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:

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Taegisan Wind Power Project
Version 01 of CDM-PDD
15 January 2008

A.2. Description of the project activity:

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" Taegisan Wind Power Project" is to build a wind power plant in southwestern area of Gangwon-Province, Republic of Korea. Wind power energy used as the electric generation source of the proposed project is one of the clean renewable energy resources without being depleted.

Also currently in Korea, they make efforts to reduce fossil fuel usage in various ways and have great concerns about the renewable energies including wind power energy.
Under this situation the proposed wind power generation project is expected to contribute to decrease the usage of electricity by thermal power plants. Those fossil fuel based thermal power plants take 59.47% of electricity generation in Korea (KEPCO: Korea Electric Power Company, 2006).

At the same time main technology of the wind power project is imported from developed countries, the proposed project may serve to develop and distribute the renewable energy technologies to all over the country.

Total installed capacity of the project is 40MW (2MW x 20). And it is composed of 20 generators (wind power turbines) with 2MW.

Taegisan, the project site is located between Hoengseong-gun and Pyeongchang-gun in Gangwon Province area. And the generators(20units) will be divided and installed into two groups in Hoengseong-gun(9 units) and Pyeongchang-gun(11units).

- Hoengseong-gun, Gangwon-do : 9 units (2MW × 9 units = 18 MW)
- Pyeongchang-gun, Gangwon-do : 11 units (2MW × 11 units = 22 MW)

Taegisan is the highest mountain in Hoengseong-gun and rises 1,261meters above the sea level. So the sites of the project have favourable conditions of location as a wind farm.

Utilisation rate of the *plant is 28.0%* and expected annual electric generation is 98,099MWh. The electricity generated from the wind turbine is transmitted to the grid, KEPCO Pyeongchang transformer substation, through 22.9kV of transmission lines.
And the whole transmission lines reach 26.8km.
Among the whole lines, the 8 km block which goes through rural communities will be constructed underground by utilizing the existing roads for environmentally friendly development.

The proposed project utilizes a renewable energy releasing no greenhouse gases. The generated electricity from the project will displace the electricity from existing grid generated from fossil fuel based power plants. The expected emission reductions of the project activities will reach 63,038 ***tCO_2e*** (tonnes of carbon dioxide equivalent) annually.

The proposed project will contribute to sustainable development of Republic of Korea by reducing GHGs emissions from fossil fuel based thermal plants.
Also this project will answer to government policy not only for the local environmental priority but also for the diffusion of clean energy resource displacing existing energies.

As a participant of the project, Taegisan Wind Power Corporation fulfilled the necessary conditions for performing the wind farm project in Korea. They attracted foreign investment and imported advanced technologies and got the cooperation of the stakeholders who were related Gangwon-do and the proposed project. Gangwon-do (Hoengseong-gun, Pyeongchang-gun), POSCO E&C(POSCO Engineering & Construction Co., Ltd) and Eurus Energy Investment jointly participated in the project.
The project plays a role to reinvigorate local economy of Gangwon province and preserve the environment of the area through introduction of foreign capital.
Specifically the proposed project contributes to sustainable development in the following ways:

- The CDM project is jointly participated by Gangwon-do, POSCO E&C, Eurus Energy Investment and it will stimulate the local economy and promote the welfare of the residents.

- Not only transmission of the advanced wind power technology, also there are some regional development effects such as development of local human resources, long-term employment and building infrastructure through construction and operation of the plant.

- The plant will contribute toward better living conditions in the plant area by reducing pollutants. It replaces electricity generated by fossil fuel in the grid and therefore prevents discharge of the pollutants such as greenhouse gas, particles, SOx and NOx etc.

This project will contribute to build up technological foundation for environmentally friendly electric generation through technical cooperation for development of renewable energy source, expanding localized lines and developing domestic wind power generation industry.

And also it will contribute to the country’s entering into the wind power market in the future, based on the technologies for the wind farm establishing and its components manufacturing and to the diffusion of the wind power technology in the country and creation of job opportunities, far reaching effects on related technologies.

A.3. Project participants:

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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)	• Taegisan Wind Power Corporation(SPC) • POSCO Engineering and Construction Co., Ltd.	No
Japan	• Eurus Energy Japan	No
(*) In accordance with the CDM modalities and procedures, at the time of making the CDM-PDD public at the stage of validation, a Party involved may or may not have provided its approval. At the time of requesting registration, the approval by the Party(ies) involved is required.		

