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

CONTENTS

Annexes

SECTION A. General description of project activity

A.1. Title of the project activity:

Captive power generation through waste heat recovery system in a steel plant in Jinan City, China
Version: 04
Date: 03/03/2008

A.2. Description of the project activity:

The project activity is to reduce GHG emissions through installation of captive power generation through waste heat recovery system known as coke dry quenching (CDQ) equipment to the coke ovens in the Jinan steel plant of Jinan Iron and Steel Group Corporation (hereafter called JIGANG) in Shandong Province of China. The CDQ systems will recover waste heat from red-hot coke produced from No. 6 and No. 7 coke ovens and utilize the heat for electricity generation.

Generation capacity of planned CDQ totals 25 MW of which the effective capacity for power generation totals 21.35MW. This will result in annual generation of approximately 176,778 MWh. Through implementation of this project activity, grid electricity from the North China Power Grid (hereafter called NCG) will be replaced and emission reductions of 167,055 tCO_2e/year can be achieved during the crediting period.

The JIGANG steel plant mainly uses coke wet quenching (CWQ) system to cool down coke coming out the coke ovens, and heat of red hot coke is released into the atmosphere. CDQ will recover currently wasted heat in wet quenching process and will result in more effective use of electricity in JIGANG steel plant.

The project activity will result in transfer of technology from a developed country to a developing country. This will contribute to sustainable development of China especially by the followings:

1) Recover wasted heat from red hot coke and utilize it for generating electricity which result in reduction of grid power import, therefore reducing GHG emissions
2) Contribute to water conservation. The project will reduce water usage by 0.38t/t-coke comparing to that of the wet quenching system
3) Improve air quality. Cooling one ton of coke with wet quenching system will produce 0.5 ton of steam which includes some chemical compounds and dust. Pollutants produced in the process of wet quenching system comprises of one third of the total pollutants produced in the whole coking process. CDQ will result in significant reduction of dust emitted into the air. Coke wet quenching system produces dust ranging 200 – 400g /t-coke while that of CDQ will be less than 3 g/t-coke based on empirical data obtained from CDQ facilities in Japan.
4) Create employment opportunities for the local community during the construction.

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)	Jinan Iron and Steel Group Corporation (JIGANG)	No
Japan	Nippon Steel Corporation (NSC)	No

For detailed contact information of the project participants, please refer to Annex 1.

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.:

>>
Shandong province

A.4.1.3. City/Town/Community etc:

>>
Jinan 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 at No.21 Industry North Road, East Industry Zone of Jinan City. It borders Taishan in the south and the Yellow River in the north. The exact location is at 117°00′ longitude and 36°40′ latitude.

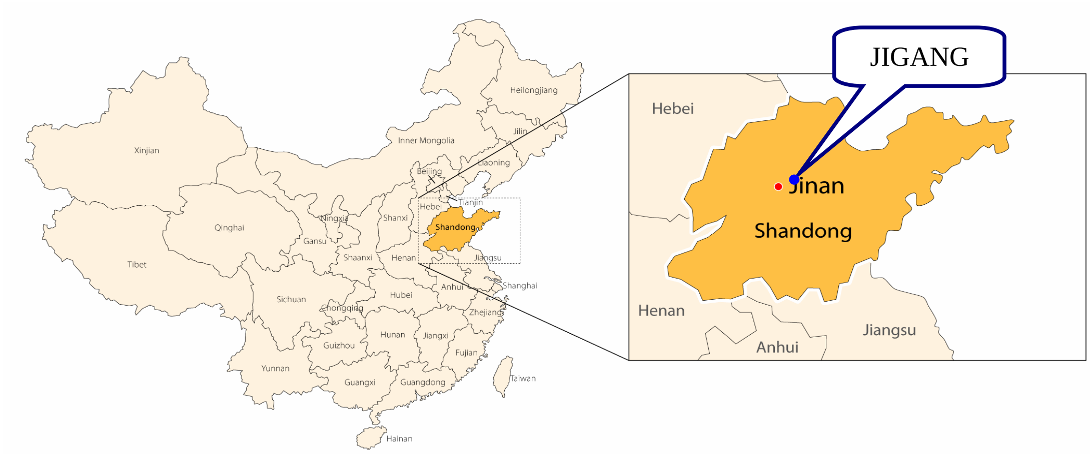

Figure 1 Location map of JIGANG

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

The project activity would be classified under Type (1) Energy industries.

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

Nippon Steel Corporation provides CDQ technology and facility to the project activity which is shown in the Figure 2 below.
Coke dry quenching (CDQ) is a process by which coke is cooled with low temperature inert gas in a shaft-like cooling unit called cooling chamber in a CDQ plant. When pushed out of the coke oven, the coke has a temperature of about 1,000 °C and with the CDQ it is cooled to 200 – 250°C. The gas, through the process of heat exchange (cooling coke), is heated to 900 –950 °C and it is recycled by a blower. The heated gas is used to produce steam in a boiler to generate power with extraction-condensing turbines. Inert gas is cooled down by going through the boiler and it is reused to cool down the heated coke.

The diagram below shows the system of CDQ.

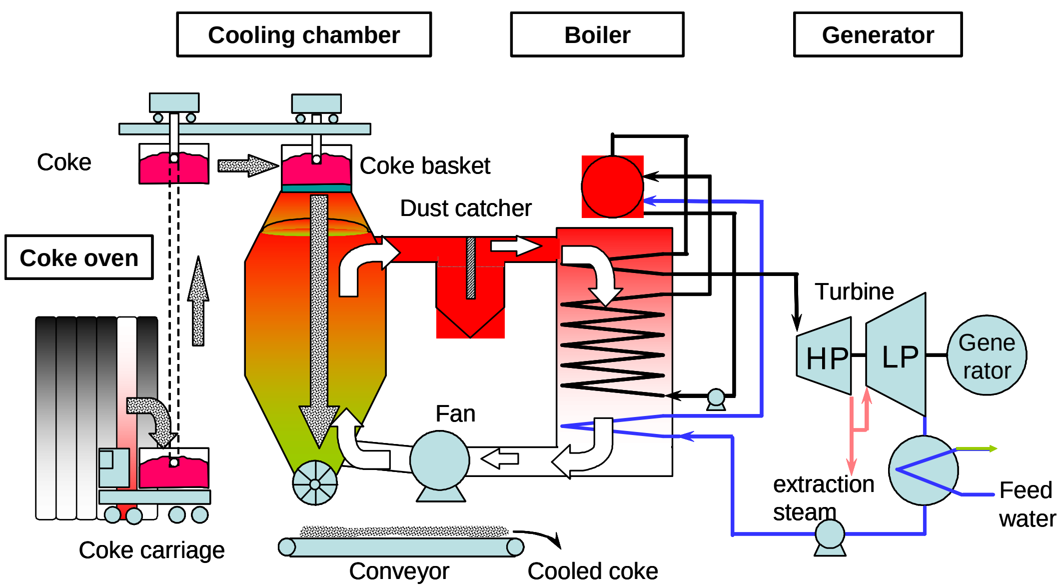

Figure 2: Diagram of coke dry quenching equipment

Main components of the CDQ system include:
- CDQ capacity: 150t/h
- Waste heat boiler with capacity of 79t/h, the steam under the pressure of 9.8MPa, 450 °C
- Turbine power generator with capacity of 25MW

The project adopted first high-temperature high-pressure waste heat boiler in China.

The main technology/equipment will be imported from Japan, including circulating fan, electromotor vibrating input device, airtight revolving valve and some other valves.

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

The project activity is expected to generate estimated annual emission reductions of 167,055tCO2e and 1,670,550 tCO_2 over the ten-year crediting period.

Please indicate the chosen crediting period and provide the total estimation of emission reductions as well as annual estimates for the chosen crediting period. Information on the emission reductions shall be indicated using the following tabular format.	
Years	**Annual estimation of emission reductions in tonnes of CO_2e**
2008	111,370
2009	167,055
2010	167,055
2011	167,055
2012	167,055
2013	167,055
2014	167,055
2015	167,055
2016	167,055
2017	167,055
April 2018	55,685
Total estimated reductions (tonnes of CO_2e)	1,670,550
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	167,055

A.4.5. Public funding of the project activity:

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No public funding from Annex 1 countries is provided to the proposed project.

