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

CONTENTS

SECTION A. General description of project activity

A.1 Title of the project activity:

Waste Heat Recovery for Captive Power Generation through Coke Dry Quenching system of POSCO, Korea
Version: 01.04
Date: 04 July 2008

A.2. Description of the project activity:

The project activity is to generate electricity from the sensible heat of red hot coke through installation of a set of Coke Dry Quenching (hereinafter referred to as "CDQ") equipment to No.2 coke plant of Pohang works, POSCO, Korea, thereby reducing GHG emissions due to electricity generation with fossil fuels in the electricity grid of Korea Power Exchange.

The CDQ equipment recovers the waste heat of the red hot coke which is prepared from coke ovens to generate electricity by utilizing the recovered waste heat. The electricity generated from the CDQ equipment will displace the electricity purchased from the nationwide electricity grid of Korea Power Exchange. The CDQ equipment includes one steam turbine (axial exhaust, extraction condensing type) with a maximum output of 14,700 kW and one generator with a capacity of 14,700 kW. The proposed project is expected to generate the net electricity of about 96,321 MWh annually and results in emission reduction of 53,650 tCO_2e/yr.

Most coke plants of steel companies usually have Coke Wet Quenching (hereinafter referred to as "CWQ") equipment to cool down the red hot coke coming out of coke ovens. In the CWQ system, the red hot coke from coke ovens is quenched to cold coke by spraying water thereon in the atmosphere and, therefore, the sensible heat of red hot coke is dispersed into the atmosphere without utilization. The CWQ system cannot recover and utilize the waste heat of the red hot coke. On the other hand, the CDQ system is a technology for retrieving the waste heat from the coke quenching process and using to generate electric power. The proposed project is to replace the existing CWQ system with the CDQ system for environmental protection and energy conservation.

By utilizing the wasted sensible heat of the red hot coke for electricity generation, the project activity will contribute to sustainable development objectives in the following ways.

- The proposed project will reduce the country's energy consumption and, therefore, decrease the reliance on the fossil fuels imported to meet the country's expanding energy requirements

- The electricity generated by the CDQ system will displace the electricity generated from mainly fossil-fuels fired power plants connected to the electricity grid of Korea Power Exchange. As a result, the proposed project will mitigate the environmental pollution from burning fossil fuels.

- The proposed project will significantly decrease dusts emitted into air compared to the existing CWQ system, thereby improving a working environment and safety of workers in the workplace as well as air quality.

- Water resources will be conserved as the CDQ equipment uses a circulating inert gas such as Nitrogen to cool down the red hot coke unlike the CWQ system.

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)
Republic of Korea(host)	POSCO	No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

A.4.1.1. Host Party(ies):

>>

Republic of Korea

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

>>

Gyeongsangbuk-do

A.4.1.3. City/Town/Community etc:

>>

Pohang-si, Dongchon-dong, POSCO Pohang works,

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

>>

The proposed project is implemented within the site of Pohang works of POSCO. The Pohang works of POSCO is situated in Pohang-si, which is located at the eastern coast of Republic of Korea. The geographic location of the Pohang works of POSCO is shown below Fig. 1.

Source: National Geographic Information Institute, Korea

<Fig. 1> Location of Pohang-si

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

Sectoral scope 1: Energy Industries

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

>>

CDQ is the process of cooling down the red hot coke coming out of coke ovens by using an inert gas as cooling medium in a closed cooling chamber. The proposed project activity includes establishing a CDQ system adopting technologies from Nippon Steel Corporation. The CDQ system is designed to cool down the red hot coke from both "2B" and "2C" batteries of No. 2 coke plant of Pohang works, POSCO. The CDQ system will handle maximum 95 ton/hour of coke production, considering coke plant operation conditions.

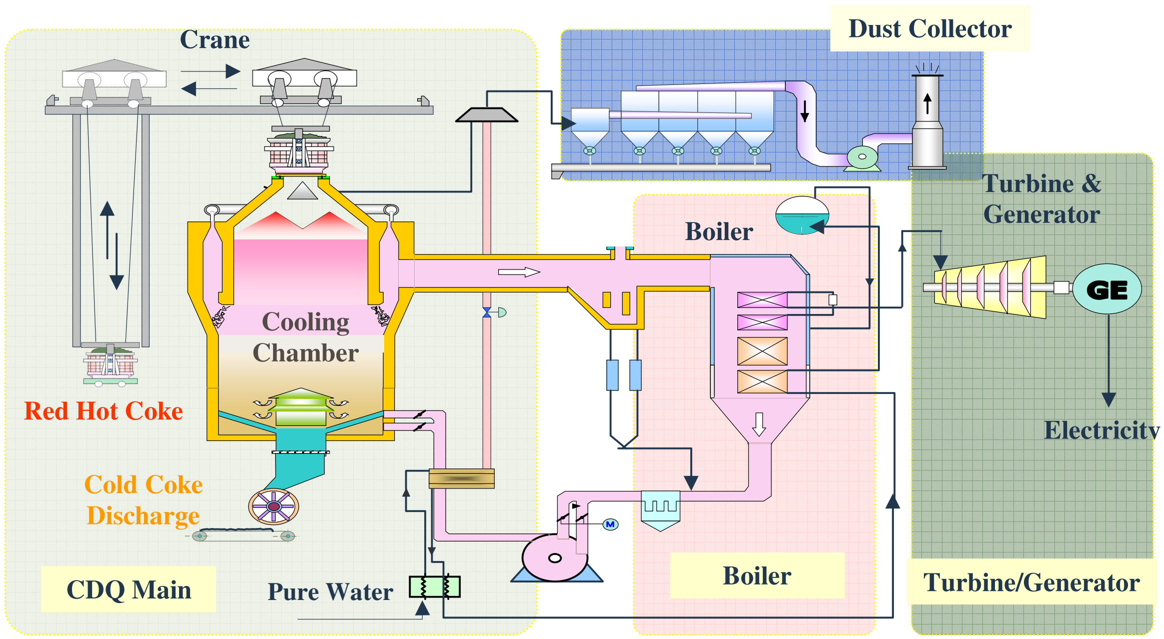
The CDQ equipment is furnished with one steam turbine and one generator to generate electricity with the waste heat recovered from the red hot coke of No.2 coke plant. The outlet steam of the turbine will be treated into low pressure steam or condensed water. According to the operation conditions of CDQ equipment, the generated electricity and low pressure steam can be adjusted. The electric power generated by the CDQ equipment will be supplied to the CDQ equipment itself. The rest power will be boosted up to 22 kV to transmit to Seon-Gang substation, and after that, supplied to the Pohang works with the electricity purchased from the grid. The capacity of the generator installed is 14.7 MW and the terminal voltage of electricity generated is 3.3 kV.

The CDQ system consists of gas circulation equipment, a pre-chamber, a cooling chamber, coke transporting equipment, a high pressure boiler, a steam turbine and generator, coke breeze collecting equipment, dust collecting equipment, an electric and instrument system, etc. The chief technology and equipment will be imported from Nippon Steel Corporation. The specification of the CDQ equipment installed by the proposed project is described below.

- Coke quenching capability: 95 ton/hr
- Circulating gas rate: 140,000 N ㎥/hr
- Capacity of pre-chamber: 220 ㎥ (effective volume)
- Capacity of cooling chamber: 390 ㎥
- Steam generation rate in CDQ boiler: Max. 59,000 kg/hr (105 kgf/㎠ G, 545℃)
- Steam turbine output: Max. 14,700 kW
- Generator capacity: 14,700 kW

Regarding environmental concern, the CDQ system is designed to prevent environmental pollution by controlling emissions through fume and dust extractions in a red hot coke charging system, operating a local dust collecting system for a good working condition, and preventing dust emissions from a coke discharging device.

The detailed process of CDQ is described with a diagram below.



<Fig. 2> The detailed process of CDQ system

The red hot coke coming out of coke ovens has a temperature between 950℃and 1,100℃. The red hot coke loaded into a coke-bucket carriage is transported to the top of the CDQ main body by a crane. The red hot coke is unloaded into a pre-chamber by the coke charging device and, then, a cooling chamber. In the cooling chamber, the sensible heat of the red hot coke is transferred to a circulating gas such as nitrogen so that the red hot coke is cooled to below 200 ℃. The cooled coke is discharged to a conveyer belt and sent to a coke screening system. Through the heat exchange process in the cooling chamber, the temperature of the circulating nitrogen gas increases to about 980℃ from about 160 ℃. The hot nitrogen gas enters a CDQ boiler to be used to produce high pressure steam by which a steam turbine is rotated to generate electricity. After heat exchange in the CDQ boiler, the nitrogen gas is lowered to about 160℃ and recycled into the cooling chamber to quench other red hot coke after being cleaned by a dust collector. The CDQ equipment is a closed system and, therefore, significantly contributes to reductions in air pollution compared to a wet quenching system.

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

>>

The proposed project will use a fixed crediting period ***from 01 January 2009 to 31 December 2018*** (10 years) and be expected to result in estimated emission reductions as follows. The details are described in the Section B. 6 and Annex 3.

<Table 1> Estimated emission reductions for crediting period

Years	Annual estimation of emission reductions in tonnes of CO_2e
2009	53,650
2010	53,650
2011	53,650
2012	53,650
2013	53,650
2014	53,650
2015	53,650
2016	53,650
2017	53,650
2018	53,650
Total estimated reductions (tonnes of CO_2e)	536,500
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2e)	53,650

A.4.5. Public funding of the project activity:

>>

There is no public funding from Annex 1 countries toward 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 and monitoring methodology ACM0012, *"Consolidated baseline methodology for GHG emission reductions for waste gas or waste heat or waste pressure based energy system" (version 02)* is applied to the project activity.

As per the methodology ACM0012, "Tool to calculate the emission factor for an electricity system (version 01)" is used to calculate the emission factor for displaced electricity, and the latest version of the "*Tool for the demonstration and assessment of additionality (version 04)*" is used to demonstrate and assess the additionality of the proposed project activity.

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

>>

The proposed project activity meets all the applicability conditions of the consolidated methodology ACM0012.

In the proposed project activity the electricity is generated by utilizing waste heat from red hot coke. The red hot coke is produced from the coke plants of Pohang Works of POSCO. The electricity generated through the proposed project will be used at the industrial facility of Pohang Works. Thus, the electricity in the proposed project activity is generated and consumed by the owner of coke plants producing waste heat, i.e., Pohang Works of POSCO.

The industrial facility generating waste heat, i.e. coke plants is equipment to make coke by indirectly heating coal. The coke produced is used as a reducing agent for iron. Here, the coal is used as a material not a fuel and, therefore, any of regulations does not constrain the coke plants from using coal.

In a coking process, red hot coke is produced by indirectly heating coals within coke ovens of coke plants with a coke oven gas (hereinafter referred to as "COG") as a heating fuel. The COG is an off gas generated from the coking process. Prior to the implementation of the proposed project activity, the red hot coke as a source of waste heat was quenched by spraying water over them to make cold coke. This process is called Coke Wet Quenching (CWQ). The cold coke is used as a reducing agent for iron. When the red hot coke was cooled, the sensible heat contained in the red hot coke was released into the atmosphere as water vapour with waste heat. The CWQ process cannot collect and utilize the sensible heat of the red hot coke or the water vapour with waste heat because the water vapour generated by the CWQ process includes a lot of dusts and particles. There is no technology to recover the water vapour from the CWQ process at present. DOE for the proposed project activity will check that Pohang Works of POSCO has had a CWQ process to quench red hot coke and no equipment for recovering waste heat from red hot coke has been installed prior to the implementation of the proposed project activity.

The credits are claimed by POSCO as the generator of energy using waste heat and the owner of industrial facility producing the waste heat. The proposed project activity produces electricity through one train CDQ plant including one steam turbine and one generator. There is no gas turbine for a combined cycle.

Accordingly, the consolidated Methodology ACM0012 is applicable to the proposed project activity.

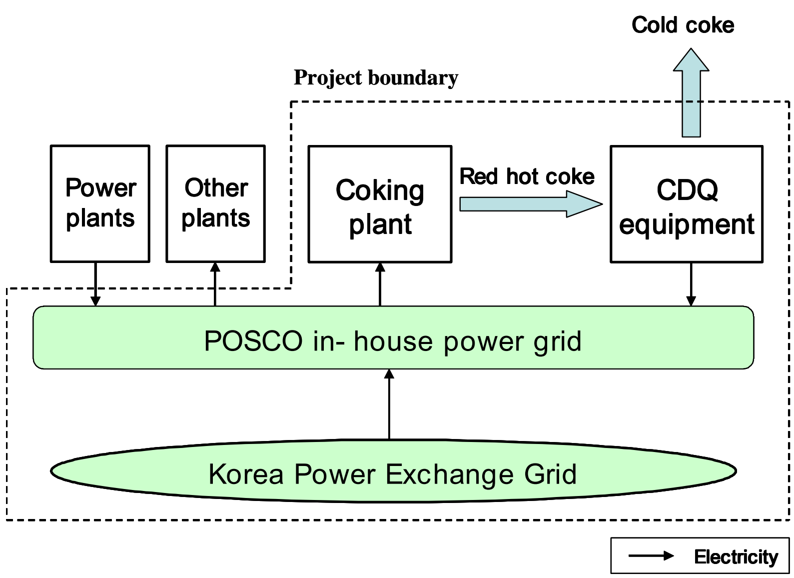
B.3. Description of the sources and gases included in the project boundary

>>

As per the methodology ACM0012, the geographical and spatial extent of the proposed project includes following:

1. 2B and 2C battery of coke ovens of No.2 Coke plant of Pohang Works, POSCO
2. #2 CDQ plant including a cooling system, a set of heat recovery boiler and auxiliaries, one steam turbine and one generator, and subsidiary facilities.
3. In-house electricity grid of Pohang Works, POSCO.
4. Nationwide electricity grid of Korea Power Exchange (hereinafter referred as “KPX”). The spatial extent of KPX grid is defined according to “Tool to calculate the emission factor for an electricity system (version 01)”.

The boundary of the proposed project activity is shown in Fig.3.



<Fig. 3> Project boundary

The emissions sources included in the project boundary are shown in Table 2.

<Table 2> Summary of gases and sources included in the project boundary and justification explanation where gases and sources are not included

	Source	Gas	Included	Justification/Explanation
Baseline	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.
	Fossil fuel consumption in boiler for thermal energy	CO_2	Included	Not applicable.
		CH_4	Excluded	
		N_2O	Excluded	
	Fossil fuel consumption in cogeneration plant	CO_2	Included	Not applicable.
		CH_4	Excluded	
		N_2O	Excluded	
	Baseline emissions from generation of steam used in the flaring process, if any	CO_2	Included	Not applicable.
		CH_4	Excluded	
		N_2O	Excluded	
Project Activity	Supplemental fossil fuel consumption at the project plant	CO_2	Included	Not applicable CDQ system needs no fossil fuel as auxiliary fuels.
		CH_4	Excluded	
		N_2O	Excluded	
	Supplemental electricity consumption	CO_2	Included	Not applicable. CDQ system requires no supplemental electricity consumption.
		CH_4	Excluded	
		N_2O	Excluded	
	Project emission from cleaning of gas	CO_2	Included	Not applicable. CDQ system does not use a waste gas.
		CH_4	Excluded	
		N_2O	Excluded	

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

>>

As per the methodology ACM0012, the baseline scenario of the proposed project is identified as the most plausible baseline scenario among all realistic and credible at alternative(s) which should be determined for:

- Waste heat use in the absence of the project activity; and
- Power generation in the absence of the project activity

Multiple sub-systems generating energy in the project activity scenario

The alternatives shall be determined as suitable combinations of the following options available for meeting the ‘power requirement’ and for ensuring ‘alternate use of waste heat’ as described below.

