0	17.2	100	50179	0.00
Refinery gas	10000 t	0.57	0.83				1.4	18.2	100	46055	43027.65
Natural gas	$10^8 m^3$	1.09	1.85	0.62			3.56	15.3	100	38931	777514.36
Other petroleum products	10000 t	21	8.38	34.8			64.18	20	100	38369	1805849.77
Other coking products	10000 t						0	25.8	100	28435	0.00
Other energy	10000 tce	12.36		15.29			27.65	0	100	0	0.00
Total											464840691.25

Date source：2006 IPCC Guidelines for National Greenhouse Gas Inventories; China Energy Statistical Yearbook 2006

Table A3-9 Calculation of average emission factor of Central China Power Grid in 2003

		Jiangxi	Henan	Hubei	Hunan	Chong qing	Sichuan	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km^3)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K= G*H*I*J*44/12/10000(mass unit) K=G*H*I*J*44/12/1000(volume unit)
Raw coal	10000 t	1427.41	5504.94	2072.44	1646.47	769.47	2430.93	13851.66	25.8	100	20908	273971539.89
Cleaned coal	10000 t							0	25.8	100	26344	0.00
Other washed coal	10000 t	2.03	39.63			106.12		147.78	25.8	100	8363	1169146.40
Coke	10000 t				1.22			1.22	25.8	100	28435	32817.40
Coke oven gas	10^8m^3			0.93				0.93	12.1	100	16726	69013.15
Other gas	10^8m^3							0	12.1	100	5227	0.00
Crude oil	10000 t		0.5	0.24			1.2	1.94	20	100	41816	59490.23
Gasoline	10000 t							0	18.9	100	43070	0.00
Diesel oil	10000 t	0.52	2.54	0.69	1.21	0.77		5.73	20.2	100	42652	181015.94
Fuel oil	10000 t	0.42	0.25	2.17	0.54	0.28	1.2	4.86	21.1	100	41816	157229.00
LPG	10000 t							0	17.2	100	50179	0.00
Refinery gas	10000 t	1.76	6.53		0.66			8.95	18.2	100	46055	275069.63
Natural gas	10^8m^3					0.04	2.2	2.24	15.3	100	38931	489222.52
Other petroleum products	10000 t							0	20	100	38369	0.00
Other coking products	10000 t							0	25.8	100	28435	0.00
Other energy	10000 tce		11.04			16.2		27.24	0	100	0	0.00
Total												276404544.15
Total electricity supply (MWh)						225987719						
Average emissions factor (tCO_2e/MWh)						1.223095						

Date source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories; China Electric Power Yearbook 2004.

Table A3-10 Calculation of average emission factor of Central China Power Grid in 2004

		Jiangxi	Henan	Hubei	Hunan	Chong qing	Sichuan	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km^3)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D	E	F	G=A+B+C+D+E+F	H	I	J	K= G*H*I*J* 44/12/10000(mass unit) K=G*H*I*J* 44/12/1000(volume unit)
Raw coal	10000 t	1863.8	6948.5	2510.5	2197.9	875.5	2747.9	17144.1	25.8	100	20908	339092605.29
Cleaned coal	10000 t		2.34					2.34	25.8	100	26344	58316.13
Other washed coal	10000 t	48.93	104.22			89.72		242.87	25.8	100	8363	1921441.23
Coke	10000 t		109.61					109.61	25.8	100	28435	2948455.29
Coke oven gas	10^8m^3			1.68		0.34		2.02	12.1	100	16726	149899.53
Other gas	10^8m^3					2.61		2.61	12.1	100	5227	60527.09
Crude oil	10000 t		0.86	0.22				1.08	20	100	41816	33118.27
Gasoline	10000 t		0.06			0.01		0.07	18.9	100	43070	2089.33
Diesel oil	10000 t	0.02	3.86	1.7	1.72	1.14		8.44	20.2	100	42652	266627.32
Fuel oil	10000 t	1.09	0.19	9.55	1.38	0.48	1.68	14.37	21.1	100	41816	464893.14
LPG	10000 t							0	17.2	100	50179	0.00
Refinery gas	10000 t	3.52	2.27					5.79	18.2	100	46055	177950.07
Natural gas	10^8m^3						2.27	2.27	15.3	100	38931	495774.61
Other petroleum products	10000 t							0	20	100	38369	0.00
Other coking products	10000 t							0	25.8	100	28435	0.00
Other energy	10000 tce		16.92		15.2	20.95		53.07	0	100	0	0.00
Total												345671697.30
Total electricity supply (MWh)						249074186						
Average emissions factor (tCO_2e/MWh)						1.387826						

Date source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories; China Electric Power Yearbook 2005.