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:

Approved consolidated baseline/ monitoring methodology ACM0004 ver2 (Consolidated baseline methodology for waste gas and /or heat and /or pressure for power generation, version 02) and ACM0002 (Consolidated baseline / monitoring methodology for grid connected electricity generation from renewable sources, version 06) are applied to this project activity.

As required by methodology ACM0004, ACM0002 is used to calculate the emission factor of electricity supply, and the latest approved version 03 of *the Tool for the Demonstration and Assessment of Additionality* is used to demonstrate and assess the project's additionality.

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

The approved consolidated baseline / monitoring methodology ACM0004 ver2 applies to project activities:

- that generate electricity from waste heat or the combustion of waste gases in industrial facilities;
- that displace electricity generation with fossil fuels in the electricity grid or displace captive electricity generation from fossil fuels;
- where no fuel switch is done in the process where the waste heat or the waste gas is produced after the implementation of the project activity.

This project meets all of the applicability conditions above:

1. The project activity will utilize wasted heat from red hot coke in the process of coking to generate electricity.
2. The project activity will replace a part of electricity in North China Power Grid which is mostly dominated by thermal power plants. .
3. After implementation of this project activity, fuel switching will not occur.

Accordingly, it is appropriate to use the consolidated baseline / monitoring methodology ACM0004 for this project.

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

The project boundary is the proposed activity, and the spatial extent of the baseline boundary comprises the waste heat sources and all power plants physically connected to the North China Power Grid which is including Beijing, Tianjin, Hebei Province, Shanxi Province, Shandong Province and Inner Mongolia Autonomous Region.

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

	Source	Gas		Justification / Explanation
Baseline	Grid electricity generation	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification. This is conservative.
		N_2O	Excluded	Excluded for simplification. This is conservative.
	Captive electricity generation	CO_2	Included	No emissions from project activity (as it utilizes waste heat to generate power).
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
Project Activity	On-site fossil fuel consumption due to the project activity	CO_2	Included	No emissions from CDQ since no fossil fuel is required to operate
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.
	Combustion of waste gas for electricity generation	CO_2	Excluded	It is assumed that this gas would have been burned in the baseline scenario.
		CH_4	Excluded	Excluded for simplification.
		N_2O	Excluded	Excluded for simplification.

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

The possible alternative scenarios in the absence of the CDM project activity would be as follows:

(a) The proposed project activity not undertaken as a CDM project activity (Project scenario)
(b) Import of electricity from the grid
(c) Existing or new captive power generation on-site, using other energy sources than waste heat and/or gas, such as coal, diesel, natural gas, hydro, wind, etc;
(d) A mix of options (b) and (c)
(e) Other uses of the waste heat
(f) The continuation of the current situation, whether this is captive or grid-based power supply.

1. Screening of alternatives that do not comply with legal and regulatory requirements:
According to *The State Council office's directive on prohibiting construction of coal-fired plants with installed capacity under 135 MW* (http://www.gov.cn/gongbao /content/2002/content_61480.htm), the Chinese government restricts construction of captive power plants with fossil fuel which have generation capacity of less than 135MW, therefore coal-fired captive power generation is not possible. Other captive power generation using other fossil fuels such as heavy oil and natural gas is also not feasible as large investment in power generation equipment and running cost of purchasing fuel surpasses the cost of importing grid electricity which requires no additional investment. As a consequence, alternative (c) listed above is not a realistic option.
Alternative (d) is not feasible, since alternative (c) is not feasible.

2. Screening of alternatives that depend on key resources such as fuels, materials or technology that are not available at the project site:
Alternative (e) is not feasible as there is no technology that utilizes waste heat of red hot coke except CDQ. At the same time, there is no demand at JIGANG plant or surroundings of JIGANG for steam as

there is sufficient steam supply already. Taking advantage of waste heat in the form other than proposed in the project activity is not plausible.

From the screening above, alternatives (a) and (b) are considered feasible baseline scenarios and discussed further in the following section.
Please see section B5 for details.

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):

According to the consolidated baseline methodology ACM0004 ver2, the project must demonstrate additionality according to the most recent version (version 3) of the "*Tool for the demonstration and assessment of additionality.*" The Tool consists of the following steps:

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 alternative scenarios in the absence of the CDM project activity would be as follows:
(a) The proposed project activity not undertaken as a CDM project activity (Project scenario)
(b) Import of electricity from the grid
(c) Existing or new captive power generation on-site, using other energy sources than waste heat and/or gas, such as coal, diesel, natural gas, hydro, wind, etc
(d) A mix of options (b) and (c)
(e) Other uses of the waste heat
(f) The continuation of the current situation, whether this is captive or grid-based power supply.

Sub step 1b. Enforcement of applicable laws and regulations

As mentioned above, the Directive issued by the General Office of the State Council (http://www.gov.cn/gongbao /content/2002/content_61480.htm) prohibits the installation of coal-fired power plants with capacity of 135MW or below.
All the alternatives are in line with applicable laws and regulations with the exception of alternative (c) and (d). Alternative (c) and (d) include investment in a 25MW captive power plant, therefore, alternative (c) and (d) are not applicable. At the same time, there are no renewable sources available near the project site. JIGANG is located in Jinan city where wind resources suitable for wind power generation are not available (wind resources suitable for power generation are available either in inland China or the coastal zones). At the same time, there are no rivers suitable for hydro power generation on-site. As such the renewable power generation with the equivalent capacity is not possible.

Alternative (a), there are no legal or regulatory barriers to this option. However, it is economically unviable, as discussed below.
Alternatives (b), without the proposed project activity, JIGANG would use the coke wet quenching technology, and the electricity necessary for supporting the production of coke would come from the North China Power Grid. Electricity import is common in most iron & steel plants in China, and it meets all national regulations. Hence, alternatives (b) are the feasible baseline scenarios.

Alternative (e) is not feasible as there is no technology and demand explained in the above section.

Alternative (f) is the same as option (b) which is already discussed above, therefore, alternative (f) will not be discussed for avoiding duplication.

From the screening above, alternatives (a) and (b) are considered feasible baseline scenarios and discussed further in the following section.

Step 2: Investment analysis

Step 2 is not used for the proposed CDM project activity.

Step 3: Barrier analysis
In this step, project participants need to determine whether the proposed project activity faces barriers that:
(a) Prevent the implementation of this type of proposed project activity; and
(b) Do not prevent the implementation of at least one of the alternatives.

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

Through additionality test, the following barriers are identified for alternative (a).

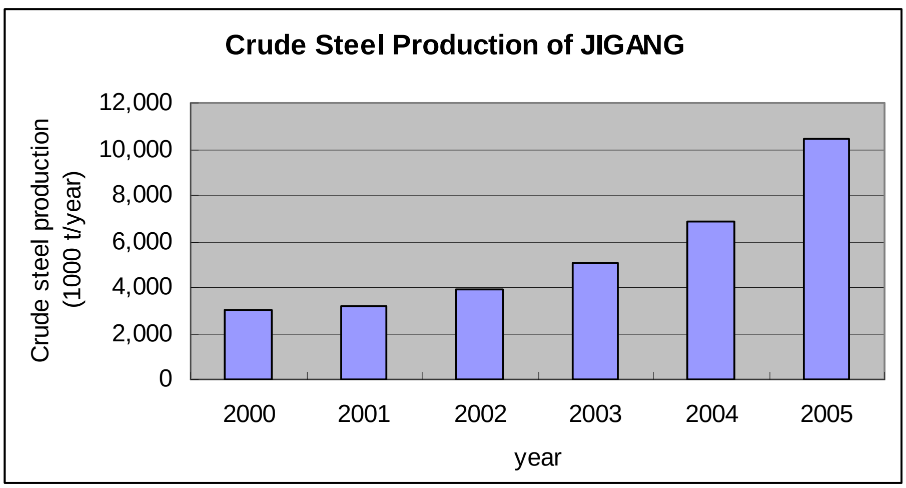
Investment barriers:

Installation of CDQ at JIGANG plant would face the following investment barriers. At the same time, the board of JIGANG indicated that it made its investment decision in expectation to gain revenues from sales of CERs.
(1) Larger upfront payment compared to that of other conventional system.
Financing new installation of CDQ will face investment barriers due to its large upfront payment and operation and maintenance costs. Investment to one set of CDQ facilities amounts 170 million yuans, while coke wet quenching system of the same capacity costs only 6 million yuans. It is difficult to justify investment to CDQ which is nearly 28 times larger than that of wet quenching system, most common system in the country.