The baseline options which correspond to the following conditions are excluded from the possible alternative scenarios:

- The scenarios which do not comply with legal and regulatory requirement; or
- The scenarios which depend on fuels used for generation of power, that are not available at the project site

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

The baseline candidates should be considered for following facilities:

- For the industrial facility where the waste heat is generated; and
- For the facility where the electricity is produced; and
- For the facility where the electricity is consumed.

For the used of waste heat, the realistic and credible alternative(s) may include, *inter alia*:

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.

The proposed project activity uses waste heat from red hot coke which is made from coals in coke ovens. In a coking process, red hot coke is generally cooled by a coke wet quenching (CWQ) process. The CWQ process includes spraying water over the red hot coke, i.e., wet quenching. During the wet quenching the sensible heat of the red hot coke is transferred into the water to form steam. The steam includes dusts and fine particles so that it cannot be used as energy. The steam generated during the wet quenching is, therefore, discarded into the atmosphere without using. There is no technology of utilizing the steam generated during the wet quenching of red hot coke. In other words, the waste heat from red hot coke cannot be sold as an energy source or used for meeting energy demand. As a result, for the use of waste heat, the realistic and credible alternative includes only one:

W2 Waste heat is released to the atmosphere.

For power generation, the realistic and credible alternative(s) may include, *inter alia*:

P1 Proposed project activity not under taken 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.)

The proposed project activity produces electricity through a CDQ system using waste heat from red hot coke as an energy source. So, the alternatives P7 and P8, which are related to the use of waste gas, are excluded from the realistic and credible alternatives.

The alternative P6 is continuation of the current situation. The electricity generated in the proposed project activity will be consumed within POSCO's Pohang Works, replacing the grid electricity which would be purchased from KPX grid if the proposed project activity is not implemented. Accordingly the alternative P6 is applicable.

Since POSCO has no on-site or off-site existing captive or identified plant based on renewable energy, the alternative P5 can be removed from the list of realistic and credible alternatives. The DOE will check that at the time of proposed project activity POSCO has no existing captive or identified plant based on renewable resources. In addition, establishing a new power plant using renewable resources requires high capital investment and costs so that it is financially unattractive.

The alternative P4 is applicable as POSCO's Pohang Works has been operating ten captive power plants using off gases from iron or steel making processes and one captive LNG power plant.

In the proposed project activity the waste heat is used for generating electricity only and, therefore, the alternatives P2 and P3 including a cogeneration plant are eliminated from the realistic and credible alternatives.

The alternative P1 is also not applicable because constructing a CDQ system needs huge initial capital investment and costs. In addition, as to be described in Section B5 below, an investment analysis for the proposed project activity indicates that IRR for establishing the CDQ system is much lower than a benchmark to determine whether or not to encourage a proposed investment. It means that the proposed project activity will not be implemented without any inducement, e.g., such as benefits from CDM. Therefore, the alternative P1 can be excluded from the realistic and credible alternatives.

Accordingly, for power generation, the realistic and credible alternative includes:

P4 On-site or off-site existing/new fossil fuel based existing captive or identified plant;
P6 Sourced Grid-connected power plants.

The proposed project activity has not to consider baseline candidates for heat generation since the CDQ system will produce only electricity.

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

The alternative P4 can select one from coal, heavy oil, and liquefied natural gas (LNG) as an energy source. Of these fossil fuels, coal is eliminated from the fuel for the baseline energy source although POSCO can secure sufficient amount of coal because at the time of proposed project activity POSCO has no coal-fired power plant. Besides, it is impossible to establish a new coal-fired power plant within or outside the site of POSCO's Pohang Works because of the complaint of the people, a limited site, high construction costs, and so on.

With regard to using heavy oil as an energy source, POSCO will not employ heavy oil as a fuel for captive power plants. POSCO's Pohang Works has ten captive power plants using off gases from iron or steel making processes. In order to utilize heavy oil as a fuel for the existing captive power plants, POSCO has to purchase separately heavy oil which is more expensive than coal and replaces the existing gas-fired burners with liquid fuel-fired burners. Regarding LNG fuel, POSCO's Pohang Works has one LNG combined cycle plant within its site. The LNG is available sufficiently at the project site because POSCO is directly importing LNG through its own Gwangyang LNG terminal.

Accordingly, both heavy oil and LNG can be selected as baseline fuels. As per methodology ACM0012, however, as a conservative approach, the available fuel with the lowest carbon emission factor has to be used as a baseline fuel. LNG has a lower carbon emission factor than that of heavy oil so that in the proposed project activity LNG is selected as a baseline fuel.

For power generation, the realistic and credible alternatives result in:

P4 On-site LNG based existing captive plant;
P6 Sourced Grid-connected power plants.

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

For the proposed project activity, *"Tool for the demonstration and assessment of additionality" version 4* is applicable and *"step 2. Investment analysis"* is used to eliminate non feasible baseline options out of the alternatives selected in the ***STEP 2*** above.

To conduct the investment analysis, Option II investment comparison analysis is selected and as the financial indicator levelized cost of electricity production in Won/kWh is used. Calculation and comparison of levelized cost of electricity production is showed in Table 3 below.

<Table 3> Comparison of Levelized cost of electricity porduction

Option	Option Description	Levelized cost of electricity production (Won/kWh)	Conclusion	remark
P4	On-site LNG based existing captive power plant	73.19	Economically unattractive compared to option P6	Source: POSCO's internal data As of year 2006
P6	Sourced Grid-connected power plants	57.67	Economically attractive compared to P4	Source: POSCO's internal data As of April, 2007

As described above Table 3, option P6 is most likely baseline option for power generation since option P4 is clearly economically unattractive compared to option P6.

As a result, the only combination of baseline options for the proposed project activity is **'W2 and P6'**,

'Waste heat is released to the atmosphere and the electricity is obtained from the grid'.

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

As there is one credible and plausible alternative scenario, the combination of W2 and P6 can be considered as the most likely baseline scenario so that methodology ACM0012 is applicable for the proposed project activity.

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 ACM0012, the additionality of the proposed project activity is demonstrated and assessed using "Tool for the demonstration and assessment of additionality, version 04 (EB 36)".

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 alternative scenarios for the proposed project activity were identified in section B. 4. Collectively, the realistic and credible alternatives available to the proposed project activity include:

For the use of waste heat,
W2 Waste heat is released to the atmosphere;

For power generation,
P4 On-site LNG based existing captive plant;
P6 Sourced Grid-connected power plants – continuation of the current situation.

For power generation, the option P6 is more feasible alternative because option P4 is clearly economically unattractive compared to the option P6 as described in section B.4. Accordingly, the most likely alternative scenario for the proposed project activity is the combination of W2 and P6 only.

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

The alternative scenario identified in the ***sub-step 1a*** is in compliance with all mandatory applicable legal and regulatory requirements in the region or country.

The Korean central government is now encouraging the industries to make a voluntary agreement of implementing energy saving and GHG emission reduction. There are, however, no mandatory obligations or penalties for failing to implement the agreement.

Step 2. Investment analysis

Sub-step 2a. Determine appropriate analysis method

Amongst simple cost analysis (Option I), investment comparison analysis (Option II), and benchmark analysis (Option III), the benchmark analysis (Option III) is applied.

Sub-step 2b. Option III. Apply benchmark analysis

To carry out the benchmark analysis, IRR (Internal rate of return) is employed as the financial indicator. As the benchmark for IRR, POSCO's internal hurdle rate is applied.

Sub-step 2c. Calculation and comparison of financial indicators

Implementation of the proposed project activity will produce direct effects and indirect effects.

Direct effects include the generation of electricity through CDQ facility and increase in the productivity of a blast furnace or fuel cost saving for a blast furnace due to improvement in the quality of coke treated by the CDQ facility. Indirect effects can be divided into positive and negative effects. The positive effect includes advantages on the increase of PCR (Pulverized Coal Ratio) in a blast furnace process. The negative one is the loss of coke by coke burning during the coke dry quenching process. The indirect effects are generally not considered in judging economic feasibility because it is difficult to demonstrate the indirect effects. Therefore, the investment analysis for the proposed project activity also does not consider the indirect effects on project implementation.

For the investment analysis, the selected financial indicator IRR is calculated on the basis of the operating period of CDQ facility installed by the proposed project activity. POSCO commonly anticipates the operating period of 15 years for CDQ equipment and estimates IRR for introducing CDQ equipment on the basis of 15 years. No.2 Coke plant of Pohang Works for which #2 CDQ equipment is installed has been operated more than 30 years since its establishment. Provided that the life time of coke ovens is about 40 years, the remaining life time of coke ovens of No.2 Coke plant would not be exceeding 10 years. It means that the operating period of #2 CDQ equipment will not be exceeding 10 years. Table 4 shows IRR estimated on the basis of operating period of #2 CDQ equipment.

<Table 4> IRR sensitivity to #2 CDQ equipment

	Operating period of CDQ equipment	
	10 years	15 years
IRR	3.1%	7.0%

As shown in the Table 4 above, IRR for the proposed project activity becomes 3.1% if the operating period of #2 CDQ equipment is 10 years. The IRR becomes 7.0% if the operating period is 15years. The IRRs calculated for both 10 years and 15 years are lower than the benchmark, POSCO's internal hurdle rate in 2006. Consequently, the proposed project activity is financially unattractive. Moreover, if the remaining life time of the coke ovens becomes less than 10 years, IRR for the proposed project activity would be much lower.

Sub-step 2d. Sensitivity analysis

In this sub-step, sensitivity analysis is conducted on IRR calculated for the operating period of 15 years, which is the maximum operating period. In the proposed project activity, IRR may be changed according to fluctuations in prices of electricity purchased from the grid as shown in Table 5.

<Table 5> IRR sensitivity to fluctuation of electricity prices

	Fluctuation of electricity prices				
	- 20%	- 10%	0	+ 10%	+ 20%
IRR	5.0%	6.0%	7.0%	8.0%	8.8%

When the electricity prices are changed in the range of –20% ~ +20%, the IRR varies in the range of 5.0% ~ 8.8% as shown in the Table 5. Although the electricity price rises up to 20%, the IRR for the proposed project activity is 8.8%, which is still lower than benchmark POSCO's internal hurdle rate. In conclusion, the proposed project activity is unlikely to be financially attractive.

Step 3. Barrier analysis

Barrier analysis is not carried out for the proposed project activity.

Step 4. Common practice analysis

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

POSCO is the only company in Korea that runs integrated steel mills, Pohang Works and Gwangyang Works. So the boundary of common practice of Korea is identified POSCO. Both Works of POSCO have several coke plants, respectively, to produce coke. POSCO's coke plants are divided into two groups, i.e., small coke plants and large coke plants. The division of small and large coke plants are divided by a height of coke oven in reference to their efficiency volume within POSCO.

The small coke plant consists of coke ovens with height of 5.15m where one coke oven can produce about 15 ton-coke per one cycle from coal charging to coal carbonization. POSCO has 2 small coke plants.

The large coke plant consists of coke ovens with height of 6.7m where one coke oven can produce about 21 ton-coke per one cycle form coal charging to coal carbonization. POSCO has 8 large coke plants.

Since late 1980's, POSCO started to import CDQ technology from Japan and establish CDQ equipment for the large coke plants in the Pohnag Works and Gwangyang Works. Table 6 shows coke plants with CDQ equipment which are operated in the Pohang and Gwangyang Works.

<Table 6> Coke plants with CDQ equipment of POSCO

		Coke plant Start date	Height of coke oven	Number of coke oven	CDQ equip. Start Date	CDQ capacity (ton/hr)
Pohang Works	No.3 Coke plant	Nov. 1978	6.7 m	146	Mar. 1989	100×2
	No.4 Coke plant	Feb. 1981	6.7 m	150	May 1988	100×2
	No.5b Coke plant	Jun. 1983	6.7 m	75	Mar. 2002	95
	No.5a Coke plant	Dec. 2007	6.7 m	75	Dec. 2007	95
Gwangyang Works	No.1 Coke plant	Apr. 1987	6.7 m	132	Mar. 1999	180
	No.2 Coke plant	Jul. 1988	6.7 m	132	Sep. 2002	180
	No.3 Coke plant	Dec. 1990	6.7 m	132	Apr. 2005	180
	No.4 Coke plant	Sep. 1992	6.7 m	132	Apr. 2005	180

As shown in Table 6, POSCO has installed the CDQ equipment for all the large coke plants, although almost all the CDQ equipments were established a considerable time after the corresponding coke plant had been completely established. POSCO has decided the installation of CDQ system through a prolonged consideration since there were difficulties in determining investing due to economical unattractiveness based on huge amount of capital investment and introduction of foreign technique.

POSCO estimates that when CDQ equipment can be used during at least 15 years, its installation is valid. Therefore, provided that the typical life time of coke oven is 40 years, POSCO has installed CDQ equipment only for coke plants the remaining life time of which is more than 20 years (See <Table 7>).

Among all the coke plants of POSCO, only Pohang Works' small coke plants have no CDQ equipment at the time of the proposed project activity (See <Table 7>).

<Table 7> Small coke facilities of POSCO

		Coke plant Start date	Height of coke oven	Number of coke oven	CDQ equipment Start Date	CDQ capacity (ton/hr)
Pohang Works	No.1 Coke plant	Apr. 1973	5.15 m	86	Not available	Not available
	No.2 Coke plant	**Apr. 1976**	**5.15 m**	**88**	**The proposed project activity**	**95**

As shown in Table 7, No. 1 and 2 Coke plants of Pohang Works have been used during more than 30 years since their establishment, and their coke production capacity is relatively small compared to the large coke plants. Such conditions made it difficult to invest in installing CDQ equipment for them.

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

As described in *sub-step 4a*, all the CDQ equipment of POSCO were installed to large coke plants including coke ovens with the height of 6.7m, the remaining life time of which is at least 20 years. In the proposed project activity, however, No.2 Coke plant of Pohang Works consists of coke ovens with the height of 5.15m and has been operated during more than 30 years since its establishment in April, 1976. Thus, the remaining life time of No. 2 Coke plant of Pohang Works is less than 10 years provided that typical coke ovens have the life time of 40 years. It means that the new CDQ equipment for No.2 Coke plant of Pohang Works would be used only during 10 years or less. In addition, installing CDQ equipment for No.2 Coke plant of Pohang Works requires higher initial investment(investment per CDQ capacity) compared with POSCO's existing CDQ equipment (See Table 8) because No.2 Coke plant of Pohang Works has relatively small coke production capacity compared to other large coke plants with CDQ equipment. Such investment barriers of the proposed project activity made the very difficult investment decision of the CDQ equipment for No.2 Coke plant of Pohang Works.