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

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A.4.1.1. Host Party(ies):

>>
The Republic of Korea

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

>>
Gangwon Province

A.4.1.3. City/Town/Community etc:

>>
Hoengseong-gun

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

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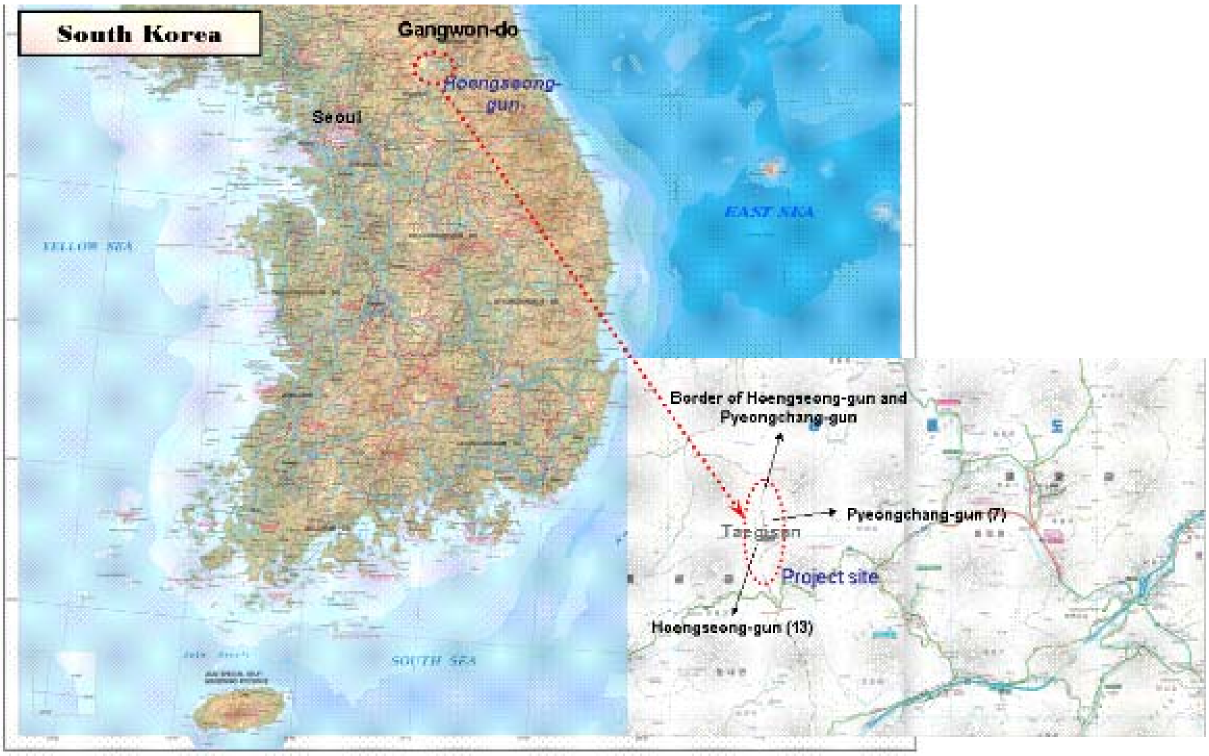
The project site is located in San #1-1, Taegi-ri, Dunnae-myun, Hoengseong-gun, Gangwon Province. It is located in the mountainous area of the Taebaek Mountains, neighbouring easterly to Pyeongchang-gun and westerly Hoengseong-gun.
The site location's approximate coordinates are east longitude of 128°20' and north latitude of 37°32'.

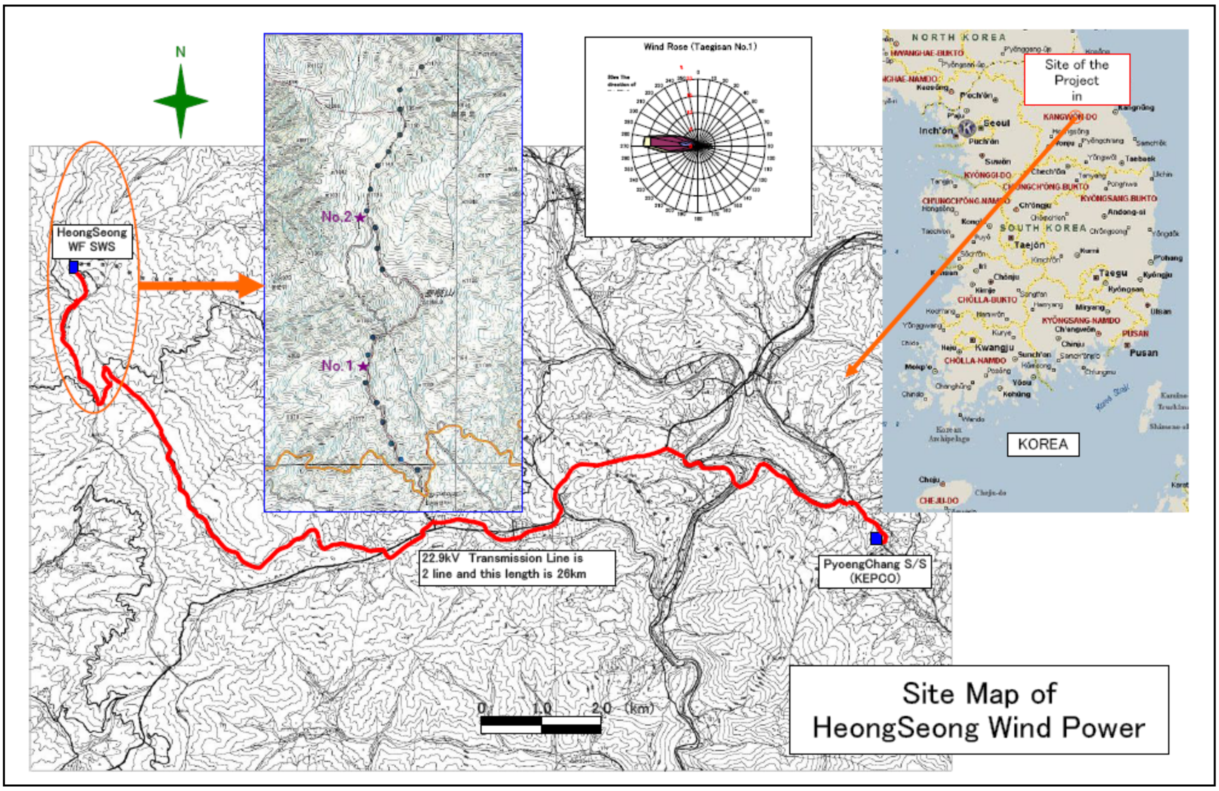
For a wind farm project, it is very important to choose a suitable place. The project needs appropriate wind speed and stable place where the wind directions don't fluctuate widely. Especially if the fluctuation of direction is sharp, the wind turbine could get damaged and life time of the mechanic could be shortened as well as brings serious danger. The annual wind speeds for the site are in the range of 6.9m/sec at 80m above the ground and wind direction is mainly southwest and west. So the project sites,