Table A3-11 Calculation of average emission factor of Central China Power Grid in 2005

		Jiangxi	Henan	Hubei	Hunan	Chongqing	Sichuan	Total	Emissions factor (tc/TJ)	Oxidation rate (%)	Heat value (MJ/t, km^3)	Emissions (tCO_2e)
Fuel	Unit	A	B	C	D	E	F	G=A+B+C +D+E+F	H	I	J	K=G*H*I*J* 44/12/10000(mass unit) K=F*G*H*I* 44/12/1000(volume unit)
Raw coal	10000 t	1869.29	7638.87	2732.15	1712.27	875.4	2999.77	17827.75	25.8	100	20908	352614496.76
Cleaned coal	10000 t	0.02						0.02	25.8	100	26344	498.43
Other washed coal	10000 t		138.12			89.99		228.11	25.8	100	8363	1804669.00
Coke	10000 t		25.95		105			130.95	25.8	100	28435	3522490.83
Coke oven gas	10^8m^3			1.15		0.36		1.51	12.1	100	16726	112053.61
Other gas	10^8m^3		10.2			3.12		13.32	12.1	100	5227	308896.88
Crude oil	10000 t		0.82	0.36				1.18	20	100	41816	36184.78
Gasoline	10000 t		0.02			0.02		0.04	18.9	100	43070	1193.90
Diesel oil	10000 t	1.3	3.03	2.39	1.39	1.38		9.49	20.2	100	42652	299797.78
Fuel oil	10000 t	0.64	0.29	3.15	1.68	0.89	2.22	8.87	21.1	100	41816	286959.09
LPG	10000 t							0	17.2	100	50179	0.00
Refinery gas	10000 t	0.71	3.41	1.76	0.78			6.66	18.2	100	46055	204688.68
Natural gas	10^8m^3						3	3	15.3	100	38931	655208.73
Other petroleum products	10000 t							0	20	100	38369	0.00
Other coking products	10000 t				1.5			1.5	25.8	100	28435	40349.27
Other energy	10000 tce		2.88		1.74	32.8		37.42	0	100	0	0.00
Total												359887487.74
Total electricity supply (MWh)						286203305						
Average emissions factor (tCO_2e/MWh)						1.257454						

Date source: 2006 IPCC Guidelines for National Greenhouse Gas Inventories; China Electric Power Yearbook 2006.

Table A3-12 Emissions Factor of Yangcheng Power Plant

year	fuel consumption rate of electricity supply (gce/kWh)	Heat Value (GJ/tce)	Oxidation rate	Emissions factor (tC/TJ)	**Emissions Factor (tCO_2e/MWh)**
2003	343	29.271	0.98	25.8	0.9497
2004	341	29.271	0.98	25.8	0.9442
2005	339	29.271	0.98	25.8	0.9387

Table A3-13 OM of the East China Power Grid in 2003

Total Emissions of East China Power Grid (tCO_2e)	A	347456039.18
Supply from Central China Power Grid (MWh)	B1	13756040
Average emission factor of Central China Power Grid in 2003	C1	0.7974
Supply from Yangcheng Power Plant (MWh)	B2	10705870
Average emission factor of Yangcheng Power Plant in 2003	C2	0.9498
Total Emissions of East China Power Grid (tCO_2e)	D=A+C1*B1+C2*B2	368593903
Total electricity supply (MWh)	E	385310464
$EF_{OM,2003}$ (tCO_2e/MWh)	F=D/E	0.9566

Table A3-14 OM of the East China Power Grid in 2004

Total Emissions of East China Power Grid (tCO_2e)	A	400791001.59
Supply from Central China Power Grid (MWh)	B1	26933850
Average emission factor of Central China Power Grid in 2004	C1	0.8264
Supply from Yangcheng Power Plant (MWh)	B2	11649610
Average emission factor of Yangcheng Power Plant in 2004	C2	0.9442
Total Emissions of East China Power Grid (tCO_2e)	D=A+C1*B1+C2*B2	434050485
Total electricity supply (MWh)	E	453378723
$EF_{OM,2004}$ (tCO_2e/ MWh)	F=D/E	0.9574

Table A3-15 OM of the East China Power Grid in 2005

Total Emissions of East China Power Grid (tCO_2e)	A	464840691.25
Supply from Central China Power Grid (MWh)	B1	160410000
Average emission factor of Central China Power Grid in 2005	C1	0.771225
Supply from Yangcheng Power Plant (MWh)	B2	77244000
Average emission factor of Yangcheng Power Plant in 2005	C2	0.9387
Total Emissions of East China Power Grid (tCO_2e)	D=A+C1*B1+C2*B2	661062081
Total electricity supply (MWh)	E	714971698
$EF_{OM,2005}$ (tCO_2e/ MWh)	F=D/E	0.9246

The Operating Margin emission factor of ECG is calculated as the weighted average of $EF_{OM,2003}$, $EF_{OM,2004}$ and $EF_{OM,2005.}$

EF_{OM}=0.9421 tCO_2e/ MWh.