<Table 8> Investment comparison between CDQ equipment

	#2 CDQ equipment of Pohang Works (Proposed project activity)	Existing CDQ equipment	
		#2 CDQ equipment of Gwangyang Works	#3, #4 CDQ equipment of Gwangyang Works
Investment per CDQ capacity [million won / CDQ capacity (ton/hr)]	689	445	427

There are distinctions between the proposed project activity and existing CDQ equipment because the proposed project activity is to establish new CDQ equipment for a small and old coke plant the remaining life time of which is 10 years or less, although POSCO has installed CDQ equipment for most of the large coke plants. Moreover, the proposed project activity of installing new CDQ equipment for No.2 Coke plant of Pohang Works is clearly financially unattractive. Thus, the proposed project activity is additional.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>>
The emission reductions of the proposed project are calculated as per the methodology ACM0012 (version 02).

Baseline Emissions

The baseline emissions for the year *y* are calculated as follows:

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

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 year *y* in tons of CO_2

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

In the proposed project activity, a waste gas is not used as an energy source and, therefore, in the baseline steam is not employed to flare the waste gas. The proposed project activity includes generation of electricity only and the baseline scenario for the proposed project activity is to obtain electricity from the grid. The baseline emissions are calculated as follows:

$$BE_y = BE_{En,y} = BE_{Elec,y} = f_{cap} * \sum_j \sum_i \left(EG_{i,j,y} * EF_{elec,i,j,y} \right)$$

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 (in the proposed project, the recipient is also generator), which in the absence of the project activity would have been sourced from i^{th} source (in the proposed project, *i* is the grid) during the year *y* in MWh, and

$EF_{elec,i,j,y}$ is the CO_2 emission factor for the electricity source *i* (*i*=*gr*(grid)), displaced due to the project activity, during the year *y* in tons CO_2/MWh

f_{cap} Energy that would have been produced in project year y using waste heat generated in base year expressed as a fraction of total energy produced using waste heat in year y. The ratio is 1 if the waste heat generated in project year y is same or less than that generated in base year. The value is estimated using equation (1f).

As the displaced electricity for recipient is supplied by a connected grid system, the CO_2 emission factor of the electricity $EF_{elec,gr,j,y}$ is determined following the guidance provided in the "Tool to calculate the emission factor for an electricity system (version 01)"

<u>Baseline emission factor of electricity</u>

According to ACM0012(version 02) , baseline emission factor is calculated by "Tool to calculate the emission factor for an electricity system (version 01)". Baseline emission factor is calculated by combined margin (CM), which is weighted average of operating margin (OM) and build margin (BM).

Baseline emissions will be calculated as following 6 steps.

STEP 1. Identify the relevant electric power system.

STEP 2. Select an operating margin (OM) method.

STEP 3. Calculate the operating margin emission factor according to the selected method.

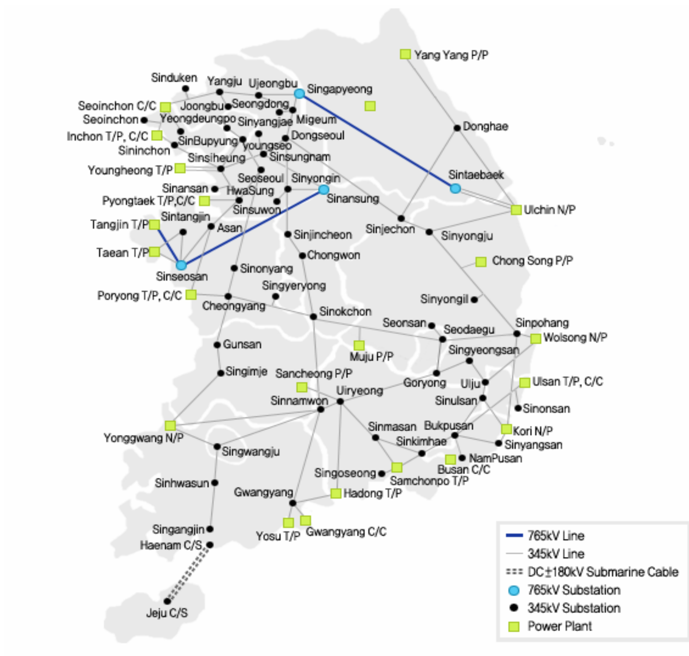
STEP 4. Identify the cohort of power units to be included in the build margin (BM).

STEP 5. Calculate the build margin emission factor.

STEP 6. Calculate the combined margin (CM) emissions factor.

Step 1. Identify the relevant electric power system

The electricity from the project activities is connected to KEPCO grid, which is the only one in Korea and so relevant electric power system is KEPCO grid.



<Fig.4> The transmission map of Korea

Step 2. Select an Operating Margin (OM) Method

The calculation of the Operating Margin emission factor ($EF_{grid,OM,y}$) is 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.

Among above 4 options, the Simple OM method can be used where low cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years. During 5 years(2002~2006), average low-cost/must run generation holds 42.85% of total KPX grid generation(See Annex 3). Thus the Simple OM method is employed in order to calculate OM emission factor.

Simple OM emission factor ($EF_{grid,OMsimple,y}$) is calculated using a 3-year generation-weighted average(ex-ante) of all generating power plants serving the system, based on the most recent data available at the time of submission of the PDD.

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

According to "Tool to calculate the emission factor for an electricity system (version 01)", the Simple OM emission factor is calculated as the generation-weighted average emissions per unit net electricity (tCO_2/MWh) of all generating power plants serving the system, not including low-operating cost and must-run power plants based on the three following options:

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

Based on data on fuel consumption and net electricity generation of each power plant/unit is available in Korea. So the proposed project can employ Option A.

Where Option A is used, the simple OM emission factor is calculated as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_{m} EG_{m,y}}$$

Where:

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

$FC_{i,m,y}$ = Amount of fossil fuel type i consumed by power plant / unit m in year y

$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y(GJ / mass or volume unit). If gross calorific values are provided by the data sources used, the gross calorific value (GCV) of the fuel can be used.

$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ). IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in Table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories

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

m	= All power plants / units serving the grid in year y except low-cost / must-run power plants / units
i	= All fossil fuel types combusted in power plant / unit m in year y
y	= 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

For the proposed project, domestic NCV_i is used. IPCC default value is used as CO_2 emission factor of fuel. Simple OM factor during 3 years (2004~2006) is 0.7282 tCO_2/MWh and this value is fixed along the credit period. The detailed baseline information used in the calculation is presented in Annex 3.

Step 4. Identify the cohort of power units to be included in the build margin

According to "Tool to calculate the emission factor for an electricity system (version 01)", the sample group of power units *m* used to calculate the build margin consists of either:

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

In the project, as the annual generation of "the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently" was 74,372,455 MWh and the annual generation of "the five power plants that have been built most recently" was 22,522 MWh. Therefore, the former is lager figure than the later, Option b is selected between the two options proposed by the methodology. The detailed data used in the calculation are presented in Annex 3.

Also according to "Tool to calculate the emission factor for an electricity system (version 01)", the BM emission factor is fixed during the credit period of the project activity.

As a general guidance, a power unit is considered to have been built at the date when it started to supply electricity to the grid. Power plant registered as CDM project activities should be **e**xcluded from the sample group *m*. However, if group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor includes power unit(s) that is (are) built more than 10 years ago then, power unit(s) that is(are) built more than 10 years ago from the group should be excluded and grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system should be included. Besides capacity additions from retrofits of power plants were not included in the calculation of the build margin emission factor.
In calculation of BM emission factor of the proposed project, these details were considered.

According to "Tool to calculate the emission factor for an electricity system (version 01)", in terms of vintage of data, project participants can choose between one of the two options (Option 1 and Option 2). And here, option 1 was chosen for the proposed project.

In accordance with Option 1, for the first crediting period, build margin emission factor is calculated 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 could be used. This option does not require monitoring the emission factor during the crediting period.

In accordance with Option 2, for the first crediting period, BM emission factor shall be updated annually, ex-post. And for the second crediting period, it shall be calculated ex-ante as the Option 1 above.

As the participants of the project won't update BM emission factor annually and instead, they will use the BM emission factor calculated ex-ante based on the most recent information for the first crediting period and fix it to use during the crediting period, Option 1 was chosen for the project.

Step 5. Calculate the build margin emission factor

According to "Tool to calculate the emission factors for electricity system (version 01)", the build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units *m* during the most recent year y for which power generation data is available, calculate as follows:

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

Where:

$EF_{grid,BM,y}$	= Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EG_{m,y}$	= Net quantity of electricity generated and delivered to the grid by power unit *m* in year y (MWh)
$EF_{EL,m,y}$	= CO_2 emission factor of power unit *m* in year y (tCO_2/MWh)
m	= Power units included in the build margin
y	= Most recent historical year for which power generation data is available

The CO_2 emission factor of each power unit *m* ($EF_{EL,m,y}$) should be determined as per the guidance in step 3 (a) for the simple OM, using options B1, B2 or B3, using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin.

In this project, as the generation amount and fuel consumption data on the power unit *m* is available thus the Option B1 presented in Step 3 (a) Simple OM was used.

For BM emission factor, $EF_{EL,m,y}$ was calculated by multiplying $FC_{i,m,y}$ (electricity consumption) by $NCV_{i,y}$ * $EF_{CO2,i,y}$ and divide it by power generation of each plant. And then $EF_{EL,m,y}$ was multiplied by power generation of each plant and finally it was divided by total power generation(2006 IPCC Guidelines on National GHG Inventories Table 1.2, Table 1.4).

BM emission factor is 0.3858 tCO_2/MWh. And further information on calculation for BM emission factor is shown in Annex 3.

Step 6. Calculate the combined emission factor

According to "Tool to calculate the emission factor for electricity system (version 01)", the combined margin emissions factor is calculated as follows:

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

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 (50%)
w_{BM}	= Weighting of build margin emissions factor (50%)

$$EF_{grid,CM,y} = 0.7282 \times 0.5 + 0.3858 \times 0.5 = 0.5570 \text{ tCO}_2\text{/MWh}$$

Capping of baseline emissions

As per methodology ACM0012, the baseline emissions have to be capped irrespective of planned/ unplanned or actual increase in output of plant, change in operational parameters and practices, change in fuels type and quantity resulting into increase in waste heat generation. For the proposed project activity, the cap is estimated using Method 1 because data is available.

According to Method 1, the baseline emissions should be capped at the maximum quantity of waste heat released into the atmosphere under normal operation conditions in the 3 years previous to the project activity. In the proposed project activity, the waste heat is generated from the quenching process of red hot coke. Thus, f_{cap} is estimated as follows:

$$f_{cap} = \frac{Q_{coke,BL}}{Q_{coke,y}} \qquad (1f)$$

Where,

$Q_{coke,BL}$	Coke production of No.2 Coke plant of Pohang Works prior to the start of the project activity (ton)
$Q_{coke,y}$	Coke production of No.2 Coke plant of Pohang Works during year y (ton)

The f_{cap} value is 1 if the waste heat generated in project year y($Q_{coke,y}$) is same or less than that generated in base year($Q_{coke,BL}$).

Project Emissions

Project emissions are calculated as follows:

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

Where:

PE_y Project emissions due to project activity

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

$PE_{EL,y}$ Project activity emissions from on-site consumption of electricity for gas cleaning equipment

In the proposed project activity, there is no combustion of auxiliary fuel to supplement waste heat and consumption of electricity for cleaning of gas. Thus, there are no project emissions for the proposed project.

$$PE_y = 0$$

Leakage

No leakage is applicable under this methodology.

Emission Reduction

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

$$ER_y = BE_y - PE_y$$

Where:

ER_y are the total emission reductions during the year *y* (tCO_2)

PE_y are the emissions from the project activity during the year *y* (tCO_2)

BE_y are the baseline emissions for the project activity during the year *y* (tCO_2)

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

Data / Parameter:	$FC_{i,m,y}$
Data unit:	Mass or volume unit
Description:	Amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y* *i* : bituminous, heavy oil, diesel, LNG *m* : all power plants / units serving the grid in year y except low-cost / must-run power plants / units *y* : 2004, 2005, 2006
Source of data used:	2006 STATISTICS OF ELECTRIC POWER IN KOREA 2005 STATISTICS OF ELECTRIC POWER IN KOREA 2004 STATISTICS OF ELECTRIC POWER IN KOREA
Value applied:	See ANNEX 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is used to calculate OM emission factor.
Any comment:	

Data / Parameter:	$NCV_{i,y}$
Data unit:	kcal/ mass or volume unit
Description:	Net calorific value of fuel *i* : bituminous, heavy oil, diesel oil, LNG *y* : 2004, 2005, 2006
Source of data used:	2006 STATISTICS OF ELECTRIC POWER IN KOREA 2005 STATISTICS OF ELECTRIC POWER IN KOREA 2004 STATISTICS OF ELECTRIC POWER IN KOREA
Value applied:	See ANNEX 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is used to calculate OM emission factor.
Any comment:	If gross calorific values are provided by the data sources used, the gross calorific value (GCV) of the fuel can be used.

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/GJ
Description:	CO_2 emission factor of fuel *i* in year *y* *i* : bituminous, heavy oil, diesel oil, LNG *y* : 2004, 2005, 2006
Source of data used:	IPCC default values at the lower limit of the uncertainty at a 95% confidence

	interval as provided in table 1.4 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories
Value applied:	Bituminous = 0.0895 Heavy oil = 0.0755 Diesel oil = 0.0726 LNG = 0.0543
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC world-wide default value
Any comment:	

Data / Parameter:	$EG_{m,y}$
Data unit:	MWh
Description:	Net electricity generated and delivered to the grid by power plant / unit *m* in year *y*
Source of data used:	2006 STATISTICS OF ELECTRIC POWER IN KOREA 2005 STATISTICS OF ELECTRIC POWER IN KOREA 2004 STATISTICS OF ELECTRIC POWER IN KOREA
Value applied:	See ANNEX 3
Justification of the choice of data or description of measurement methods and procedures actually applied :	It is used to calculate OM / BM emission factor.
Any comment:	

Data / Parameter:	$Q_{coke,BL}$
Data unit:	ton / year
Description:	Coke production of No.2 Coke plant of Pohang Works prior to the start of the project activity (ton)
Source of data used:	POSCO internal data
Value applied:	611,789 ton
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value of $Q_{coke,BL}$ has to be selected as the maximum quantity of coke production of No. 2 Coke plant of Pohang Works under normal operation conditions in the 3 years previous to the project activity. See ANNEX 3
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

Baseline Emissions

The baseline emissions are calculated as follows:

$$BE_y = f_{cap} * \sum_j \sum_i \left(EG_{i,j,y} * EF_{elec,i,j,y} \right)$$

Where,

BE_y are total baseline emissions 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 (in the proposed project, the recipient is also generator), which in the absence of the project activity would have been sourced from i^{th} source (in the proposed project, i is the grid) during the year y in MWh, and

$EF_{elec,i,j,y}$ is the CO_2 emission factor for the electricity source i (i=gr(grid)), displaced due to the project activity, during the year y in tons CO_2/MWh

f_{cap} Energy that would have been produced in project year y using waste heat generated in base year expressed as a fraction of total energy produced using waste heat in year y. The ratio is 1 if the waste heat generated in project year y is same or less than that generated in base year. The value is estimated using equation (1f).