(2) Past experience and credibility gap for CDQ which hampered investment
JIGANG has installed two sets of CDQ to its steel plant in 1999 as a part of national energy saving demonstration project, however, JIGANG had to face with their malfunctions. Because the CDQ facilities installed at the time was not properly installed, JIGANG had to rebuild most of the equipment by itself (more than 90%), which was a large burden on JIGANG. In addition, the CDQ facilities did not achieve the manufacturer specification. Those CDQ facilities operate at only 70% of specification data. Furthermore, they still have malfunctions which cause extra maintenance and extra cost. JIGANG had to make investment just for repairing the existing CDQs. The part of the cost was reported in JIGANG's annual report in 2005. The cost amounted up to 26.41 million yuans (8 million was invested in 2004). JIGANG expects to raise profit of 53.0 million yuans out of repairing the CDQs over 20 year period which result in payback period of about 10 years. This is much longer comparing to other investments which normally have payback period of 3 to 4 years.
These outcomes brought from the first sets of CDQ embedded strong negative impression of the facility to not only the board members but also to the engineers on the technical aspects of CDQ for a long time.

This experience of malfunctions and unexpected costs of CDQ created pressure on the board members when making new investment in certain types of energy efficiency technology as they may face the risk of unsatisfactory result of the investment and also the risk of criticism from its shareholders.
Investment into CDQ seemed to be a high risk option for JIGANG as it was not readily justifiable to its shareholders based on the past experience. As a consequence, there had been no investment made to build CDQ until Nippon Steel Corporation introduced its new CDQ technology with the idea of the CDM and guaranteed technical support.

(3) Investment priority in JIGANG
As explained in Section A.2, JIGANG has tripled its steel production over the past 6 years (see Graph 1 below). This production expansion involved vast amount of investment and the trend of investment continues today.
When there is high demand for iron and steel products, which is main products of JIGANG, the board of directors have much higher priority in the area of investment for production rather than that for energy efficiency improvement.
Investment in energy efficiency is placed as lower investment priority for many companies that are expanding its production.
In the case of JIGANG, it has already installed wet quenching system for cooling coke which has remaining life of around 30 years, and this even makes its investment to CDQ a more difficult option.



Graph 1 Crude steel production of JIGANG from year 2000 to 2005

The investment barriers mentioned above were alleviated as NSC offered to procure all the CERs generated by the project activity.

These investment barriers listed in items (1) to (3) above do not exist for alternative (b).

<u>Technical barrier:</u>

The CDQ facilities used in the project activity are developed by NSC, and their key parts and technology in the process has to be imported from Japan. In China, existing CDQ facilities are either supported by the Chinese government or aided by the Japanese government.
Technological differences of CDQ installed in JIGANG before and the new sets that are introduced from NSC caused hesitation by JIGANG. The new CDQ facilities proposed by NSC are almost twice the size of the existing CDQ facilities compared to those already installed in JIGANG.

The CDQ facility has advanced technology and complicated system. This results in higher requirements for facility design and construction than that of wet quenching system. As a consequence, CDQ will require additional engineers to operate and maintain the facility. For instance, those engineers to operate the CDQ will have to have training. In the case of the proposed project activity, CDQ operation requires 48 persons while that of wet quenching system requires only about 10 persons. CDQ operation and maintenance requires not only more personnel but also higher quality of personnel. Therefore, JIGANG has to provide intensive training for CDQ manager, operator, engineers, maintenance staff and electricians for a few months.

From the past experience in malfunction of CDQ facilities, JIGANG was reluctant to consider the proposal of installing new sets of CDQ until NSC encouraged to take steps in line with CDM and promised continued cooperation.
The necessary engineering and training will be provided from NSC to JIGANG as stipulated in the contract dated 11 May 2005 which alleviate above mentioned technical barriers.

This barrier does not exist for alternative (b).

These conditions mentioned above pose both investment and technical barriers to the project activity which is alternative (a) whereas these do not pose any barriers to the alternative (b).
From the abovementioned conditions, it can be concluded that the baseline scenario for the project activity is alternative (b) which is “Import of electricity from the grid”.

Step 4．Common practice analysis

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

In overall China, there are some companies that have already adopted CDQ for quenching coke. For instance, Bao Steel Group has introduced its first CDQ in the country in 1980’s from Japan as a part of national policy of the Chinese government. Other examples of CDQ being implemented is with financial support of official development assistance. At the same time, some steel plants have adopted CDQ for trial as their parent steel company established an engineering company which provides CDQ.
On the other hand, despite the fact that CDQ is encouraged by national policy, overall CDQ diffusion rate in China is still at a low rate through the study conducted by the project participants. The diffusion rate of the CDQ at the time of PDD elaboration was below 10% from 1999 to 2004[1] based on study and interviews conducted by the project participants while the Tenth Five Year Plan by the Chinese government estimates the potential of CDQ installation is at the level of 60 %. This is due to rapid increase in coke production surpassing implementation rate of CDQ in China.

[1] 26 August 2004 was the date that JIGANG made its investment decision on CDQ as a CDM project activity and the basic design of the CDQ facility began on 1 April 2005, therefore, the common practice analysis was conducted up to the year 2004.

In addition, despite the fact that there are many steel plants in the North China region, there is only one example of CDQ installation (except the case of JIGANG which was installed as a part of demonstration project), which was done in the ShouGang steel plant. The facility was aided by the Japanese government as an Activity Implemented Jointly project under the UNFCCC scheme.

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

There are only few cases in China that utilize CDQ for quenching coke, and in the North China region, there is no project activity similar to the proposed project activity. Moreover, most of the cases are either supported under national program or aid from overseas. Currently installed CDQs are still at their early stage and their results need to be demonstrated to prove the effectiveness of its technology. As it stands now, CDQ technology still faces financial barrier at the time of its investment as well as understanding for technological credibility.

The followings are to respond to the comments made in Section 4.9 of the Draft Validation Report:

Comments made in Section 4.9 of the Draft Validation Report	Response to the comments
Comment 1: The possible prevalence of CDQ in Chinese steel plants should be discussed considering the tenth five year plan in China.	Although the tenth Five Year Plan identifies the potential diffusion rate of CDQ to be 60%, the actual diffusion rate is far lower than the potential due to rapid increase in coke production surpassing implementation rate of CDQ in China. The data will be submitted to the DOE.
Comment 2: The prevalence of CDQ in 2005 should be discussed.	As this project activity describes its own situation at the time the project made its investment decision, the study was conducted up until 2004, and there is no detailed study conducted for the data vintages after 2005. However, to demonstrate how CDQ became more diffused with the CDM scheme, the list of CDQ projects in the stage of registration, requesting registration and under validation is shown below. This shows current diffusion of CDQ is made with the CDM. Registered: -Qian'an Zhonghua Coal Chemical Co., Ltd. -Baotou Iron & Steel Under validation: - Shanxi Antai Group Holding Co., Ltd - Jiangsu Shagang Group Company - Anshan Iron and Steel Group Corporation (Yingkou) - Anshan Iron and Steel Group Corporation (Anshan) - Shanghai Meishan Iron & Steel Co., Ltd. - Wugang (2 projects) - Laiwu Iron & Steel Group Corp. - Jingdezhen Kaimenzi Ceramics Chemical Industry Group Limited Company

	- Ma Steel (2 projects)
Comment 3: The CDQ existing currently in China should be explained.	As explained above, when JIGANG made its investment decision, the only examples of CDQ installed were Bao Steel (government funded national project), ShouGang (AIJ aided by Japanese government), JIGANG (environmental demonstration project) and others with ODA or trial projects. The detailed list will be provided to DOE for clarification.
Comment 4: The scale and the operating result of the host company are not considered to link with the investment barrier directly. However the project participants need to clarify it.	JIGANG is a publicly listed company with good financial records. It generated profit of 12 billion yuans in 2005, however, this does not simply solve the barrier for investment to CDQ. As it is publicly listed, JIGANG has to consider shareholders opinion. As explained above, past investment to CDQ turned out to be unprofitable and JIGANG has to be very careful before it makes the investment into the same type of project. Moreover, JIGANG was expanding its operation to survive through merger and acquisition foreseen at the time. As a result, investment to energy efficiency was put on the bottom of the investment priority when there was no mandatory regulation to follow.
Comment 5: "IRR of the project owner's operation is 7.01%" is not correct however it's ROA. Although ROA can not be compared with the project IRR, the project participants should clarify considering the comment received.	IRR describes how much earnings that an investment can make in the future while ROA describes earnings from total assets of a company in a certain point in time. A company would not measure profitability of its investment based on ROA or comparing IRR of a project with ROA of the companies.
Comment 6: The comment received is inconsistent with the description in the PDD. It needs be clarified and evidenced in the PDD.	As mentioned above, investment referred in the comment is only a part of the total investment (8 million yuans out of 26.41 million yuans) just for repairing CDQ which was reported in the 2004 annual report. This is the amount for additional investment besides investment in the facility itself at the beginning. At the same time the expected profit will be gained not in a short period of time, rather it is expected to be recovered over 20 years.