2.Calculate BM

Table A3-16 Emissions Factors of Most Advanced Commercial Power Technologies

	Variable	Power Generation Efficiency	Emissions Factor (tc/TJ)	Oxidation rate	Emissions Factor (tCO_2/MWh)
		A	B	C	D=3.6/A/1000*B*C*44/12
Coal-fired Power Plant	$EF_{Coal,Adv}$	35.82%	25.8	1	0.9508
Gas-fired Power Plant	$EF_{Gas,Adv}$	47.67%	15.3	1	0.4237
Oil-fired Power Plant	$EF_{Oil,Adv}$	47.67%	21.1	1	0.5843

2.1Calculate the proportions of the corresponding CO_2 emissions of the solid fuel, liquid fuel and gas fuel to the total emission.

$$\lambda_{Coal} = \frac{\sum_{i \in COAL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

$$\lambda_{Oil} = \frac{\sum_{i \in OIL, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

$$\lambda_{Gas} = \frac{\sum_{i \in GAS, j} F_{i,j,y} \times COEF_{i,j}}{\sum_{i,j} F_{i,j,y} \times COEF_{i,j}}$$

From the formula above and Table A3-8, the proportions of the corresponding CO_2 emissions of the solid fuel, liquid fuel and gas fuel to the total emission could be calculated as follows:

λ_{Coal}=96.71%，λ_{Oil}=2.35%，λ_{Gas}=0.94%.

2.2 Calculate the fuel-fired emission factors ($EF_{Thermal}$) of the grids based on the emissions of the best technology commercially as follows:

$EF_{Thermal} = \lambda_{Coal} \times EF_{Coal,Adv} + \lambda_{Oil} \times EF_{Oil,Adv} + \lambda_{Gas} \times EF_{Gas,Adv} = 0.9372$ tCO_2e/MWh.

2.3 Calculate EF_{BM} of the ECG

Table A3-17 Installed Capacity of East China Power Grid in 2005

Installed Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Fossil fuel-fired	MW	13113.5	42506.4	27688.1	11423.2	9345.4	104076.6
Hydro	MW	0	142.6	6952.1	749.8	8224.9	16069.4
Nuclear	MW	0	0	3066	0	0	3066
Wind and others	MW	253.3	58.8	37.2	0	52	401.3
total	MW	13366.8	42707.8	37743.4	12173	17622.3	123613.3

Source: China Electric Power Yearbook 2006.

Table A3-18 Installed Capacity of East China Power Grid in 2004

Installed Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Fossil fuel-fired	MW	12014.9	28289.5	21439.8	9364.5	8315.4	79424.1
Hydro	MW	0	126.5	6418.4	692.8	7180.1	14417.8
Nuclear	MW	0	0	3056	0	0	3056
Wind and others	MW	3.4	17.6	39.7	0	12	72.7
total	MW	12018.3	28433.6	30953.9	10057.3	15507.5	96970.6

Source: China Electric Power Yearbook 2005.

Table A3-19 Installed Capacity of East China Power Grid in 2003

Installed Capacity	Unit	Shanghai	Jiangsu	Zhejiang	Anhui	Fujian	Total
Fossil fuel-fired	MW	11092.6	22245	15321.2	9284.9	7092.8	65036.5
Hydro	MW	0	137.8	6054.5	649.1	6761.1	13602.5
Nuclear	MW	0	0	2406	0	0	2406
Wind and others	MW	0	0	39.7	0	12	51.7
total	MW	11092.6	22382.7	23821.4	9934	13865.8	81096.5

Source: China Electric Power Yearbook 2004.

Table A3-20 BM of East China Power Grid

Installed Capacity	2003	2004	2005	2004-2005	Ratio of the Increased Installed capacity
	A	B	C	D=C-B	
Fossil fuel-fired（MW）	65036.5	79424.1	104076.6	24652.5	92.53%
Hydro（MW）	13602.5	14417.8	16069.4	1651.6	6.20
Nuclear（MW）	2406	3056	3066	10	0.04
Wind（MW）	51.7	72.6	401.3	328.7	1.23
total（MW）	**81096.5**	**96970.5**	**123613.3**	**26642.8**	**100.00%**
Ratio of the Installed capacity in 2004	65.60%	78.45%	100%		
BM (tCO_2/MWh)	0.8672				

Therefore,EF_{BM}=0.9004 tCO_2e/MWh×87.39％＝0.8672tCO_2e/MWh.

Annex 4

MONITORING INFORMATION

Please refer to Section B7 for the detailed Monitoring Plan.