The CO_2 emission factor of electricity $EF_{elec,i,j,y}$ is calculated as the weighted average of $EF_{OM,y}$ and $EF_{BM,y}$.

$$EF_{elec,i,j,y} = 0.7282 \times 0.5 + 0.3858 \times 0.5 = 0.5570 \text{ tCO}_2\text{/MWh}$$

The quantity of electricity supplied to the recipient by the generator $EG_{i,j,y}$ means the net electricity generated by #2 CDQ equipment of Pohang Works.

(Net electricity generation of #2 CDQ equipment) = (Total electricity generation of #2 CDQ equipment) – (Self consumption of #2 CDQ equipment)

At the time of PDD submission, when it is assumed that the utilization ratio of #2 CDQ equipment is 88% and the self consumption of the #2 CDQ equipment is 15%, the net electricity generation of #2 CDQ equipment is estimated as follows:

(Net electricity generation of #2 CDQ equipment) = 14.7 MW × 365day × 24 h/day × 0.88 × 0.85
= 96,321 MWh

If the quantity of waste heat generated during project year y is identical with the quantity of waste heat generated during the base year (i.e., the value of f_{cap} is '1'), the baseline emissions during the project year y are calculated as follows:

$$BE_y = 1 \times 96{,}321\,\text{MWh} \times 0.5570\ \text{tCO}_2/\text{MWh} = 53{,}650\ \text{tCO}_2$$

Project Emissions

In the proposed project activity, there is no combustion of auxiliary fuel. Thus, there are no project emissions for the proposed project.

$$PE_y = 0$$

Leakage

No leakage is applicable under this methodology.

Emission Reduction

Emission reductions during the year y are calculated as follows:

$$ER_y = BE_y - PE_y$$

Where:

ER_y are the total emission reductions during the year *y* (tCO_2)

PE_y are the emissions from the project activity during the year *y* (tCO_2)

BE_y are the baseline emissions for the project activity during the year *y* (tCO_2)

$$ER_y = BE_y - PE_y = 53{,}650 - 0 = 53{,}650\text{tCO}_2$$

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 reduction (tonnes of CO_2e)
2009	0	53,650	0	53,650
2010	0	53,650	0	53,650
2011	0	53,650	0	53,650
2012	0	53,650	0	53,650
2013	0	53,650	0	53,650
2014	0	53,650	0	53,650

2015	0	53,650	0	53,650
2016	0	53,650	0	53,650
2017	0	53,650	0	53,650
2018	0	53,650	0	53,650
Total (tonnes of CO_2e)	0	536,500	0	536,500

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

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)	
Data / Parameter:	$EG_{i,j,y}$
Data unit:	MWh
Description:	The quantity of electricity supplied to the recipient *j* by generator (in the proposed project, the recipient is also generator), i.e. the net electricity generation of #2 CDQ equipment of Pohang Works, during the year *y*.
Source of data to be used:	Calculated based on the data monitored by the project developer
Value of data applied for the purpose of calculating expected emission reductions in section B.5	96,321 MWh
Description of measurement methods and procedures to be applied:	Project developer calculates the value by subtracting the self consumption of #2 CDQ equipment from the total electricity generation of #2 CDQ equipment. The total electricity generation and self consumption of #2 CDQ equipment of Pohang Works are measured by the project developer.
QA/QC procedures to be applied:	Since this value is calculated from the monitored data, there are no QA/QC procedures for it.
Any comment:	

Data / Parameter:	Total electricity generation of #2 CDQ equipment
Data unit:	MWh
Description:	The total quantity of electricity generated by #2 CDQ equipment which is installed to No.2 Coke plant of Pohang Works.
Source of data to be used:	POSCO's Energy management system
Value of data applied for the purpose of calculating expected emission reductions in section B.5	113,319 MWh

Description of measurement methods and procedures to be applied:	The electricity generated by #2 CDQ equipment is continuously measured by a wattmeter installed in the project site. The measured data is transmitted to UCC (Utility Control Centre) through DCS (Distribution Control System) in real time. The real-time data is stored in UCC on hourly basis. The data of UCC is sent to the database of Energy Management System hourly. Therefore, the data of total electricity generation of #2 CDQ equipment can be obtained from the database of Energy Management System. Energy Management System is administrated by POSCO's environmental energy department.
QA/QC procedures to be applied:	The wattmeter for measuring electricity generation is calibrated and verified by KESCO (Korea electric safety corporation) before using. Then, the wattmeter installed will be calibrated and verified once every two years. In addition, Electrical Maintenance Section of Electric & Control Maintenance Department in POSCO will maintain the wattmeter once a year.
Any comment:	

Data / Parameter:	Self consumption of #2 CDQ equipment
Data unit:	MWh
Description:	The quantity of electricity consumed by #2 CDQ equipment of Pohang Works
Source of data to be used:	POSCO's Energy management system
Value of data applied for the purpose of calculating expected emission reductions in section B.5	16,998 MWh
Description of measurement methods and procedures to be applied:	The electricity consumed by #2 CDQ equipment itself is continuously measured by a wattmeter installed in the project site. The measured data is transmitted to UCC (Utility Control Centre) through DCS (Distribution Control System) in real time. The real-time data is stored in UCC on hourly basis. The data of UCC is sent to the database of Energy Management System hourly. Therefore, the data of self consumption of #2 CDQ equipment can be obtained from the database of Energy Management System. Energy Management System is administrated by POSCO's environmental energy department.
QA/QC procedures to be applied:	The wattmeter for measuring the self consumption of #2 CDQ equipment is calibrated and verified by KESCO (Korea electric safety corporation) before using. Then, the wattmeter installed will be calibrated and verified once every two years. In addition, Electrical Maintenance Section of Electric & Control Maintenance Department in POSCO will maintain the wattmeter once a year.
Any comment:	

Data / Parameter:	$Q_{coke,y}$
Data unit:	ton
Description:	Coke production of No.2 Coke plant of Pohang Works during project year *y*
Source of data to be used:	Pohang Works' Manufacturing Execution System
Value of data applied	611,789 ton

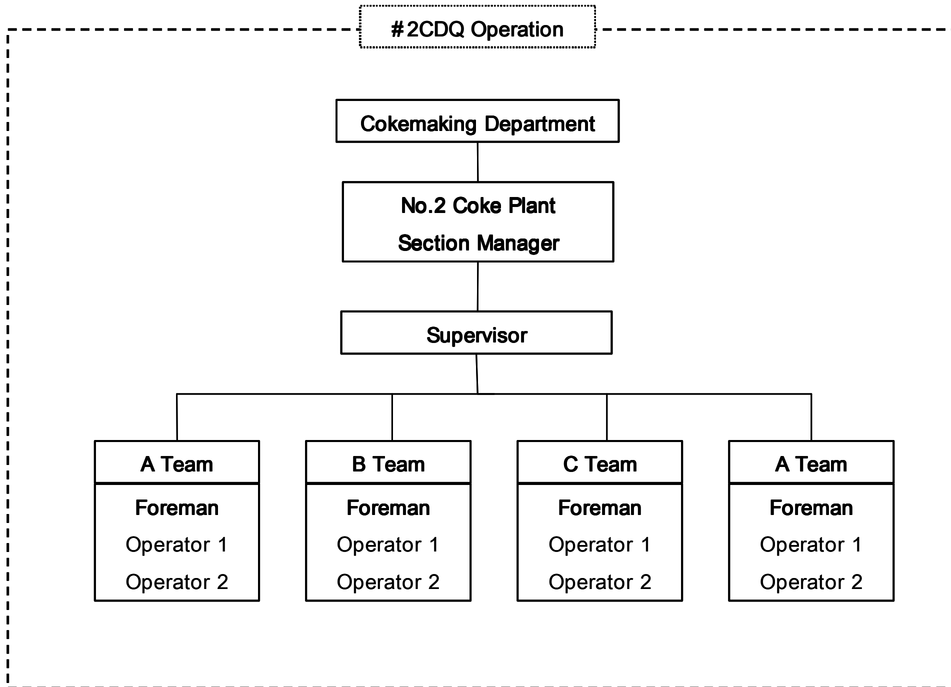
for the purpose of calculating expected emission reductions in section B.5	
Description of measurement methods and procedures to be applied:	The coke production of No.2 Coke plant of Pohang Works is automatically measured by a belt weigher that is installed on the belt conveyor to transport coke cooled by the CDQ equipment. The measured data is transmitted to Manufacturing Execution System to store therein. Therefore, the data of coke production of No.2 Coke plant can be obtained from the database of Manufacturing Execution System of Pohang Works.
QA/QC procedures to be applied:	The belt weigher of #2 CDQ system is maintained by Cokemaking Machinery Maintenance Section of Machinery & Equipment Department in accordance with POSCO's internal standards.
Any comment:	

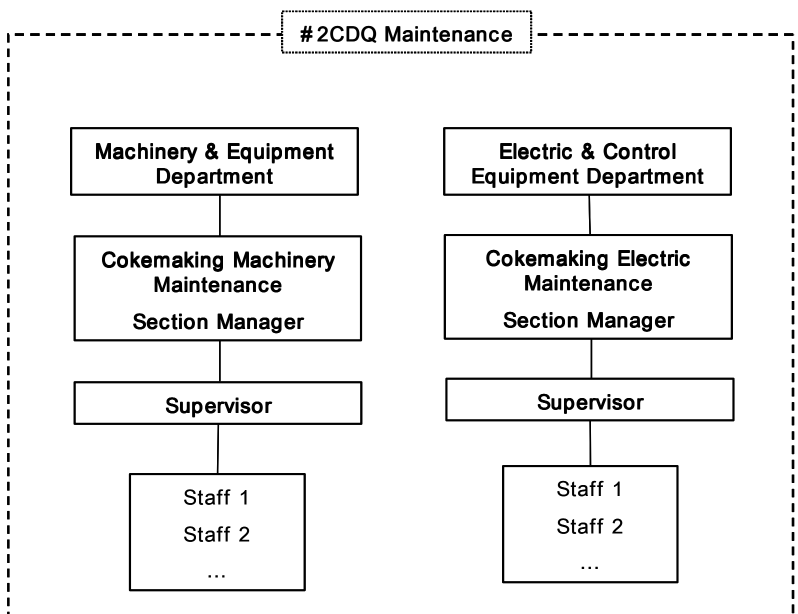
B.7.2 Description of the monitoring plan:

>>
As per consolidated methodology ACM0012, all data collected as part of monitoring plan will be archived electronically and kept at least for 2 years after the end of the crediting period.

The total electricity generation and self consumption of #2 CDQ equipment of Pohang Works, and coke production of No.2 Coke plant of Pohang Works are automatically measured by measuring instruments. The data measured is electronically archived in Energy Management System or Manufacturing Execution System and, therefore, will be able to be obtained from the database of the systems at any time. The Energy Management System is administrated by Environment & Energy Department of POSCO. The Manufacturing Execution System is managed by operation departments within the site.

The #2 CDQ equipment established by the proposed project will be operated and managed by No.2 Coke plant section of Cokemaking Department. The maintenance of #2 CDQ equipment will be carried out by Cokemaking Machinery Maintenance Section and Cokemaking Electrical Maintenance Section.





POSCO has established an environment management system corresponding to international standards and obtained ISO14001 certification. Thus, monitoring plan of the proposed project activity will be managed in integration and continuation with the environment management system through ISO14001.

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: October, 2007

Entity responsible for the application of the baseline and monitoring methodology
RCC Co., Ltd.
Pohang TechnoPark 601, Venture 1st building
Gigok-dong 601, Nam-gu, Pohang-si
Gyeongbuk 790-834, Korea.
e-mail: joko@rcc-posco.co.kr

Energy Business Department, Energy Business Planning Group
*POSCO
POSCO Center, 892 Daechi 4-dong, Gangnam-gu, Seoul 135-777, Korea
E-mail: yeunjae.jeong@posco.co.kr

*This entity is also a project participant listed in Annex 1.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>

21 March 2007

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

>>

9 years

C.2 Choice of crediting period and related information:

C.2.1. Renewable crediting period

>>

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

>>

Not applicable

C.2.1.2. Length of the first crediting period:

>>

Not applicable

C.2.2. Fixed crediting period:

>>

C.2.2.1. Starting date:

>>

01/01/2009

C.2.2.2. Length:

>>

10 years

SECTION D. Environmental impacts

>>

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

>>

Because CDQ equipment is the airtight system, it will be able to minimize the generation of pollutant in comparison with existing CWQ system. Likewise it will be able to contribute greatly to the conservation of water resources, since it uses the circulation of nitrogen instead of water with the cooling media.

As existing CWQ system is directly in contact with the red hot coke and water, the steam will contains particulates(minuteness coke) in the cooling process. So it has directly influence on workers in the coke plant or nearby equipment, and it carried to the residential area or nearby town by the wind causes the popular enmity as well as air pollution. Because the steam generated in the cooling process of red hot coke also obstructs sight of workers, it causes an accident of lives or equipment, corrosion acceleration of the coke plant or nearby equipment and traffic barrier as the obstacle of driver sight on a road. Besides this factor of atmospheric environment, the possibility of the secondary water pollution is high because of the treatment of water generated in the cooling process of red hot coke.

Meanwhile the proposed project could minimize those environmental effects from existing CWQ systems, but the particulates are likely to be generated during CDQ process or conveyance of the cooled cokes to the blast furnace systems. Therefore, to address that, the overall equipment including the belt conveyer is established as an airtight system so that it could constrain the generation of particulates and minimize the loss of cokes.

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 proposed project activity is the project activity performed in the site of Pohang works of POSCO, as per the municipal law of Korea it is not applicable to the target equipment of Environmental Impact Assessment. Therefore this project isn't need to enforce separately Environmental Impact Assessment.

SECTION E. Stakeholders' comments

>>

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

>>

POSCO held "the presentation of CDM project of POSCO" at 8th March, 2007 in Gigok-dong, Nam-gu, Pohang-si in order to inform the inhabitants and local stakeholders of the proposed project and be given their opinion. Total 23 people including the public servant related to Pohang city hall attended this presentation, and there is the question and answer for the environmental advantages of CDQ equipment and CDM project generally.

< Public hearing of the proposed CDM project, 08 March 2007 >

E.2. Summary of the comments received:

>>

POSCO held the presentation of CDM project in order to be given the stakeholders opinion of the proposed project. The attendant of presentation has no objection against the installation project of CDQ equipment in POSCO. Instead, they requested the detailed explanation about the conversion process of the existing wet process(CWQ) to the dry process(CDQ) and the environmental safety of CDQ system. There is also the question about the possibility of environmental pollution in the case of the airtight circulation or the disposal of the inert gas nitrogen used in CDQ equipment. The answer of this question is clearly explained on-site, the stakeholders will be able to understand enough.