The construction of the CDQ had started on 11 November 2006 and the general contract of CDQ design among Shougang Design Institute, Nippon Steel and Beijing China-Japan Joint Environmental Engineering was agreed on 3 March 2005.
The project had been discussed as a CDM project between Nippon Steel Corporation and JIGANG. In August 2004, after close consultation with NSC on the CDM scheme, the Board of JIGANG has made its decision for the investment to the CDQ facility as a CDM project activity which is the evidence prior to the starting date of the project activity.

B.6. Emission Reductions:

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B.6.1. Explanation of methodological choices:

Project emissions:
Project emissions and leakage emissions are zero as CDQ uses only waste heat and no auxiliary fuels. At the same time, there is no leakage involved in the project activity and calculation for leakage is not required by ACM0004 ver2.

Baseline emissions:
The formula for calculating baseline emission is as follows:

$BE_{electricity,\ y} = EG_y * EF_y$

Where,

EG_y	Net quantity of electricity supplied to the manufacturing facility by the project during the year *y* in MWh, and
EFy	CO_2 baseline emission factor for the electricity displaced due to the project activity during the year y (tCO_2e/MWh).

Since the baseline scenario is determined as grid power imports, following the Option 2 of the baseline emission calculation in ACM0004 ver2, the emission factor is calculated as in the method described in ACM0002 ver6. It applies a combined margin (CM) method as an average value obtained from operating margin (OM) and build margin (BM) emission factors.

STEP 1. Calculate the Operating Margin emission factor(s) ($EF_{OM,y}$) based on one of the four following methods:

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

This project activity employs the Simple OM method. According to the ACM0002 ver6, the Simple OM method (a) as North China Power Grid is dominated by low-cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years (see detail for report on carbon emission factor made publicly available by the Chinese DNA).

The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated as the generation-weighted average emissions per electricity unit (tCO_2e/MWh) of all generating sources serving the system, not including low-operating cost and must-run power plants:

The Simple OM emission factor was calculated using either of the following data vintages for years(s) *y*:
(ex-ante) the full generation-weighted average for the most recent 3 years for which data are available at the time of PDD submission, if or,

In this project activity, ex-ante vintage from 2003 to 2005 will be applied to calculate carbon emission factor of the project activity and will remain fixed during the crediting period.

The following formula is used to calculate the emission factor of Simple OM.

$$EF_{OM,simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}}$$

where,

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

j refers to the power sources delivering electricity to the grid, not including low-operating cost and mustrun power plants, and including imports[2] to the grid,

$COEF_{i,j\,y}$ is the CO_2 emission coefficient of fuel *i* (tCO_2 e/ mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources *j* and the percent oxidation of the fuel in year(s) *y*, and

$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source *j*.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEF_i = NCV_i * EF_{CO2,i} * OXID_i$$

where:

NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel *i*,

$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 2006 IPCC Guidelines for default values),

$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel *i*.

Where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

STEP 2. Calculate the Build Margin emission factor (*$EF_{BM,y}$*) as the generation-weighted average emission factor (tCO_2/MWh) of a sample of power plants *m*, as follows:

The following formula is used to calculate the emission factor of BM.

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}}$$

where $F_{i,m,y}$, $COEF_{i,m}$ and $GEN_{m,y}$ are analogous to the variables described for the simple OM method

[2] As described above, an import from a connected electricity system should be considered as one power source *j*.

above for plants *m*.

According to ACM0002, project participants shall choose between one of the following two options:

- Option 1. Calculate the Build Margin emission factor $EF_{BM,y}$ ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission.
- Option 2. For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually ex-post for the year in which actual project generation and associated emissions reductions occur.

For the project activity, option 1 was chosen for BM emission factor.

The sample group m consists of either the five power plants that have been built most recently, or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

In China, it is very difficult to obtain the data of the five existing power plants built most recently or the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that were built most recently because these data are considered as confidential business information by the plants owners.

Taking account of the situation, EB accepted 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 EB suggested that the Project participants use the following alternative solutions in absence of data[3]: Use the efficiency level of the best technology commercially available in the provincial/regional or national grid of China, as a conservative proxy, foe 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.

STEP 3. Calculate the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

Emission factor of OM ($EF_{OM,y}$) is based on data made available in Chinese national statistics by the Chinese government.

According to the data, value for OM is 1.1207 and BM is 0.9397 (See Annex 3 for detail).

Calculation of the baseline emission factor EF_y as the weighted average of the Operating Margin emission factor ($EF_{OM,y}$) and the Build Margin emission factor ($EF_{BM,y}$):

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[3] 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

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y}$$

where the weights w_{OM} and w_{BM}, by default, are 50% (i.e., $w_{OM} = w_{BM} = 0.5$), and $EF_{OM,y}$ and $EF_{BM,y}$ are calculated as described in Steps 1 and 2 above and are expressed in tCO_2/MWh

Therefore, $EF_y = 0.5 \times 1.1207 + 0.5 \times 0.9397 = 1.0302$ tCO_2e/MWh

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

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	Electricity delivered to the grid by relevant power sources j excluding low operating cost/must run power plants in year 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 :	Since the detailed generation data by power plants are not publicly available, therefore the aggregated data by fuel types are used instead.
Any comment:	All archived data explained in the tables will be kept during the crediting period and two years after.

Data / Parameter:	$F_{i,j,y}$
Data unit:	t/m^3
Description:	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 :	Since the detailed fuel consumption data by power plants are not publicly available, therefore the aggregated data by fuel types are used instead.
Any comment:	All archived data explained in the tables will be kept during the crediting period and two years after.

Data / Parameter:	$OXID_i$
Data unit:	%
Description:	Oxidation factor of the fuel *i*
Source of data used:	IPCC 2006 Guidelines default value
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:	All archived data explained in the tables will be kept during the crediting period and two years after.

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:	IPCC 2006 Guidelines default value
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. As such IPCC default values are used instead.
Any comment:	All archived data explained in the tables will be kept during the crediting period and two years after.

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 :	According to ACM0002, the national specific value shall be used preferentially.
Any comment:	All archived data explained in the tables will be kept during the crediting period and two years after.

Data / Parameter:	$CAP_{j,y}$
Data unit:	MW
Description:	Installed capacity of relevant power source j connected to the grid 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 :	Following the EB guidance regarding application of AM0005 in China, the capacity weighted is used instead of generation weighted in calculation of BM emission factor.
Any comment:	All archived data explained in the tables will be kept during the crediting period and two years after.

Data / Parameter:	EF_{OM}
Data unit:	tCO_2/ MW
Description:	Operating Margin Emission Factor
Source of data used:	Calculated ex ante as weighted average emission factor of power plants excluding the low operating cost/must run power plants.
Value applied:	1.1207
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according to ACM0002 and EB guidance.
Any comment:	All archived data explained in the tables will be kept during the crediting period and two years after.

Data / Parameter:	EF_{BM}
Data unit:	tCO_2/ MW
Description:	Build Margin Emission Factor
Source of data used:	Calculated ex ante as weighted average emission factor of the 20% most recent power plants built.
Value applied:	0.9397
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated according to ACM0002 and EB guidance.
Any comment:	All archived data explained in the tables will be kept during the crediting period and two years after.

Data / Parameter:	EF_y
Data unit:	tCO_2/ MW
Description:	Combined Margin Emission Factor
Source of data used:	Calculated ex ante as weighted average of OM and BM emission factors
Value applied:	1.0302
Justification of the choice of data or description of measurement methods and procedures actually applied :	Calculated following the formula presented in ACM0002.
Any comment:	All archived data explained in the tables will be kept during the crediting period and two years after.

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

Project emissions (PE_y)
Project emissions and leakage emissions are zero as mentioned section B.6.2.

Baseline emissions (BE_y)
The formula for calculating baseline emission is as follows:

$BE_y = EG_y * EF_y$

Where,

EG_y Net quantity of electricity supplied to the manufacturing facility by the project during the year y (MWh/y)
EF_y CO_2 baseline emission factor for the electricity displaced due to the project activity during the year y (tCO_2e/MWh)

$EG_y = EG_{GEN} - EG_{aux}$

Where,

EG_{GEN} Total quantity of electricity generated by the project activity during the year y (MWh/y)
EG_{aux} Auxiliary electricity consumption by the project activity during the year y (MWh/y)

Project emission reductions:

Note that the numbers appear below are rounded from the exact figures used in the excel file and the values calculated with the numbers may not coincide with the calculation result shown below.

Electricity generation (MWh/y) = Generation capacity (MW) * Hours per day (h/day) * Days per year (day/y) * Load factor (%)
= 21.35 * 24 * 365 * 0.9452
= 176,778 MWh/y

Self consumption of electricity (MWh/y) = Generation capacity (MW) * Hours per day (h/day) * Days per year (day/y) * Load factor (%)
= 1.766 [4] * 24 * 365 * 0.9452
= 14,620 MWh/y

Net electricity supplied = 176,778 MWh/y - 14,620 MWh/y
= 162,158 MWh/y

Emission reduction = Baseline electricity consumption * Baseline carbon emission factor
= 162,158 MWh/y * 1.0302 tCO_2e/MWh

[4] This includes all the power consuming equipment related to CDQ: CDQ itself, dust catcher, control room, power station, blower and boiler cooling water system

= 167,055 tCO_2e/y

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

>>

Year	Estimation of project activity emissions (□ones of CO_2e)	Estimation of baseline emissions (□ones of CO_2e)	Estimation of leakage (□ones of CO_2e)	Estimation of overall emission reductions (□ones of CO_2e)
2008	0	111,370	0	111,370
2009	0	167,055	0	167,055
2010	0	167,055	0	167,055
2011	0	167,055	0	167,055
2012	0	167,055	0	167,055
2013	0	167,055	0	167,055
2014	0	167,055	0	167,055
2015	0	167,055	0	167,055
2016	0	167,055	0	167,055
2017	0	167,055	0	167,055
April 2018	0	55,685	0	55,685
Total (tonnes of CO_2e)	0	1,670,550	0	1,670,550

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

B.7.1. Data and parameters monitored:

Data / Parameter:	E_{GEN}
Data unit:	MWh/yr
Description:	The gross electricity generated by the proposed project
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	176,778
Description of measurement methods and procedures to be applied:	Continuous measurement. Use one power meter; personnel are responsible for periodic adjustment of the power meter.
QA/QC procedures to be applied:	The power meter is periodically adjusted by a qualified service company to ensure that it meets the national standard.
Any comment:	All archived data explained in the tables will be saved in electronic format and kept during the crediting period and two years after.

Data / Parameter:	E_{AUX}
Data unit:	MWh/yr
Description:	Part of the electricity consumed by the facility of the proposed project

	itself
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	14,620
Description of measurement methods and procedures to be applied:	Continuous measurement. Use power meters; personnel are responsible for periodic adjustment of the power meter.
QA/QC procedures to be applied:	The power meter is periodically adjusted by a qualified service company to ensure that it meets the national standard.
Any comment:	All archived data explained in the tables will be saved in electronic format and kept during the crediting period and two years after.

Data / Parameter:	EG_y
Data unit:	MWh/yr
Description:	Net quantity of electricity generated by the facility by the project activity
Source of data to be used:	Calculated
Value of data applied for the purpose of calculating expected emission reductions in section B.5	162,158
Description of measurement methods and procedures to be applied:	Calculated from abovementioned parameters (E_{GEN} - E_{AUX})
QA/QC procedures to be applied:	The calculation will be double-checked by the monitoring division and MMD.
Any comment:	All archived data explained in the tables will be saved in electronic format and kept during the crediting period and two years after.

B.7.2. Description of the monitoring plan:

1. Administrative department

Project director will manage the whole monitor system and procedure. The Measurement Management Department (MMD) of JIGANG will be in charge of monitoring power-generation, archiving and calibration duties. The organization chart for monitoring is as followed:

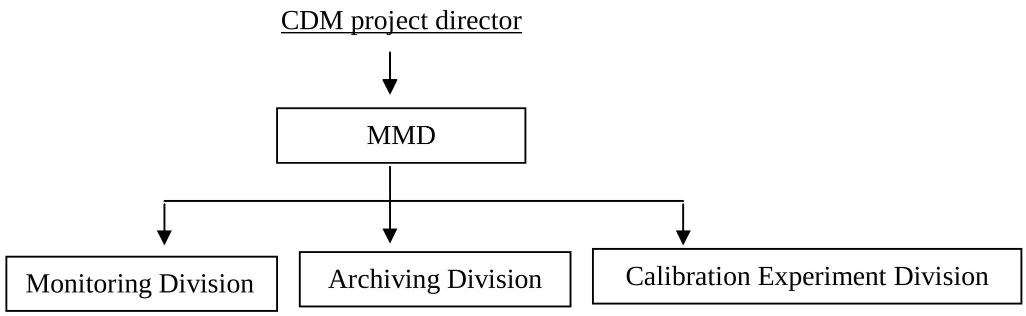

Figure 3 Organization chart

The staff from Monitoring Division will monitor the data stipulated in the monitoring plan monthly, and report it to the director of MMD. After the director of MMD sings the report, then it is finally reported to the CDM project director. When CDM project director affirms the report, it would be sent to the Archiving Division and it will be archived during the crediting period and two years after.

2. Monitoring point

The monitoring in this project will be carried out as per methodology ACM0004. The locations of monitoring points are shown in the chart below.

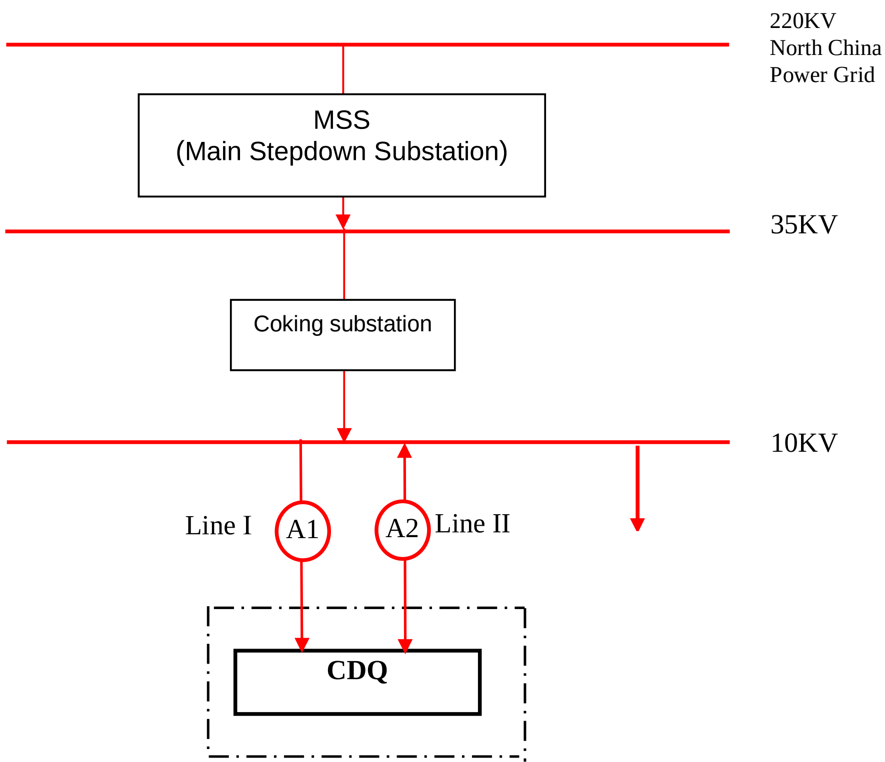

Figure 4 Diagram of monitoring point

Electric power for CDQ will be supplied by line I and line II, on which power meter A1 and A2 is provided separately on these two lines. The power consumption will be monitored by these two power meters. The power generated by CDQ will be transmitted outside via line II on which the bidirectional power meter A2 is mounted to monitor not only the power consumption in CDQ, but also the power generated by the same.