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

>>

The answer of question from the presentation of POSCO CDM project is directly performed at the presentation of the day on site.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	POSCO
Street/P.O.Box:	#892 Daechi 4-dong, Gangnam-gu
Building:	POSCO Centre
City:	Seoul
State/Region:	Seoul
Postfix/ZIP:	135-777
Country:	Republic of Korea
Telephone:	82-2-3457-1681
FAX:	82-2-3457-1988
E-Mail:	yeunjae.jeong@posco.co.kr
URL:	www.posco.com
Represented by:	
Title:	Assistant Manager
Salutation:	Mr.
Last Name:	Jeong
Middle Name:	
First Name:	Yeunjae
Department:	Energy Business Department
Mobile:	
Direct FAX:	82-2-3475-1988
Direct tel:	82-2-3475-1681
Personal E-Mail:	yeunjae.jeong@posco.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no pubic funding from Annex I countries toward the proposed project.

Annex 3

BASELINE INFORMATION

Simple OM calculation

The simple OM method can be used where low cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years.

< Generation of power plants groups (MWh, Gross)>

year	Low cost/must run					Total grid generation	Low cost/must run ratio
	Hydro	Coal (Anthracite)	Nuclear	Alternative*	Subtotal		
2001	4,150,753	7,007,385	112,133,033	0	123,291,171	285,223,757	43.23%
2002	5,311,047	6,674,542	119,102,905	0	131,088,494	306,474,064	42.77%
2003	6,886,983	6,999,937	129,671,763	0	143,558,683	322,451,697	44.52%
2004	5,861,434	5,787,070	130,714,816	350,183	142,713,503	342,147,967	41.71%
2005	5,188,888	5,789,778	146,779,023	404,101	158,161,790	364,639,331	43.37%
2006	5,218,621	5,709,388	148,748,887	511,223	160,188,119	381,180,709	42.02%
Average of five recent years	**5,693,395**	**6,192,143**	**135,003,479**	**253,101**	**147,142,118**	**343,378,754**	**42.85%**

*Alternative: Geothermal, Wind, Low-cost biomass, Solar, LFG

Source: 2006 Statistics of Electric Power in Korea, KEPCO, 2007.05.

Carbon Emission Factor

CO_2 Emission Factor of fossil fuel type *i* (unit: tCO_2/GJ) ($EF_{CO2,i,y}$)

Bituminous coal	**0.089500**
Heavy Oil	**0.075500**
Diesel Oil	**0.072600**
LNG	**0.054300**

*Source:: IPCC 2006

IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 of 2006 IPCC Guidelines on National GHG Inventories

Simple OM for the proposed project activity

Operating margin for 2006: 0.7219 tCO_2/MWh

Operating margin for 2005: 0.7322 tCO_2/MWh

Operating margin for 2004: 0.7306 tCO_2/MWh

$$EF_{OM} = \frac{0.7219 + 0.7322 + 0.7306}{3} = 0.7282 \mathrm{tCO_2/MWh}$$

Operating Margin for 2006

Power plant (m)		Fuel (i) Type	*Net Generation ($EG_{m,y}$) (MWh)	**Fuel consumption ($FC_{i,m,y}$)				***Calorific value (energy content)				Calorific value (energy content) ($CV_{i,y}$)				$FC_{i,m,y}$ * $CV_{i,y}$ * $EF_{CO2,i,y}$				$\sum_i FC_{i,m,y}$ * $CV_{i,y}$ * $EF_{CO2,i,y}$ (tCO_2)
				Bituminous coal (ton)	Heavy oil (kl)	Diesel Oil (kl)	LNG (ton)	Bituminous coal (kcal/kg)	Heavy oil (kcal/l)	Diesel Oil (kcal/l)	LNG (kcal/kg)	Bituminous coal (kJ/kg)	Heavy oil (kJ/l)	Diesel Oil (kJ/l)	LNG (kJ/kg)	Bituminous coal (tCO_2)	Heavy oil (tCO_2)	Diesel Oil (tCO_2)	LNG (tCO_2)	
Honam	#1	Coal-thermal	1,622,639	781,139	1,113	279	0	5,436	9,809	8,917	0	22,759	41,068	37,334	0	1,591,157	3,451	756	0	1,595,364
	#2	Coal-thermal	1,782,016	859,736	1,251	359	0	5,407	9,823	8,870	0	22,638	41,127	37,137	0	1,741,914	3,884	968	0	1,746,766
Samchonpo	#1	Coal-thermal	4,161,219	1,696,271	0	860	0	5,937	0	8,814	0	24,857	0	36,902	0	3,773,701	0	2,304	0	3,776,005
	#2	Coal-thermal	3,703,880	1,508,082	0	1,362	0	5,942	0	8,814	0	24,878	0	36,902	0	3,357,862	0	3,649	0	3,361,511
	#3	Coal-thermal	3,779,585	1,519,385	0	457	0	5,858	0	8,814	0	24,526	0	36,902	0	3,335,204	0	1,224	0	3,336,429
	#4	Coal-thermal	3,816,997	1,521,263	0	1,818	0	5,861	0	8,803	0	24,539	0	36,856	0	3,341,037	0	4,865	0	3,345,901
	#5	Coal-thermal	3,761,205	1,665,339	0	977	0	5,236	0	9,000	0	21,922	0	37,681	0	3,267,439	0	2,673	0	3,270,112
	#6	Coal-thermal	4,065,091	1,770,348	0	428	0	5,255	0	9,000	0	22,002	0	37,681	0	3,486,074	0	1,171	0	3,487,245
Yongheng	#1	Coal-thermal	5,337,432	2,004,193	0	2,548	0	6,072	0	8,891	0	25,422	0	37,225	0	4,560,123	0	6,886	0	4,567,009
	#2	Coal-thermal	5,727,937	2,129,118	0	2,545	0	6,086	0	8,899	0	25,481	0	37,258	0	4,855,533	0	6,884	0	4,862,417
Boryeong	#1	Coal-thermal	3,988,848	1,638,140	0	306	0	5,768	0	8,855	0	24,149	0	37,074	0	3,540,638	0	824	0	3,541,462
	#2	Coal-thermal	3,423,101	1,389,425	0	1,137	0	5,766	0	8,943	0	24,141	0	37,443	0	3,002,030	0	3,091	0	3,005,121
	#3	Coal-thermal	3,409,486	1,323,779	0	514	0	5,845	0	8,943	0	24,472	0	37,443	0	2,899,381	0	1,397	0	2,900,778
	#4	Coal-thermal	4,133,946	1,610,928	0	82	0	5,824	0	8,943	0	24,384	0	37,443	0	3,515,627	0	223	0	3,515,850
	#5	Coal-thermal	3,364,148	1,296,455	0	541	0	5,845	0	8,749	0	24,472	0	36,630	0	2,839,535	0	1,439	0	2,840,974
	#6	Coal-thermal	3,987,488	1,553,273	0	518	0	5,834	0	8,749	0	24,426	0	36,630	0	3,395,623	0	1,378	0	3,397,001
Taean	#1	Coal-thermal	3,556,797	1,354,832	0	514	0	5,982	0	8,749	0	25,045	0	36,630	0	3,036,946	0	1,367	0	3,038,313
	#2	Coal-thermal	4,035,753	1,532,209	0	162	0	5,978	0	8,371	0	25,029	0	35,048	0	3,432,252	0	412	0	3,432,664
	#3	Coal-thermal	3,528,613	1,338,967	0	575	0	5,983	0	8,649	0	25,050	0	36,212	0	3,001,886	0	1,512	0	3,003,397
	#4	Coal-thermal	4,069,820	1,548,909	0	133	0	5,979	0	8,665	0	25,033	0	36,279	0	3,470,242	0	350	0	3,470,592
	#5	Coal-thermal	4,013,235	1,542,775	0	544	0	5,934	0	8,665	0	24,844	0	36,279	0	3,430,484	0	1,433	0	3,431,917
	#6	Coal-thermal	3,381,867	1,294,577	0	1,113	0	5,960	0	8,665	0	24,953	0	36,279	0	2,891,208	0	2,931	0	2,894,140
	#7	Coal-thermal	159,677	61,910	0	4,799	0	5,965	0	8,558	0	24,974	0	35,831	0	138,381	0	12,484	0	150,865
Hadong	#1	Coal-thermal	3,607,063	1,373,049	0	515	0	5,969	0	8,838	0	24,991	0	37,003	0	3,071,092	0	1,384	0	3,072,476
	#2	Coal-thermal	4,068,036	1,543,074	0	293	0	5,959	0	8,928	0	24,949	0	37,380	0	3,445,604	0	795	0	3,446,399
	#3	Coal-thermal	4,079,158	1,549,094	0	153	0	5,958	0	8,928	0	24,945	0	37,380	0	3,458,466	0	415	0	3,458,881
	#4	Coal-thermal	3,631,374	1,376,612	0	796	0	5,969	0	8,825	0	24,991	0	36,949	0	3,079,062	0	2,135	0	3,081,197
	#5	Coal-thermal	4,092,625	1,554,524	0	242	0	5,963	0	8,911	0	24,966	0	37,309	0	3,473,502	0	655	0	3,474,157
	#6	Coal-thermal	3,610,222	1,371,801	0	690	0	5,967	0	8,901	0	24,983	0	37,267	0	3,067,273	0	1,867	0	3,069,140
Dangjin	#1	Coal-thermal	3,598,820	1,380,527	0	966	0	5,882	0	8,975	0	24,627	0	37,577	0	3,042,812	0	2,635	0	3,045,448
	#2	Coal-thermal	4,115,891	1,570,077	0	161	0	5,906	0	8,978	0	24,727	0	37,589	0	3,474,719	0	439	0	3,475,158
	#3	Coal-thermal	3,666,490	1,402,916	0	433	0	5,886	0	9,007	0	24,644	0	37,711	0	3,094,263	0	1,185	0	3,095,448
	#4	Coal-thermal	3,610,984	1,386,317	0	1,549	0	5,875	0	9,015	0	24,597	0	37,744	0	3,051,938	0	4,245	0	3,056,182
	#5	Coal-thermal	3,946,931	1,456,458	0	745	0	6,046	0	8,955	0	25,313	0	37,493	0	3,299,676	0	2,028	0	3,301,704
	#6	Coal-thermal	3,392,395	1,216,582	0	3,051	0	6,120	0	8,895	0	25,623	0	37,242	0	2,789,961	0	8,249	0	2,798,210
	#7	Coal-thermal	1,474	1,008	0	505	0	5,818	0	8,984	0	24,359	0	37,614	0	2,198	0	1,379	0	3,577

Operating Margin for 2006 (continued)

Ulsan	#1	Heavy oil-thermal	275,016	0	72,243	605	0	0	9,915	9,120	0	0	41,512	38,184	0	0	226,421	1,677	0	228,099
	#2	Heavy oil-thermal	306,668	0	80,187	469	0	0	9,923	9,120	0	0	41,546	38,184	0	0	251,522	1,300	0	252,822
	#3	Heavy oil-thermal	376,132	0	96,459	518	0	0	9,919	9,120	0	0	41,529	38,184	0	0	302,440	1,436	0	303,876
	#4	Heavy oil-thermal	1,511,557	0	360,919	3,729	0	0	10,030	9,120	0	0	41,994	38,184	0	0	1,144,300	10,337	0	1,154,637
	#5	Heavy oil-thermal	1,583,846	0	375,985	3,678	0	0	10,033	9,120	0	0	42,006	38,184	0	0	1,192,423	10,196	0	1,202,619
	#6	Heavy oil-thermal	1,589,838	0	378,331	3,694	0	0	10,035	9,120	0	0	42,015	38,184	0	0	1,200,103	10,240	0	1,210,343
Youngnam	#1	Heavy oil-thermal	359,205	0	107,090	1,016	0	0	10,138	8,845	0	0	42,446	37,032	0	0	343,187	2,732	0	345,918
	#2	Heavy oil-thermal	323,595	0	95,127	1,494	0	0	10,110	8,862	0	0	42,329	37,103	0	0	304,007	4,024	0	308,032
Yosu	#1	Heavy oil-thermal	403,547	0	99,129	281	0	0	9,963	8,798	0	0	41,713	36,835	0	0	312,191	751	0	312,942
	#2	Heavy oil-thermal	906,849	0	215,957	291	0	0	9,954	8,796	0	0	41,675	36,827	0	0	679,507	778	0	680,285
Pyongtaek	#1	Heavy oil-thermal	1,123,948	0	261,458	141	3,997	0	9,707	8,943	12,941	0	40,641	37,443	54,181	0	802,262	383	11,759	814,404
	#2	Heavy oil-thermal	1,198,620	0	277,025	166	5,687	0	9,719	8,943	12,941	0	40,692	37,443	54,181	0	851,079	451	16,731	868,261
	#3	Heavy oil-thermal	1,304,568	0	303,858	134	3,891	0	9,747	8,949	12,859	0	40,809	37,468	53,838	0	936,205	365	11,375	947,944
	#4	Heavy oil-thermal	1,052,228	0	245,602	103	3,473	0	9,693	8,949	12,963	0	40,583	37,468	54,273	0	752,522	280	10,235	763,037
Namjeju	#1	Heavy oil-thermal	34,448	0	11,406	17	0	0	9,908	8,974	0	0	41,483	37,572	0	0	35,723	46	0	35,769
	#2	Heavy oil-thermal	28,686	0	9,772	14	0	0	9,908	8,952	0	0	41,483	37,480	0	0	30,605	38	0	30,644
	#3	Heavy oil-thermal	179,033	0	46,504	2,509	0	0	9,898	8,938	0	0	41,441	37,422	0	0	145,501	6,816	0	152,318
Jeju	#1	Heavy oil-thermal	24,748	0	8,603	23	0	0	9,870	8,873	0	0	41,324	37,149	0	0	26,841	62	0	26,903
	#2	Heavy oil-thermal	462,023	0	113,679	64	0	0	9,952	8,973	0	0	41,667	37,568	0	0	357,618	175	0	357,793
	#3	Heavy oil-thermal	479,676	0	117,464	67	0	0	9,953	8,973	0	0	41,671	37,568	0	0	369,563	183	0	369,745
Seoul	#4	Gas-thermal	306,558	0	0	1	69,383	0		9,070	13,018	0	0	37,974	54,504	0	0	3	205,343	205,346
	#5	Gas-thermal	685,011	0	0	1	152,891	0		9,070	12,882	0	0	37,974	53,934	0	0	3	447,762	447,765
Incheon	#1	Gas-thermal	32,932	0	0	0	6,945	0		0	13,036	0	0	0	54,579	0	0	0	20,583	20,583
	#2	Gas-thermal	24,366	0	0	0	5,223	0		0	13,028	0	0	0	54,546	0	0	0	15,470	15,470
	#3	Gas-thermal	78,669	0	0	311	15,426	0		8,982	13,018	0	0	37,606	54,504	0	0	849	45,654	46,503
	#4	Gas-thermal	62,414	0	0	311	12,454	0		8,981	13,024	0	0	37,602	54,529	0	0	849	36,875	37,724