Key data of CDQ used in the monitoring plan are as follows:

- ✧ Gross electricity generation of the CDQ system , E_{GEN};
- ✧ Electricity consumption of auxiliary equipment, E_{AUX};

Therefore, the electricity consumed by CDQ is the plus of E_{AUX}. The net electricity supplied by the CDQ $E_{net}= E_{GEN} - E_{AUX}$

3. Quality assurance and quality control measures
The type of power meter A1 and A2 is DSSD178, accuracy is 0.5. The check and calibration of instruments for monitoring will be organized by Measurement Management Department of JIGANG. The check and calibration will be conducted every year by Calibration Experiment Division, which is one branch of Measurement Management Department and is authorized by the state.

4. Saving monitoring data
The data monitored by the power meter will be analyzed and saved by Measurement Management Department. Meanwhile monthly and yearly reports (paper copy) are requested for archiving. And the data will be also backed up in a different computer for assuring data safety.

The data will be made available for verification purposes.

The monitoring data shall be saved for two years after the end of the crediting period.

5. Monitoring report
The monitoring report would be written by personnel from Monitoring Division of MMD. The report includes monitored parameters and data, quality assurance and quality control measures. It will be checked by CDM project director.

6. Training of personnel
The JIGANG will have a training procedure for monitoring, and training will be conducted to make sure proper implementation of monitoring plan and QA/QC procedure to ensure monitoring quality. Training will be conducted to all the personnel related to monitoring process.

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

Date of completion of the methodology application: 28 Feb 2007
Responsible entity:

Dr. OKAZAKI, Teruo
Global Environmental Affairs Dept.

Environmental Affairs Div.
Nippon Steel Corporation (project participant to this project activity)

Mr. Sun Demin
Vice – Director, Manager, Senior Engineer
The Technology Centre of Jinan Iron & Steel Group Corporation
JIGANG Technical Trade Company
Jinan Iron and Steel Group Corporation (JIGANG)

SECTION C. Duration of the project activity / Crediting period

C.1 . Duration of the project activity:

C.1.1. Starting date of the project activity:

03/03/2005 (Date of implementation)

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

.
15 years

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

>>

C.2.1. Renewable crediting period

>> 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:

>>
01/06/2008 or the date of registration whichever the later

C.2.2.2. Length:

>>
10 years

SECTION D. Environmental impacts

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

The environmental impact assessment (EIA) for this project has been approved by Environment Protection Bureau of Jinan City.
According to the approval of EIA, environment impacts by the project activity and the protective measures taken for the impacts are as follows.

Impacts on air: Red hot coke carried into CDQ could cause dust dispersion. To prevent dust pollution, CDQ is equipped with waste gas dust collection units at the top-charging device, transportation of red hot coke, coke discharging unit, material unloading and transfer sections, outlet of exhaust pipe, pressure-relief point of recirculated gas piping and humidified-dust loading section. The dust content in exhausted off gas shall be in compliance with the relevant national criteria.

Impacts on water: The CDQ has water purification system which is composed of water circulating system for electricity generation and a circulating system for the CDQ facility. Water will be recycled resulting in water conservation.

Noise pollution: Silencers will be provided at boiler bleeding piping, dedusting fan, etc. sound-insulation measure will be taken at coke discharging unit, air-recirculating fan, and to other relevant facilities.

Solid waste: The dust collected by CDQ dedusting system will be carried into the dust silo via drag conveyor and bucket elevator for humidifying before being transferred for downstream utilization.

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 environmental impact assessment for this project has been approved by Environment Protection Bureau of Jinan City. The discharged pollutants in this project are in compliance with the national emission criteria.
Currently there is no environmental monitoring required for the type of project activity, however, if local government will in the future, implement environmental monitoring which includes the project activity, the project participants will conduct monitoring accordingly.

SECTION E. Stakeholders' comments

>>

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

This project aims at energy-saving and environmental protection and will reduce environmental impacts on both surrounding environment and the local residents in the vicinity comparing with those caused by conventional coke wet quenching system.

It is important for JIGANG to inform the stakeholders on possible impacts which may be caused by construction and operation of the proposed project and collect comments and inputs from the stakeholders on this project.
In China, as a part of EIA process, there is a step to invite public opinions for a planned project. JIGANG took the same approach for collecting stakeholders' opinion and conducted different types of survey methods including a meeting as explained below in detail.

1. Stakeholders' meeting
JIGANG staff conducted a stakeholders' meeting on 16 June 2006 at Jinan Cultural Center. Prior to the stakeholders' meeting, JIGANG notified the stakeholders using public announcements placed on bulletin boards in the communities.
There were altogether 35 people participating in the meeting, including local government officials and environmental management commissioner from Wangsheren town, residents from neighboring communities to the project site, the teachers from schools of JIGANG and Wangsheren town, the doctor from JIGANG's hospital and relevant workers from JIGANG.
JIGANG introduced the CDQ project to the stakeholders and held open discussion with them. During the discussion, the participants raised questions as listed below:
(1) What do you think of the local environment? In what impact do you focus on?
(2) How much do you think the CDQ will improve the local environment?
(3) Whether the CDQ project will cause downside environmental impacts? If there are any impacts, what kind of impacts there are?
(4) Do you support the proposed project?

2. Discussions with local governmental organizations
JIGANG made appointments with governmental organizations which are in close relationship with iron and steel industry and CDQ. These organizations include local government and local Metal Trade Association.

E.2. Summary of the comments received:

1. The comments from stakeholders' meeting
The stakeholders raised their suggestions and ideas.
Five people (14.3%) among the total thirty-five are unsatisfied with the current situation of the local environment with respect to air pollution.
All the responders believe that CDQ will cause less pollution to the environment compared with currently operated coke wet quenching system.
32 people think CDQ would not cause negative impacts while three people expected that there would be some noise pollution.
100% of the responders supported the implementation of the project.

2. The comments from local governmental organizations
Wangsheren town policy and Metal Institute of Shandong province all agreed that CDQ project is an energy saving and environmental protection project, they all support the construction of the project.

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

All stakeholders, the leader of Wangsheren Town support the CDQ project. Meanwhile, JIGANG will take stakeholders' suggestions seriously, and will strictly implement measures required by the EIA

especially waste gas and the noise so as to achieve the project's environmental, social and economic benefits.

In addition, JIGANG will maintain regular communication with the stakeholders during the construction and operating periods.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

No public funding from Annex I country is involved in the project activity.

Annex 3

BASELINE INFORMATION

Baseline data for calculating OM and BM emission factors are based on Chinese national statistics. The detailed data are shown below in the form of tables.

1. Calculation of OM emission factor ($EF_{OM,y}$)

Table 1: Calculation of CO_2 emission of the North China Power Grid 2003

Fuel Types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emission Factor	Oxidation Factor	NCV	CO2Emission (tCO2e)
		A	B	C	D	E	F	G=A+B+C +D+E+F	(tC/TJ) H	(%) I	(MJ/t,km3) J	K=G*H*I*J*44/12/10000 (mass basis) K=G*H*I*J*44/12/1000 (vol. basis)
Raw Coal	10kt	714.73	1052.74	5482.64	4528.51	3949.32	6808	22535.94	25.8	100	20908	445737636.1
Cleaned Coal	10kt						9.41	9.41	25.8	100	26344	234510.5998
Other Washed Coal	10kt	6.31		67.28	208.21		450.9	732.7	25.8	100	8363	5796681.315
Coke	10kt					2.8		2.8	29.2	100	28435	85244.33867
Coke Oven Gas	100mil. m3	0.24	1.71		0.9	0.21	0.02	3.08	12.1	100	16726	228559.6749
Other Coal Gas	100mil. m3	16.92		10.63		10.32	1.56	39.43	12.1	100	5227	914399.7064
Crude Oil	10kt						29.68	29.68	20	100	41816	910139.1787
Gasoline	10kt						0.01	0.01	18.9	100	43070	298.4751
Diesel	10kt	0.29	1.35	4		2.91	5.4	13.95	20.2	100	42652	440693.2596
Fuel Oil	10kt	13.95	0.02	1.11		0.65	10.07	25.8	21.1	100	41816	834672.4496
Liquefied Petroleum Gas	10kt							0	17.2	100	50179	0
Refinery Gas	10kt			0.27			0.83	1.1	15.7	100	46055	29163.56117
Natural Gas	100mil. m3		0.5				1.08	1.58	15.3	100	38931	345076.5978
Other Petroleum Products	10kt							0	20	100	38369	0
Other Coking Products	10kt							0	25.8	100	28435	0
Other Energy	10ktce	9.83					39.21	49.04	0	100	0	0
											Total	455,557,075