Operating Margin for 2006 (continued)

Namjeju D/P	Internal combustion	239,690	0	51,347	111	0	0	10,246	8,907	0	0	42,898	37,292	0	0	166,302	301	0	166,603
Jeju G/T	Internal combustion	15,986	0	0	8,264	0	0	0	8,792	0	0	0	36,810	0	0	0	22,085	0	22,085
Jeju D/P	Internal combustion	252,764	0	52,907	0	0	0	9,617	0	0	0	40,264	0	0	0	160,836	0	0	160,836
Pyongtaek C/C	Combined cycle	497,441	0	0	45	84,054	0	0	8,950	13,030	0	0	37,472	54,554	0	0	122	248,992	249,114
Ilsan C/C	Combined cycle	3,038,165	0	0	1,384	556,504	0	0	8,989	13,017	0	0	37,635	54,500	0	0	3,782	1,646,877	1,650,659
Bundang C/C	Combined cycle	4,059,300	0	0	0	720,381	0	0	0	13,025	0	0	0	54,533	0	0	0	2,133,153	2,133,153
Ulsan C/C	Combined cycle	3,608,435	0	0	0	536,196	0	0	0	12,646	0	0	0	52,946	0	0	0	1,541,554	1,541,554
Seoincheon C/C	Combined cycle	8,726,521	0	0	1,066	1,199,196	0	0	9,200	13,025	0	0	38,519	54,533	0	0	2,981	3,550,994	3,553,975
Shinincheon C/C	Combined cycle	11,797,500	0	0	0	1,641,038	0	0	0	13,025	0	0	0	54,533	0	0	0	4,859,353	4,859,353
Boryeong C/C	Combined cycle	7,089,662	0	0	0	998,683	0	0	0	13,034	0	0	0	54,571	0	0	0	2,959,289	2,959,289
Incheon C/C	Combined cycle	3,648,288	0	0	0	484,606	0	0	0	12,998	0	0	0	54,420	0	0	0	1,432,014	1,432,014
Busan C/C	Combined cycle	10,455,401	0	0	0	1,396,417	0	0	0	13,017	0	0	0	54,500	0	0	0	4,132,454	4,132,454
Hallim C/C	Combined cycle	175,356	0	0	48,475	0	0	0	8,954	0	0	0	37,489	0	0	0	131,933	0	131,933
GS Anyang C/C	Combined cycle	1,286,480	0	0	0	230,969	0	0	0	13,028	0	0	0	54,546	0	0	0	684,090	684,090
GS Bucheon C/C	Combined cycle	1,241,795	0	0	215	225,713	0	0	10,927	13,013	0	0	45,749	54,483	0	0	714	667,753	668,467
POSCO Power	Combined cycle	2,338,128	0	0	0	408,018	0	0	0	13,031	0	0	0	54,558	0	0	0	1,208,757	1,208,757
GS EPS Bugog	Combined cycle	2,911,683	0	0	0	389,811	0	0	0	13,030	0	0	0	54,554	0	0	0	1,154,730	1,154,730
Yulchon C/C	Combined cycle	2,276,276	0	0	0	315,132	0	0	0	13,376	0	0	0	56,003	0	0	0	958,299	958,299
	$\sum_m EG_{m,y}$=	**206,605,295**																$\sum_{i,m} FC_{i,m,y} \cdot CV_{i,y} \cdot EF_{CO2,i,y}$=	**149,156,959**

*, **, ***: 2006 Statistics of Electric Power in Korea, KEPCO, 2007.5.

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_{m} EG_{m,y}} = 0.7219$$

Operating Margin for 2005

Plant (m)		Fuel (i) Type	*Net Generation ($EG_{m,y}$) (MWh)	**Fuel consumption ($FC_{i,m,y}$)				***Calorific value (energy content)				Calorific value (energy content) ($CV_{i,y}$)				$FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$				$\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ (tCO_2)
				Bituminous coal (ton)	Heavy oil (kl)	Diesel Oil (kl)	LNG (ton)	Bituminous coal (kcal/kg)	Heavy oil (kcal/l)	Diesel Oil (kcal/l)	LNG (kcal/kg)	Bituminous coal (kJ/kg)	Heavy oil (kJ/l)	Diesel Oil (kJ/l)	LNG (kJ/kg)	Bituminous coal (tCO_2)	Heavy oil (tCO_2)	Diesel Oil (tCO_2)	LNG (tCO_2)	
Honam	#1	Coal-thermal	1,787,715	870,214	961	278	0	5,392	9,835	8,809	0	22,575	41,177	36,882	0	1,758,252	2,988	744	0	1,761,984
	#2	Coal-thermal	1,875,790	912,497	338	185	0	5,376	9,854	8,804	0	22,508	41,257	36,861	0	1,838,214	1,053	495	0	1,839,761
Samchonpo	#1	Coal-thermal	3,810,079	1,534,223	0	1,220	0	5,913	0	8,841	0	24,757	0	37,015	0	3,399,395	0	3,279	0	3,402,673
	#2	Coal-thermal	4,323,618	1,731,265	0	626	0	5,924	0	8,883	0	24,803	0	37,191	0	3,843,119	0	1,690	0	3,844,809
	#3	Coal-thermal	4,343,666	1,723,152	0	377	0	5,897	0	9,000	0	24,690	0	37,681	0	3,807,676	0	1,031	0	3,808,707
	#4	Coal-thermal	4,112,297	1,632,334	0	1,029	0	5,898	0	8,943	0	24,694	0	37,443	0	3,607,606	0	2,797	0	3,610,403
	#5	Coal-thermal	3,542,728	1,516,654	0	1,415	0	5,347	0	8,614	0	22,387	0	36,065	0	3,038,799	0	3,705	0	3,042,504
	#6	Coal-thermal	3,643,969	1,546,663	0	1,001	0	5,376	0	9,000	0	22,508	0	37,681	0	3,115,733	0	2,738	0	3,118,471
Yongheng	#1	Coal-thermal	5,623,299	2,081,972	0	4,541	0	6,131	0	8,935	0	25,669	0	37,409	0	4,783,122	0	12,333	0	4,795,455
	#2	Coal-thermal	4,658,862	1,761,395	0	2,903	0	6,053	0	8,947	0	25,343	0	37,459	0	3,995,146	0	7,895	0	4,003,041
Boryeong	#1	Coal-thermal	3,547,140	1,440,343	0	761	0	5,830	0	8,943	0	24,409	0	37,443	0	3,146,587	0	2,069	0	3,148,656
	#2	Coal-thermal	3,433,608	1,388,532	0	551	0	5,816	0	8,943	0	24,350	0	37,443	0	3,026,116	0	1,498	0	3,027,614
	#3	Coal-thermal	4,124,745	1,589,150	0	90	0	5,882	0	8,740	0	24,627	0	36,593	0	3,502,637	0	239	0	3,502,876
	#4	Coal-thermal	3,698,705	1,421,343	0	603	0	5,890	0	8,748	0	24,660	0	36,626	0	3,137,036	0	1,603	0	3,138,639
	#5	Coal-thermal	4,121,314	1,587,999	0	156	0	5,882	0	8,749	0	24,627	0	36,630	0	3,500,100	0	415	0	3,500,515
	#6	Coal-thermal	3,283,477	1,260,305	0	627	0	5,901	0	8,749	0	24,706	0	36,630	0	2,786,805	0	1,667	0	2,788,472
Taean	#1	Coal-thermal	3,992,112	1,508,570	0	621	0	6,000	0	8,692	0	25,121	0	36,392	0	3,391,735	0	1,641	0	3,393,376
	#2	Coal-thermal	3,484,251	1,323,078	0	395	0	6,009	0	8,684	0	25,158	0	36,358	0	2,979,154	0	1,043	0	2,980,196
	#3	Coal-thermal	3,957,054	1,494,175	0	650	0	6,007	0	8,676	0	25,150	0	36,325	0	3,363,290	0	1,714	0	3,365,004
	#4	Coal-thermal	3,653,534	1,383,297	0	365	0	5,999	0	8,705	0	25,117	0	36,446	0	3,109,564	0	966	0	3,110,530
	#5	Coal-thermal	3,744,413	1,411,398	0	742	0	6,032	0	8,676	0	25,255	0	36,325	0	3,190,187	0	1,957	0	3,192,143
	#6	Coal-thermal	3,999,847	1,504,962	0	417	0	6,017	0	8,691	0	25,192	0	36,387	0	3,393,210	0	1,102	0	3,394,312
Hadong	#1	Coal-thermal	3,997,914	1,513,930	0	284	0	6,003	0	8,940	0	25,133	0	37,430	0	3,405,488	0	772	0	3,406,260
	#2	Coal-thermal	3,732,583	1,410,099	0	792	0	5,997	0	8,928	0	25,108	0	37,380	0	3,168,757	0	2,149	0	3,170,906
	#3	Coal-thermal	3,769,077	1,422,196	0	472	0	5,998	0	8,982	0	25,112	0	37,606	0	3,196,474	0	1,289	0	3,197,763
	#4	Coal-thermal	3,989,315	1,511,054	0	567	0	5,999	0	8,938	0	25,117	0	37,422	0	3,396,754	0	1,540	0	3,398,294
	#5	Coal-thermal	3,553,901	1,345,648	0	614	0	5,995	0	8,975	0	25,100	0	37,577	0	3,022,915	0	1,675	0	3,024,590
	#6	Coal-thermal	4,037,763	1,520,774	0	331	0	5,995	0	8,928	0	25,100	0	37,380	0	3,416,325	0	898	0	3,417,223
Dangjin	#1	Coal-thermal	3,797,307	1,438,702	0	637	0	5,962	0	8,834	0	24,962	0	36,986	0	3,214,164	0	1,710	0	3,215,875
	#2	Coal-thermal	3,798,078	1,437,473	0	632	0	5,962	0	8,915	0	24,962	0	37,325	0	3,211,419	0	1,713	0	3,213,131
	#3	Coal-thermal	4,081,017	1,549,041	0	141	0	5,935	0	8,844	0	24,849	0	37,028	0	3,444,997	0	379	0	3,445,376
	#4	Coal-thermal	4,079,557	1,544,010	0	134	0	5,941	0	8,828	0	24,874	0	36,961	0	3,437,280	0	360	0	3,437,640
	#5	Coal-thermal	1,318,670	499,714	0	5,701	0	6,115	0	8,904	0	25,602	0	37,279	0	1,145,047	0	15,430	0	1,160,476
	#6	Coal-thermal	96,365	38,671	0	1,779	0	6,221	0	11,095	0	26,046	0	46,453	0	90,147	0	6,000	0	96,147

Operating Margin for 2005 (continued)

Ulsan	#1	Heavy oil-thermal	262,393	0	70,183	750	0	0	9,900	9,116	0	0	41,449	38,167	0	0	219,632	2,078	0	221,711
	#2	Heavy oil-thermal	255,812	0	67,296	585	0	0	9,903	9,113	0	0	41,462	38,154	0	0	210,662	1,620	0	212,282
	#3	Heavy oil-thermal	200,518	0	53,085	662	0	0	9,908	9,119	0	0	41,483	38,179	0	0	166,260	1,835	0	168,095
	#4	Heavy oil-thermal	1,549,091	0	375,417	1,971	0	0	10,001	9,122	0	0	41,872	38,192	0	0	1,186,825	5,465	0	1,192,290
	#5	Heavy oil-thermal	1,500,935	0	363,992	1,676	0	0	9,993	9,122	0	0	41,839	38,192	0	0	1,149,786	4,647	0	1,154,433
	#6	Heavy oil-thermal	1,454,644	0	352,776	1,708	0	0	9,979	9,118	0	0	41,780	38,175	0	0	1,112,795	4,734	0	1,117,529
Youngnam	#1	Heavy oil-thermal	1,022,470	0	359,910	844	0	0	7,482	8,942	0	0	31,326	37,438	0	0	851,218	2,294	0	853,512
	#2	Heavy oil-thermal	531,006	0	190,085	584	0	0	7,729	8,943	0	0	32,360	37,443	0	0	464,409	1,588	0	465,996
Yosu	#1	Heavy oil-thermal	430,310	0	106,919	434	0	0	9,960	8,887	0	0	41,701	37,208	0	0	336,623	1,172	0	337,795
	#2	Heavy oil-thermal	904,597	0	218,356	346	0	0	9,944	8,886	0	0	41,634	37,204	0	0	686,365	935	0	687,300
Pyongtaek	#1	Heavy oil-thermal	1,258,662	0	293,214	118	3,553	0	9,903	8,943	12,898	0	41,462	37,443	54,001	0	917,869	321	10,418	928,608
	#2	Heavy oil-thermal	1,376,342	0	321,188	140	2,641	0	9,905	8,961	12,872	0	41,470	37,518	53,892	0	1,005,641	381	7,729	1,013,751
	#3	Heavy oil-thermal	1,321,167	0	308,042	132	1,784	0	9,907	8,949	12,942	0	41,479	37,468	54,186	0	964,676	359	5,249	970,284
	#4	Heavy oil-thermal	1,338,204	0	311,245	138	2,047	0	9,909	8,949	12,893	0	41,487	37,468	53,980	0	974,903	375	6,000	981,278
Namjeju	#1	Heavy oil-thermal	44,602	0	14,628	15	0	0	9,878	9,318	0	0	41,357	39,013	0	0	45,675	42	0	45,718
	#2	Heavy oil-thermal	44,654	0	15,031	12	0	0	9,879	9,307	0	0	41,361	38,967	0	0	46,939	34	0	46,973
Jeju	#1	Heavy oil-thermal	36,266	0	12,564	12	0	0	9,932	8,885	0	0	41,583	37,200	0	0	39,445	32	0	39,478
	#2	Heavy oil-thermal	532,700	0	129,516	0	0	0	9,929	0	0	0	41,571	0	0	0	406,498	0	0	406,498
	#3	Heavy oil-thermal	502,189	0	122,866	48	0	0	9,925	8,938	0	0	41,554	37,422	0	0	385,471	130	0	385,601
Seoul	#4	Gas-thermal	207,498	0	0	0	49,143	0	0	0	13,002	0	0	0	54,437	0	0	0	145,263	145,263
	#5	Gas-thermal	444,324	0	0	1	108,761	0	0	9,070	13,008	0	0	37,974	54,462	0	0	3	321,637	321,640
Incheon	#1	Gas-thermal	16,450	0	0	0	4,365	0	0	0	13,032	0	0	0	54,562	0	0	0	12,932	12,932
	#2	Gas-thermal	37,727	0	0	0	8,505	0	0	0	13,025	0	0	0	54,533	0	0	0	25,185	25,185
	#3	Gas-thermal	-130	0	0	372	746	0	0	8,964	13,030	0	0	37,530	54,554	0	0	1,014	2,210	3,223
	#4	Gas-thermal	29,202	0	0	400	6,620	0	0	8,954	13,026	0	0	37,489	54,537	0	0	1,089	19,604	20,693

Operating Margin for 2005 (continued)