Source: China Energy Statistical Year Book 2004

Table 2: Calculation of CO_2 emission of the North East Power Grid 2003

Fuel type	Unit	Liaoning A	Jilin B	Heilongjiang C	Total D=A+B+C	Emission Factor (tC/ TJ) E	Oxidation Factor (%) F	NCV (MJ/ t,km3) G	CO2Emission (tCO2e) H=G* D* E* F* 44/ 12/ 10000 (mass basis) H=G* D* E* F* 44/ 12/ 1000 (vol. basis)
Raw Coal	kt	3,557	2,007	2,764	8,327	25.8	100	20908	164695313
Cleaned Coal	kt	71		3	74	25.8	100	26344	1839948.734
Other Washed Coal	kt	617	16	53	686	25.8	100	8363	5429988.017
Coke	kt				0	29.2	100	28435	0
Coke Oven Gas	mil m3	2			2	12.1	100	16726	123184.7599
Other Coal Gas	mil m3	5			5	12.1	100	5227	123141.3249
Crude Oil	kt	3			3	20	100	41816	103954.576
Gasoline	kt					18.9	100	43070	0
Diesel	kt	0	0		1	20.2	100	42652	20850.00368
Fuel Oil	kt	15	1	4	20	21.1	100	41816	643474.2257
Liquefied Petroleum Gas	kt	2			2	17.2	100	50179	49051.64513
Refinery Gas	kt	4		0	4	15.7	100	46055	119040.3542
Natural Gas	mil m3		0	4	5	15.3	100	38931	984997.1241
Other Petroleum Products	kt				0	20	100	38369	0
Other Coking Products	kt				0	25.8	100	28435	0
Other Energy	ktce	29			29	0	100	0	0
								Total	174132943.7

Source: China Energy Statistical Year Book 2004

Table3: Power Generation of North East Power Grid in 2003

Province	Generation (MWh)	On-site power use ratio (%)	Power supply (MWh)
Liaoning	79751000	7.17	74032853.3
Jilin	29739000	7.32	27562105.2
Heilongjiang	48493000	8.48	44380793.6
Total			145975752

Source: China Electric Power Yearbook 2004

Table 4: Power generation and supply of North China Power Grin in 2003

Province	Generation (MWh)	On-site power use ratio (%)	Power supply (MWh)
Beijing	18608000	7.52	17208678
Tianjin	32191000	6.79	30005231
Hebei	108261000	6.5	101224035
Shanxi	93962000	7.69	86736322
Inner Mongolia	65106000	7.66	60118880
Shandong	139547000	6.79	130071759
Total			425364906

Source: China Electric Power Yearbook 2004

For 2003, average emission factor of North East Power Grid
=174132943.7tCO_2/153227362.8MWh
=1.1364tCO_2/MWh

The imported electricity from North East Power Grid to North China Power Grid in 2003 is 4244380MWh.
(Import electricity source: http://www.sp.com.cn/zgdl/spw/12y/wsdljh.htm)

The imported CO_2 Emission from North East Power Grid to North China Power Grid is 4.82MtCO_2;

Therefore,
$EF_{OM, simple,}$
= (455.54 MtCO_2 + 4.82MtCO_2)/ (425364905.8MWh + 4244380MWh)
=1.072tCO_2/MWh

Table 5: Calculation of CO2 emission of the North China Power Grid 2004

Fuel Types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emission Factor	Oxidation Factor	NCV	CO2Emission (tCO2e)
		A	B	C	D	E	F	G=A+B+C +D+E+F	(tC/TJ) H	(%) I	(MJ/t,km3) J	K=G*H*I*J*44/12/10000 (mass basis) K=G*H*I*J*44/12/1000 (vol. basis)
Raw Coal	10kt	823.09	1410	6299.8	5213.2	4932.2	8550	27228.29	25.8	100	20908	538547476.6
Cleaned Coal	10kt						40	40	25.8	100	26344	996856.96
Other Washed Coal	10kt	6.48		101.04	354.17		284.22	745.91	25.8	100	8363	5901190.882
Coke	10kt					0.22		0.22	29.2	100	28435	6697.769467
Coke Oven Gas	100mil. m3	0.55		0.54	5.32	0.4	8.73	15.54	12.1	100	16726	1153187.451
Other Coal Gas	100mil. m3	17.74		24.25	8.2	16.47	1.41	68.07	12.1	100	5227	1578574.385
Crude Oil	10kt							0	20	100	41816	0
Gasoline	10kt								18.9	100	43070	0
Diesel	10kt	0.39	0.84	4.66				5.89	20.2	100	42652	186070.4874
Fuel Oil	10kt	14.66		0.16				14.82	21.1	100	41816	479451.3838
Liquefied Petroleum Gas	10kt							0	17.2	100	50179	0
Refinery Gas	10kt		0.55	1.42				1.97	15.7	100	46055	52229.28682
Natural Gas	100mil. m3		0.37		0.19			0.56	15.3	100	38931	122305.6296
Other Petroleum Products	10kt							0	20	100	38369	0
Other Coking Products	10kt							0	25.8	100	28435	0
Other Energy	10ktce	9.41		34.64	109.73	4.48		158.26	0	100	0	0
											Total	549024040.8

Source: China Energy Statistical Year Book 2005

Table 6: Calculation of CO2 emission of North East Power Grid in 2004

Fuel type	Unit	Liaoning	Jilin	Heilongjiang	Total	Emission Factor (tC/TJ)	Oxidation Factor (%)	NCV (MJ/t,km3)	CO2Emission (tCO2e) H=G*D*E*F*44/12/10000 (mass basis)
		A	B	C	D=A+B+C	E	F	G	H=G*D*E*F*44/12/1000
Raw Coal	kt	4144.2	2,311	3,085	9,540	25.8	100	20908	188689376.8
Cleaned Coal	kt	84.75	1	5	91	25.8	100	26344	2260871.585
Other Washed Coal	kt	577.67	14	61	653	25.8	100	8363	5165589.096
Coke	kt				0	29.2	100	28435	0
Coke Oven Gas	mil m3	4.83	3		8	12.1	100	16726	574367.4948
Other Coal Gas	mil m3	57.33	4		62	12.1	100	5227	1426676.894
Crude Oil	kt				0	20.0	100	41816	0
Gasoline	kt					18.9	100	43070	0
Diesel	kt	2.04	1	0	3	20.2	100	42652	108672.7465
Fuel Oil	kt	12.81	2	3	17	21.1	100	41816	564536.2111
Liquefied Petroleum Gas	kt	2.19			2	17.2	100	50179	69305.22764
Refinery Gas	kt	9.79		1	11	15.7	100	46055	289779.7487
Natural Gas	mil m3		0	3	3	15.3	100	38931	559111.4496
Other Petroleum Products	kt				0	20.0	100	38369	0
Other Coking Products	kt				0	25.8	100	28435	0
Other Energy	ktce	26.97	5		32	0.0	100	0	0
								Total	199708287.3

Source: China Energy Statistical Year Book 2004

Table 7: Power generation and supply of North East Power Grid in 2004

Province	Generation (MWh)	On-site power use ratio (%)	Power supply (MWh)
Liaoning	84543000	7.21	78447449.7
Jilin	33242000	7.68	30689014.4
Heilongjiang	53482000	7.84	49289011.2
Total			158425475

Source: China Electric Power Yearbook 2005

Table 8: Power generation and supply of the North China Power Grid in 2004

Province	Generation (MWh)	On-site power use ratio (%)	Power supply (MWh)
Beijing	18579000	7.94	17103827
Tianjin	33952000	6.35	31796048
Hebei	124970000	6.5	116846950
Shanxi	104926000	7.7	96846698
Inner Mongolia	80427000	7.17	74660384
Shandong	163918000	7.32	151919202
Total			489173110

Source: China Electric Power Yearbook 2005

For 2004, average emission factor of North East Power Grid

= 199708287.3tCO_2/170090469MWh

=1.1738tCO_2/MWh

The imported electricity from North East Power Grid to North China Power Grid in 2004 is 4514550MWh.
(Import electricity source: China Electric Power Yearbook (2005))