Namjeju D/P	Internal combustion	268,073	0	56,727	37	0	0	9,877	8,975	0	0	41,353	37,577	0	0	177,110	101	0	177,211
Jeju G/T	Internal combustion	5,069	0	0	2,869	0	0	0	8,919	0	0	0	37,342	0	0	0	7,778	0	7,778
Jeju D/P	Internal combustion	151,759	0	31,808	72	0	0	9,932	8,954	0	0	41,583	37,489	0	0	99,862	196	0	100,058
Pyongtaek C/C	Combined cycle	659,932	0	0	1	110,953	0	0	8,950	13,030	0	0	37,472	54,554	0	0	3	328,674	328,677
Ilsan C/C	Combined cycle	2,873,958	0	0	0	533,188	0	0	0	13,011	0	0	0	54,474	0	0	0	1,577,150	1,577,150
Bundang C/C	Combined cycle	3,742,073	0	0	0	671,994	0	0	0	13,025	0	0	0	54,533	0	0	0	1,989,872	1,989,872
Ulsan C/C	Combined cycle	3,131,075	0	0	0	470,131	0	0	0	12,750	0	0	0	53,382	0	0	0	1,362,734	1,362,734
Seoincheon C/C	Combined cycle	7,001,031	0	0	335	989,645	0	0	9,200	13,009	0	0	38,519	54,466	0	0	937	2,926,883	2,927,820
Shinincheon C/C	Combined cycle	10,543,280	0	0	0	1,458,815	0	0	0	13,013	0	0	0	54,483	0	0	0	4,315,784	4,315,784
Boryeong C/C	Combined cycle	8,221,926	0	0	0	1,161,510	0	0	0	13,030	0	0	0	54,554	0	0	0	3,440,721	3,440,721
Incheon C/C	Combined cycle	2,055,016	0	0	0	281,813	0	0	0	13,012	0	0	0	54,479	0	0	0	833,656	833,656
Busan C/C	Combined cycle	9,076,327	0	0	0	1,211,117	0	0	0	13,000	0	0	0	54,428	0	0	0	3,579,410	3,579,410
Hallim C/C	Combined cycle	100,346	0	0	29,686	0	0	0	8,973	0	0	0	37,568	0	0	0	80,967	0	80,967
GS Anyang C/C	Combined cycle	1,433,978	0	0	0	261,202	0	0	0	13,025	0	0	0	54,533	0	0	0	773,457	773,457
GS Bucheon C/C	Combined cycle	1,404,160	0	0	0	261,705	0	0	0	13,003	0	0	0	54,441	0	0	0	773,638	773,638
POSCO Power	Combined cycle	2,571,095	0	0	0	445,253	0	0	0	13,024	0	0	0	54,529	0	0	0	1,318,358	1,318,358
GS EPS Bugog	Combined cycle	2,189,808	0	0	0	297,976	0	0	0	13,756	0	0	0	57,594	0	0	0	931,870	931,870
Yulchon C/C	Combined cycle	1,300,627	0	0	159	194,534	0	0	10,930	13,023	0	0	45,762	54,525	0	0	528	575,955	576,483
	$\sum_m EG_{m,y}$=	**195,044,936**																**$\sum_{i,m} FC_{i,m,y}$ * $CV_{i,y}$ * $EF_{CO2,i,y}$ =**	**142,807,535**

*, **, ***: 2005 Statistics of Electric Power in Korea, KEPCO, 2006.5.

$$EF_{grid,OMsimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_{m} EG_{m,y}} = 0.7322$$

Operating Margin for 2004

Plant (m)		Fuel (i) Type	*Net Generation ($EG_{m,y}$) (MWh)	**Fuel consumption ($FC_{i,m,y}$)				***Calorific value (energy content)				Calorific value (energy content) ($CV_{i,y}$)				$FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$				$\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ (tCO_2)
				Bituminous coal (ton)	Heavy oil (kl)	Diesel Oil (kl)	LNG (ton)	Bituminous coal (kcal/kg)	Heavy oil (kcal/l)	Diesel Oil (kcal/l)	LNG (kcal/kg)	Bituminous coal (kJ/kg)	Heavy oil (kJ/l)	Diesel Oil (kJ/l)	LNG (kJ/kg)	Bituminous coal (tCO_2)	Heavy oil (tCO_2)	Diesel Oil (tCO_2)	LNG (tCO_2)	
Honam	#1	Coal-thermal	1,855,554	885,758	606	300	0	5,493	9,814	8,848	0	22,998	41,089	37,045	0	1,823,182	1,880	807	0	1,825,868
	#2	Coal-thermal	1,625,399	783,300	1,714	335	0	5,430	9,817	8,850	0	22,734	41,102	37,053	0	1,593,798	5,319	901	0	1,600,018
Samchonpo	#1	Coal-thermal	3,974,202	1,624,500	0	1,674	0	5,527	0	9,012	0	23,140	0	37,731	0	3,364,453	0	4,586	0	3,369,038
	#2	Coal-thermal	3,839,080	1,564,986	0	744	0	6,275	0	9,010	0	26,272	0	37,723	0	3,679,844	0	2,038	0	3,681,882
	#3	Coal-thermal	3,652,769	1,467,177	0	814	0	6,530	0	9,006	0	27,340	0	37,706	0	3,590,054	0	2,228	0	3,592,282
	#4	Coal-thermal	3,811,371	1,538,768	0	785	0	6,507	0	9,004	0	27,244	0	37,698	0	3,751,969	0	2,148	0	3,754,117
	#5	Coal-thermal	4,147,957	1,707,777	0	230	0	4,829	0	9,000	0	20,218	0	37,681	0	3,090,250	0	629	0	3,090,879
	#6	Coal-thermal	4,185,213	1,734,977	0	652	0	4,773	0	9,000	0	19,984	0	37,681	0	3,103,062	0	1,784	0	3,104,845
Yongheng	#1	Coal-thermal	2,986,382	1,114,254	0	27,916	0	5,892	0	8,927	0	24,669	0	37,376	0	2,460,097	0	75,749	0	2,535,846
	#2	Coal-thermal	1,172,450	459,217	0	18,314	0	5,852	0	8,720	0	24,501	0	36,509	0	1,006,995	0	48,542	0	1,055,538
Boryeong	#1	Coal-thermal	4,014,109	1,599,557	0	311	0	5,924	0	8,770	0	24,803	0	36,718	0	3,550,749	0	829	0	3,551,578
	#2	Coal-thermal	3,915,285	1,555,055	0	616	0	5,922	0	8,910	0	24,794	0	37,304	0	3,450,797	0	1,668	0	3,452,465
	#3	Coal-thermal	3,746,265	1,427,263	0	574	0	5,943	0	8,749	0	24,882	0	36,630	0	3,178,447	0	1,526	0	3,179,974
	#4	Coal-thermal	4,097,489	1,560,014	0	179	0	5,945	0	8,749	0	24,891	0	36,630	0	3,475,246	0	476	0	3,475,722
	#5	Coal-thermal	3,660,240	1,397,343	0	422	0	5,931	0	8,749	0	24,832	0	36,630	0	3,105,533	0	1,122	0	3,106,656
	#6	Coal-thermal	4,093,207	1,559,785	0	350	0	5,937	0	8,749	0	24,857	0	36,630	0	3,470,060	0	931	0	3,470,991
Taean	#1	Coal-thermal	3,780,097	1,438,094	0	999	0	5,980	0	8,765	0	25,037	0	36,697	0	3,222,506	0	2,662	0	3,225,167
	#2	Coal-thermal	3,975,123	1,509,379	0	310	0	5,977	0	8,699	0	25,025	0	36,421	0	3,380,546	0	820	0	3,381,365
	#3	Coal-thermal	3,732,363	1,415,585	0	390	0	5,975	0	9,004	0	25,016	0	37,698	0	3,169,415	0	1,067	0	3,170,482
	#4	Coal-thermal	4,048,258	1,539,502	0	254	0	5,967	0	8,721	0	24,983	0	36,513	0	3,442,243	0	673	0	3,442,916
	#5	Coal-thermal	4,091,406	1,547,217	0	329	0	5,996	0	8,912	0	25,104	0	37,313	0	3,476,307	0	891	0	3,477,198
	#6	Coal-thermal	4,056,835	1,531,751	0	230	0	5,996	0	8,804	0	25,104	0	36,861	0	3,441,558	0	615	0	3,442,173
Hadong	#1	Coal-thermal	3,688,313	1,389,739	0	533	0	6,032	0	9,002	0	25,255	0	37,690	0	3,141,231	0	1,458	0	3,142,689
	#2	Coal-thermal	4,028,529	1,515,681	0	145	0	6,025	0	8,975	0	25,225	0	37,577	0	3,421,922	0	396	0	3,422,318
	#3	Coal-thermal	3,997,064	1,501,027	0	670	0	6,046	0	8,983	0	25,313	0	37,610	0	3,400,650	0	1,829	0	3,402,479
	#4	Coal-thermal	3,724,757	1,397,482	0	737	0	6,097	0	8,993	0	25,527	0	37,652	0	3,192,770	0	2,015	0	3,194,785
	#5	Coal-thermal	4,013,845	1,501,672	0	318	0	5,982	0	8,983	0	25,045	0	37,610	0	3,366,098	0	868	0	3,366,966
	#6	Coal-thermal	3,685,698	1,379,396	0	689	0	5,935	0	8,983	0	24,849	0	37,610	0	3,067,714	0	1,881	0	3,069,596
Dangjin	#1	Coal-thermal	3,986,406	1,502,885	0	294	0	6,011	0	8,880	0	25,167	0	37,179	0	3,385,149	0	794	0	3,385,942
	#2	Coal-thermal	4,038,457	1,523,605	0	211	0	6,000	0	8,889	0	25,121	0	37,216	0	3,425,539	0	570	0	3,426,109
	#3	Coal-thermal	3,711,787	1,404,465	0	605	0	5,976	0	8,897	0	25,020	0	37,250	0	3,145,044	0	1,636	0	3,146,680
	#4	Coal-thermal	3,801,495	1,434,844	0	528	0	5,966	0	8,898	0	24,978	0	37,254	0	3,207,696	0	1,428	0	3,209,124

Operating Margin for 2004 (continued)

Ulsan	#1	Heavy oil-thermal	271,544	0	73,408	114	0	0	9,893	9,010	0	0	41,420	37,723	0	0	229,562	312	0	229,875
	#2	Heavy oil-thermal	244,246	0	65,316	82	0	0	9,901	9,010	0	0	41,454	37,723	0	0	204,422	225	0	204,647
	#3	Heavy oil-thermal	268,231	0	71,305	554	0	0	9,896	9,010	0	0	41,433	37,723	0	0	223,053	1,517	0	224,571
	#4	Heavy oil-thermal	1,759,376	0	420,739	1,238	0	0	9,972	9,120	0	0	41,751	38,184	0	0	1,326,246	3,432	0	1,329,678
	#5	Heavy oil-thermal	2,141,162	0	513,497	931	0	0	9,963	9,120	0	0	41,713	38,184	0	0	1,617,176	2,581	0	1,619,757
	#6	Heavy oil-thermal	2,196,344	0	527,083	1,603	0	0	9,959	9,120	0	0	41,696	38,184	0	0	1,659,296	4,444	0	1,663,740
Youngnam	#1	Heavy oil-thermal	973,872	0	347,107	837	0	0	7,432	8,865	0	0	31,116	37,116	0	0	815,452	2,255	0	817,707
	#2	Heavy oil-thermal	665,973	0	248,049	274	0	0	7,679	8,876	0	0	32,150	37,162	0	0	602,104	739	0	602,843
Yosu	#1	Heavy oil-thermal	723,968	0	181,712	571	0	0	10,011	8,924	0	0	41,914	37,363	0	0	575,030	1,549	0	576,579
	#2	Heavy oil-thermal	1,304,109	0	316,523	436	0	0	10,009	8,956	0	0	41,906	37,497	0	0	1,001,440	1,187	0	1,002,627
Pyongtaek	#1	Heavy oil-thermal	850,533	0	204,664	247	2,095	0	9,877	8,917	12,920	0	41,353	37,334	54,093	0	638,992	669	6,154	645,815
	#2	Heavy oil-thermal	880,646	0	209,664	232	2,515	0	9,879	8,941	12,907	0	41,361	37,434	54,039	0	654,736	631	7,380	662,746
	#3	Heavy oil-thermal	751,633	0	179,921	240	3,791	0	9,902	8,907	12,910	0	41,458	37,292	54,052	0	563,163	650	11,127	574,939
	#4	Heavy oil-thermal	800,854	0	192,294	225	3,217	0	9,903	8,915	12,956	0	41,462	37,325	54,244	0	601,952	610	9,476	612,037
Namjeju	#1	Heavy oil-thermal	50,294	0	16,510	6	0	0	9,900	9,333	0	0	41,449	39,075	0	0	51,667	17	0	51,684
	#2	Heavy oil-thermal	48,714	0	16,040	13	0	0	9,901	8,846	0	0	41,454	37,036	0	0	50,201	35	0	50,236
Jeju	#1	Heavy oil-thermal	44,659	0	15,306	7	0	0	9,897	8,961	0	0	41,437	37,518	0	0	47,884	19	0	47,904
	#2	Heavy oil-thermal	486,401	0	118,473	73	0	0	9,912	8,936	0	0	41,500	37,413	0	0	371,202	198	0	371,400
	#3	Heavy oil-thermal	509,330	0	124,160	41	0	0	9,919	8,928	0	0	41,529	37,380	0	0	389,295	111	0	389,406
Seoul	#4	Gas-thermal	90,322	0	0	1	22,409	0	0	9,070	13,011	0	0	37,974	54,474	0	0	3	66,285	66,288
	#5	Gas-thermal	480,919	0	0	3	117,908	0	0	9,070	13,014	0	0	37,974	54,487	0	0	8	348,848	348,856
Incheon	#1	Gas-thermal	47,491	0	0	0	10,523	0	0	0	13,038	0	0	0	54,587	0	0	0	31,191	31,191
	#2	Gas-thermal	49,144	0	0	0	11,094	0	0	0	13,039	0	0	0	54,592	0	0	0	32,886	32,886
	#3	Gas-thermal	19,018	0	0	149	4,235	0	0	8,951	13,038	0	0	37,476	54,587	0	0	405	12,553	12,958
	#4	Gas-thermal	594	0	0	171	526	0	0	8,949	13,021	0	0	37,468	54,516	0	0	465	1,557	2,022

Operating Margin for 2004 (continued)