The imported CO_2 Emission from North East Power Grid to North China Power Grid in 2004 is 5.30MtCO_2;

Therefore,
$EF_{OM, simple}$
= (549.02MtCO_2 + 5.30MtCO_2)/ (489173109.9MWh + 4514550MWh)
=1.123tCO_2/MWh

Table 9: Calculation of CO2 emission of the North China Power Grid 2005

Fuel Types	Unit	Beijing	Tianjin	Hebei	Shanxi	Inner Mongolia	Shandong	Total	Emission Factor	Oxidation Factor	NCV	CO2Emission (tCO2e)
		A	B	C	D	E	F	G=A+B+C +D+E+F	(tC/TJ) H	(%) I	(MJ/t,km3) J	K=G*H*I*J*44/12/10000 (mass basis) K=G*H*I*J*44/12/1000 (vol. basis)
Raw Coal	10kt	897.75	1675.2	6726.5	6176.45	6277.23	10405.4	32158.53	25.8	100	20908	636062535.8
Cleaned Coal	10kt						42.18	42.18	25.8	100	26344	1051185.664
Other Washed Coal	10kt	6.57		167.45	373.65		108.69	656.36	25.8	100	8363	5192725.191
Coke	10kt					0.21	0.11	0.32	29.2	100	28435	9742.210133
Coke Oven Gas	100mil. m3	0.64	0.75	0.62	21.08	0.39		23.48	12.1	100	16726	1742396.483
Other Coal Gas	100mil. m3	16.09	7.86	38.83	9.88	18.37		91.03	12.1	100	5227	2111027.27
Crude Oil	10kt					0.73		0.73	20	100	41816	22385.49867
Gasoline	10kt			0.01				0.01	18.9	100	43070	298.4751
Diesel	10kt	0.48		3.54		0.12		4.14	20.2	100	42652	130786.3867
Fuel Oil	10kt	12.25		0.23		0.06		12.54	21.1	100	41816	405689.6325
Liquefied Petroleum Gas	10kt							0	17.2	100	50179	0
Refinery Gas	10kt			9.02				9.02	15.7	100	46055	239141.2016
Natural Gas	100mil. m3	0.28	0.08		2.76			3.12	15.3	100	38931	681417.0792
Other Petroleum Products	10kt							0	20	100	38369	0
Other Coking Products	10kt							0	25.8	100	28435	0
Other Energy	10ktce	8.58		32.35	69.31	7.27	118.9	236.41	0	100	0	0
											Total	647649330.9

Source: China Energy Statistical Year Book 2006.

Table 10: Calculation of CO2 emission of North East Power Grid in 2005

Fuel type	Unit	Liaoning A	Jilin B	Heilongjiang C	Total D=A+B+C	Emission Factor (tC/ TJ) E	Oxidation Factor (%) F	NCV (MJ/ t,km3) G	CO2Emission (tCO2e) H=G* D* E* F* 44/ 12/ 10000 (mass basis) H=G* D* E* F* 44/ 12/ 1000
Raw Coal	kt	4305.41	2,446	3,383	10,135	25.8	100	20908	200454895.9
Cleaned Coal	kt				0	25.8	100	26344	0
Other Washed Coal	kt	524.74	19	24	568	25.8	100	8363	4494939.888
Coke	kt				0	29.2	100	28435	0
Coke Oven Gas	mil m3	1.03	4	1	5	12.1	100	16726	391816.5856
Other Coal Gas	mil m3	12.62	8		21	12.1	100	5227	486767.6854
Crude Oil	kt	1.16			1	20.0	100	41816	35571.47733
Gasoline	kt				0	18.9	100	43070	0
Diesel	kt	1.18	1	1	3	20.2	100	42652	102038.6544
Fuel Oil	kt	9.32	2	2	13	21.1	100	41816	431247.4323
Liquefied Petroleum Gas	kt	0.12			0	17.2	100	50179	3797.54672
Refinery Gas	kt	5.48		1	7	15.7	100	46055	180283.8327
Natural Gas	mil m3		1	2	3	15.3	100	38931	672680.9628
Other Petroleum Products	kt				0	20.0	100	38369	0
Other Coking Products	kt				0	25.8	100	28435	0
Other Energy	ktce	16.18			16	0.0	100	0	0
								Total	207254040

Source: China Energy Statistical Year Book 2006

Table 11: The power generation and supply of North East Power Grid in 2005

Province	Generation (MWh)	On-site power use ratio (%)	Power supply (MWh)
Liaoning	83697000	7.03	77813100.9
Jilin	35294000	6.59	32968125.4
Heilongjiang	58000000	7.96	53383200
Total			164164426

Source: China Electric Power Yearbook 2006

Table 12: The power generation and supply of the North China Power Grid in 2004

Province	Generation (MWh)	On-site power use ratio (%)	Power supply (MWh)
Beijing	20880000	7.73	19265976
Tianjin	36993000	6.63	34540364
Hebei	134348000	6.57	125521336
Shanxi	128785000	7.42	119229153
Inner Mongolia	92345000	7.01	85871616
Shandong	189880000	7.14	176322568
Total			560751013

Source: China Electric Power Yearbook 2006

For 2005, average emission factor of North East Power Grid

= 207254040tCO_2/ 179031569MWh

= 1.1576tCO_2/MWh

The imported electricity from North East Power Grid to North China Power Grid in 2005 is 23423000MWh.
(Import electricity source: China Electric Power Yearbook 2006)

The imported CO_2 Emission from North East Power Grid to North China Power Grid in 2005is 27.1MtCO_2;

Therefore,
$EF_{OM, simple}$
= (647.69MtCO_2 + 5.30MtCO_2)/ (560751013MWh + 23423000MWh)
=1.155tCO_2/MWh

In conclusion,
Total power supplied by thermal power plants from 2003 to 2005 is 1507470959MWh
Total emission from 2003 to 2005 is 1689468648tCO_2

Therefore,
The generation weighted average emission factor of NCPG:
= 1689468648/ 1507470959
= 1.1207 tCO_2/MWh

2. Calculation of BM emission factor ($EF_{BM,y}$)

BM emission factor is calculated in line with the steps below

2.1. Calculation of emission factors from power plant types

The table below summarizes the proportions of the corresponding CO_2emission factor from power plants that fire different types of fossil fuel.

Table 13: Emission Factors of the most advanced commercial power plants by fuel types

	Variable	Power Generation Efficiency A	Emissions Factor (tC/TJ) B	Oxidation rate C	Emissions Factor (tCO_2/MWh) 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

Source: Chinese DNA website (http://cdm.ccchina.gov.cn/english/NewsInfo.asp?NewsId=1891)

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

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

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

From the formula above and Table 9, 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} = 99.17% , λ_{Oil} = 0.08% , λ_{Gas} = 0.74%.

2.2. Calculation of emission factor $EF_{Thermal}$

Calculate the emission factor ($EF_{Thermal}$) of thermal power plants of the grid based on the emissions of the best commercial technology as follows:

$EF_{Thermal} = \lambda_{Coal} * EF_{Coal,Adv} + \lambda_{Oil} * EF_{Oil,Adv} + \lambda_{Gas} * EF_{Gas,Adv}$ = 0.9465 tCO_2e/MWh.

2.3. Calculation of BM emission factor of North China Power Grid

Table 14: Calculation of Build margin data for the North China Power Grid

Source	Capacity, 2003(MW)	Capacity, 2004(MW)	Capacity, 2005(MW)	Added capacity 2003-2005(MW)	Share(%)
Thermal	84006.6	93594.9	111068.7	27062.1	99.28%
Hydro	3266.0	3250.7	3216.2	-49.8	-0.18%
Wind & other	90.1	137.5	335.5	245.4	0.90%
Total	87362.7	96983.1	114620.4	27257.7	100.00%

Source: China Electric Power Yearbook 2003, 2005 and 2006.

Therefore,

EF_{BM} = 0.9465 * 99.28%

=0.9397 tCO_2/MWh

3. Calculation of CM emission factor ($EF_{,y}$)

As explained in Section E.2, the result is shown below

$$EF_y = 0.5 \times 1.1207 + 0.5 \times 0.9397 = 1.0302 \quad tCO_2e/MWh$$

Annex 4

MONITORING PLAN

No other supplementary information is provided here. Please refer to monitoring plan in the section B.7.2 of this PDD.