Namjeju D/P	Internal combustion	274,089	0	57,808	80	0	0	9,901	8,867	0	0	41,454	37,124	0	0	180,924	216	0	181,140
Jeju G/T	Internal combustion	3,016	0	0	2,232	0	0	0	8,948	0	0	0	37,463	0	0	0	6,071	0	6,071
Pyongtaek C/C	Combined cycle	596,001	0	0	21	98,846	0	0	8,758	13,033	0	0	36,668	54,567	0	0	56	292,877	292,933
Ilsan C/C	Combined cycle	3,281,407	0	0	0	593,548	0	0	0	13,017	0	0	0	54,500	0	0	0	1,756,503	1,756,503
Bundang C/C	Combined cycle	3,650,122	0	0	0	653,880	0	0	0	13,026	0	0	0	54,537	0	0	0	1,936,383	1,936,383
Ulsan C/C	Combined cycle	2,329,524	0	0	0	347,076	0	0	0	12,920	0	0	0	54,093	0	0	0	1,019,458	1,019,458
Seoincheon C/C	Combined cycle	8,353,619	0	0	88	1,209,806	0	0	9,211	13,010	0	0	38,565	54,470	0	0	246	3,578,286	3,578,533
Shinincheon C/C	Combined cycle	11,596,955	0	0	0	1,587,638	0	0	0	13,017	0	0	0	54,500	0	0	0	4,698,340	4,698,340
Boryeong C/C	Combined cycle	6,979,928	0	0	0	988,548	0	0	0	13,025	0	0	0	54,533	0	0	0	2,927,235	2,927,235
Busan C/C	Combined cycle	9,884,075	0	0	2,687	1,298,418	0	0	9,250	13,004	0	0	38,728	54,445	0	0	7,555	3,838,606	3,846,161
Hallim C/C	Combined cycle	96,435	0	0	28,796	0	0	0	8,972	0	0	0	37,564	0	0	0	78,531	0	78,531
GS Anyang C/C	Combined cycle	1,506,070	0	0	0	270,559	0	0	0	13,025	0	0	0	54,533	0	0	0	801,165	801,165
GS Bucheon C/C	Combined cycle	1,425,073	0	0	0	258,596	0	0	0	13,013	0	0	0	54,483	0	0	0	765,035	765,035
KIE Co.	Combined cycle	2,809,983	0	0	0	467,583	0	0	0	13,023	0	0	0	54,525	0	0	0	1,384,369	1,384,369
GS EPS Bugog	Combined cycle	1,894,996	0	0	0	260,653	0	0	0	13,028	0	0	0	54,546	0	0	0	772,009	772,009
Yulchon C/C	Combined cycle	36,366	0	0	596	7,388	0	0	11,731	13,014	0	0	49,115	54,487	0	0	2,125	21,858	23,984
	$\sum_m EG_{m,y}$=	**187,514,441**																**$\sum_{i,m} FC_{i,m,y}$ * $CV_{i,y}$ * $EF_{CO2,i,y}$ =**	**136,993,929**

*, **, ***: 2004 Statistics of Electric Power in Korea, KEPCO, 2005.5.

$$EF_{grid,OMsimple,} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{\sum_{m} EG_{m,y}} = 0.7306$$

Plant/unit information

Power plant (m)					Fuel (i) Type
	Commissioning	Capacit y(MW)		Plant factor(%)	
Honam	1985.03		#1	80.09	Coal-thermal
	1984.12		#2	87.87	Coal-thermal
	Total	500		83.98	
Samchonpo	1983.08		#1	90.53	Coal-thermal
	1984.02		#2	80.43	Coal-thermal
	1993.04		#3	81.46	Coal-thermal
	1994.03		#4	81.84	Coal-thermal
	1997.07		#5	89.36	Coal-thermal
	1998.01		#6	96.67	Coal-thermal
	Total	3,240		86.48	
Yongheng	2004.07		#1	80.45	Coal-thermal
	2004.11		#2	85.75	Coal-thermal
	Total	1,600		83.10	
Boryeong	1983.12		#1	96.93	Coal-thermal
	1984.09		#2	81.69	Coal-thermal
	1993.04		#3	81.45	Coal-thermal
	1993.06		#4	98.63	Coal-thermal
	1993.12		#5	80.25	Coal-thermal
	1994.04		#6	95.27	Coal-thermal
	Total	3,000		89.04	
Taean	1995.06		#1	85.21	Coal-thermal
	1995.12		#2	96.29	Coal-thermal
	1997.03		#3	84.18	Coal-thermal
	1997.07		#4	97.33	Coal-thermal
	2001.10		#5	96.44	Coal-thermal
	2002.05		#6	81.30	Coal-thermal
			#7	.	Coal-thermal
	Total	3,000		90.12	
Hadong	1997.07		#1	86.41	Coal-thermal
	1997.11		#2	96.95	Coal-thermal
	1998.07		#3	97.30	Coal-thermal
	1999.03		#4	86.64	Coal-thermal
	2000.07		#5	97.78	Coal-thermal
	2001.07		#6	86.33	Coal-thermal
	Total	3,000		91.90	

Power plant (m)					Fuel (i) Type
	Commissioning	Capacity (MW)		Plant factor(%)	
Dangjin	1996.06		#1	86.02	Coal-thermal
	1999.12		#2	98.21	Coal-thermal
	2000.09		#3	87.44	Coal-thermal
	2001.03		#4	86.23	Coal-thermal
	2005.10		#5	94.74	Coal-thermal
	2006.04		#6	92.40	Coal-thermal
			#7	.	Coal-thermal
	Total	3,000		88.84	
Ulsan	1970.12		#1	16.90	Heavy oil-thermal
	1971.03		#2	18.66	Heavy oil-thermal
	1973.07		#3	23.04	Heavy oil-thermal
	1979.12		#4	46.01	Heavy oil-thermal
	1980.09		#5	48.15	Heavy oil-thermal
	1981.01		#6	48.36	Heavy oil-thermal
	Total	1,800		38.18	
Youngnam	1972.12		#1	21.96	Heavy oil-thermal
	1970.12		#2	19.81	Heavy oil-thermal
	Total	400		20.88	
Yosu	1975.06	200	#1	24.10	Heavy oil-thermal
	1977.07	328.6	#2	33.40	Heavy oil-thermal
	Total	528.6		29.88	
Pyongtaek	1980.04		#1	38.19	Heavy oil-thermal
	1980.06		#2	40.53	Heavy oil-thermal
	1983.05		#3	44.16	Heavy oil-thermal
	1983.08		#4	35.84	Heavy oil-thermal
	Total	1,400		39.68	
Namjeju	1991.11	10	#1	46.23	Heavy oil-thermal
	1992.2	10	#2	39.04	Heavy oil-thermal
	2006.09	100	#3	28.96	Heavy oil-thermal
	Total	100		33.80	
Jeju	1982.12	10	#1	30.80	Heavy oil-thermal
	2000.03	75	#2	75.30	Heavy oil-thermal
	2000.12	75	#3	78.03	Heavy oil-thermal
	Total	1,690		73.80	

Power plant (m)					Fuel (i) Type
	Commissioning	Capacit y(MW)		Plant factor(%)	
Seoul	1971.04	137.5	#4	27.32	Gas-thermal
	1969.04	250	#5	32.89	Gas-thermal
	Total	387.5		30.91	
Incheon	1970.05		#1	1.57	Gas-thermal
	1974.12		#2	1.15	Gas-thermal
	1978.06		#3	2.92	Gas-thermal
	1978.12		#4	2.33	Gas-thermal
	Total	1,150		2.07	
Namjeju D/P	1992.02	40		71.72	Internal combustion
Jeju G/T	1977.12	165		3.42	Internal combustion
Jeju D/P	2005.07	40		76.68	Internal combustion
Pyongtaek C/C	1994.06	480		12.00	Combined cycle
Ilsan C/C	1996.03	900		39.11	Combined cycle
Bundang C/C	1997.03	900		52.17	Combined cycle
Ulsan C/C	1997.08	1,200		34.82	Combined cycle
Seoincheon C/C	1992.11	1,800		55.99	Combined cycle
Shinincheon C/C	1997.07	1,800		77.23	Combined cycle
Boryeong C/C	2002.08	1,800		45.80	Combined cycle
Incheon C/C	2005.06	503.5		84.47	Combined cycle
Busan C/C	2004.03	1,800		67.73	Combined cycle
Hallim C/C	1997.07	105		19.41	Combined cycle
GS Anyang C/C	1993.09	450		33.22	Combined cycle
GS Bucheon C/C	1993.11	450		32.21	Combined cycle
POSCO Power	2002.01	1,800		15.18	Combined cycle
GS EPS Bugog	2001.04	500.7		67.38	Combined cycle
Yulchon C/C	2005.07	525.5		50.70	Combined cycle

*, **, ***: 2006 Statistics of Electric Power in Korea, KEPCO, 2007.5.

Build Margin (BM) calculation

For the calculation of the Build Margin emission factor ($EF_{BM,y}$), the sample group m is selected according to Option 1.

<Choice of Sample group m>

2006 Net Generation (MWh)		Percentage	Remark
Grid total	365,368,967	100.00%	
Sample group m - five plants	22,522	0.01%	
Sample group m - 20% plants	**74,372,455**	**20.36%**	**Selected**

Carbon Emission Factor

CO_2 Emission Factor of fossil fuel type *i* (unit: tCO_2/GJ) ($EF_{CO2,i,y}$)

Bituminous coal	**0.089500**
Heavy Oil	**0.075500**
Diesel Oil	**0.072600**
LNG	**0.054300**

*Source:: IPCC 2006

IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 of 2006 IPCC Guidelines on National GHG Inventories

BM for the proposed project activity

Build margin for 2006: 0.3858 tCO_2/MWh

$$EF_{BM} = 0.3858 \mathrm{tCO_2/MWh}$$

Build Margin for 2006

Plant (m)	Fuel (i) type	*Net Generation ($EG_{m,y}$) (MWh)	**Fuel consumption ($FC_{i,m,y}$)				***Calorific value (energy content)				Calorific value (energy content) ($CV_{i,y}$)				$FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$				$\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ (tCO_2)	$EF_{EL,m,y}$ (tCO_2/MWh)	$EG_{m,y} * EF_{EL,m,y}$ (tCO_2)
			Bituminous coal (ton)	Heavy oil (kl)	Diesel Oil (kl)	LNG (ton)	Bituminous coal (kcal/kg)	Heavy oil (kcal/l)	Diesel Oil (kcal/l)	LNG (kcal/kg)	Bituminous coal (kJ/kg)	Heavy oil (kJ/l)	Diesel Oil (kJ/l)	LNG (kJ/kg)	Bituminous coal (tCO_2)	Heavy oil (tCO_2)	Diesel Oil (tCO_2)	LNG (tCO_2)			
Cheongsong pumping#2	Hydro-pumping	21,542	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Bundang fuel cell	Fuel cell	290	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Solar park	Solar	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Namhae solar	Solar	297	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Hanlajeunggong solar	Solar	287	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Top infra	Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Enepark	Solar	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yongheng solar	Solar	242	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Cheongsong pumping#1	Hydro-pumping	39,965	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Namjeju #3	Heavy oil-thermal	179,033	0	46,504	2,509	0	0	9,898	8,938	0	0	41,441	37,422	0	0	145,501	6,816	0	152,318	0.8508	152,318
Yangyang pumping#4	Hydro-pumping	62,801	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Hadongho	Hydro	1,294	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yangyang pumping#3	Hydro-pumping	93,471	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Goheung Solar	Solar	619	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Jangseong	Hydro	514	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yangyang pumping#2	Hydro-pumping	97,896	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Dangjin #6	Coal-thermal	3,392,395	1,216,582	0	3,051	0	6,120	0	8,895	0	25,623	0	37,242	0	2,789,961	0	8,249	0	2,798,210	0.8248	2,798,210
Sinchang-wind power	Wind	2,969	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yangyang pumping#1	Hydro-pumping	129,063	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Suncheon solar	Solar	1,247	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Samcheonpo solar	Solar	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Dangjin #5	Coal-thermal	3,946,931	1,456,458	0	745	0	6,046	0	8,955	0	25,313	0	37,493	0	3,299,676	0	2,028	0	3,301,704	0.8365	3,301,704
Taean solar	Solar	127	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Incheon C/C	Combined cycle	3,648,288	0	0	0	484,606	0	0	0	12,998	0	0	0	54,420	0	0	0	1432014	1,432,014	0.3925	1,432,014
Jeju D/P	Internal combustion	252,764	0	52,907	0	0	0	9,617	0	0	0	40,264	0	0	0	160,836	0	0	160,836	0.6363	160,836
Daegok	Hydro	1,740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Donghwa	Hydro	2,434	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Ulchin #6	Nuclear	7,401,424	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Hanrye LFG	LFG	5,045	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Busan bio-gas	Biogas	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yongdam	Hydro	23,972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0

Build Margin for 2006 (continued)

Maebongsan-wind power	Wind	8,998	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Daegwanryung-wind power	Wind	3,451	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yongheng #2	Coal-thermal	5,727,937	2,129,118	0	2,545	0	6,086	0	8,899	0	25,481	0	37,258	0	4,855,533	0	6,884	0	4,862,417	0.8489	4,862,417
Gunsan-wind power	Wind	6,069	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
New solar energy	Solar	216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Ulchin #5	Nuclear	7,879,757	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yongheng #1	Caol-thermal	5,337,432	2,004,193	0	2,548	0	6,072	0	8,891	0	25,422	0	37,225	0	4,560,123	0	6,886	0	4,567,009	0.8557	4,567,009
Yulchon C/C	Combined cycle	2,276,276	0	0	0	315,132	0	0	0	13,376	0	0	0	56,003	0	0	0	958299	958,299	0.4210	958,299
Busan C/C	Combined cycle	10,455,401	0	0	0	1,396,417	0	0	0	13,017	0	0	0	54,500	0	0	0	4132454	4,132,454	0.3952	4,132,454
Hankyung-wind power	Wind	18,371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Chunsang	Hydro	183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Cheongju LFG	LFG	6,906	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Wunjeong LFG	LFG	17,419	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Daejon Geumgodong	LFG	12,768	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Hoicheon ENC	LFG	4,501	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Muju	Hydro	555	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Seohee-ENC(Sanggok)	LFG	33,895	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Sangwon ENC	LFG	17,353	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yonggwang #6	Nuclear	7,969,957	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Taean #6	Coal-thermal	3,381,867	1,294,577	0	1,113	0	5,960	0	8,665	0	24,953	0	36,279	0	2,891,208	0	2,931	0	2,894,140	0.8558	2,894,140
Yonggwang #5	Nuclear	7,681,293	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Sanchong	Hydro	1,385	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Sanchong pumping #2	Hydro-pumping	204,444	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Milyang	Hydro	5,820	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Taean #5	Coal-thermal	4,013,235	1,542,775	0	544	0	5,934	0	8,665	0	24,844	0	36,279	0	3,430,484	0	1,433	0	3,431,917	0.8551	3,431,917
	$\sum_m EG_{m,y}$=	**74,372,455**																		$\sum_m EG_{m,y} * EF_{EL,m,y}$ =	**28,691,317**

*, **, ***: 2006 Statistics of Electric Power in Korea, KEPCO, 2007.5.

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \times EF_{EL,m,y}}{\sum_m EG_{m,y}} = 0.3858$$

Coke Production of No.2 Coke Plant of Pohang Works

	2002	2003	2004	Remark
Lump Coke (ton)	537,110	513,917	529,152	
Coke Breeze (ton)	70,780	79,090	82,637	
Total (ton)	607,890	593,007	611,789	

Source: POSCO internal data

<u>Annex 4</u>

MONITORING INFORMATION

No other supplementary information.

- - - - -