Taegi Mountain has stable natural conditions for wind farm project considering these conditions.

Figure 1 shows the location of the project site and where the turbines are installed.



<Figure 1> The location of Taegisan Wind farm



<Figure 2> The location of Taegisan Wind farm

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

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Sectoral scope 1 : Energy industries(renewable source)

Accoring to "Modalities and Procedures for CDM ", the proposed project falls in to Sectoral Scope 1: Energy industrial project.
- Renewable Electricity Generation for a Grid(Wind)

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

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Wind power generation uses the current of wind to rotate the blades and gets electric power from it. Consequently the proper amount of wind and choice of the generator which fits to the purpose is very important to build a wind power plant.

The energy source of wind power generation is wind and it depends on the terrain. So the project developers considered weather conditions and chose to Mt. Taegie area as the plant site, which is the highest mountain of Hoengseong area in Gangwon Province.

Total installed capacity of the project is 40MW (2MW x 20). And it is composed of 20 generators (wind power turbines) with 2MW.

Generators(20units) will be divided and installed into two groups in Taegi mountain area of Dunnae-myeon, Hoengseong-gun(9 units) and Bongpyeong-myeon, Pyeongchang-gun(11 units) in Gangwon Province. The expected annual out is 98,099MWh and the electricity will be supplied to the electricity market.

The project will use the turbine technology with OptiSpeed ™[1] and OptiTip®[2] and these generator facilities will be imported from Denmark.
Turbine model of is VESTAS V80-2.0MW, which has already been installed around the world for large scale wind power generation projects and it was chosen through bids.
The main facilities of the wind farm consist of rotor, nacelle, tower and generator.

The VESTAS V80-2.0MW turbine has following features.

The VESTAS V80-2.0MW is a pitch regulated upwind turbine with active yaw and a rotor with tree blades. The rotor is converting kinetic energy of wind to rotatory power and it effects on the efficiency of generator. Especially the design of each rotor blade is very important part of the facilities. This turbine has a rotor diameter of 80m and this feature enables the rotor to operate with variable speed(RPM). With pitch regulating system, the angles of the blades are constantly regulated so they are always pitched at the optimal angle for current wind conditions.

At higher wind speeds, the pitch regulating system keeps the power at nominal, regardless of the air temperature and density. At lower wind speeds it optimize the power output by
selecting the optimal RPM and pitch angle. This optimizes power production and noise levels.
The blades are made of glass fiber reinforced epoxy and each blade consists of two blade shells, bonded to a supporting beam.

Special steel root inserts connect the blades to the blade bearing. The blade bearing is a 4-point contact ball bearing, which is bolted to the blade hub.
Nacelle is the main part of the wind power facilities and composed of all the items for converting rotatory power from kinetic energy of wind to electric energy.
So the main components such as gearbox, generator, transformer etc. are kept within the nacelle.

The main shaft transmits the power to the generator through the gearbox. The gearbox is a combined planetary and helical gearbox. From the gearbox, power is transmitted via a maintenance-free composite coupling to the generator. The generator is a special asynchronous 4-pole generator with wound rotor. The gearbox and converter system control the frequency and power factor and for cooling, air cooling system is used.

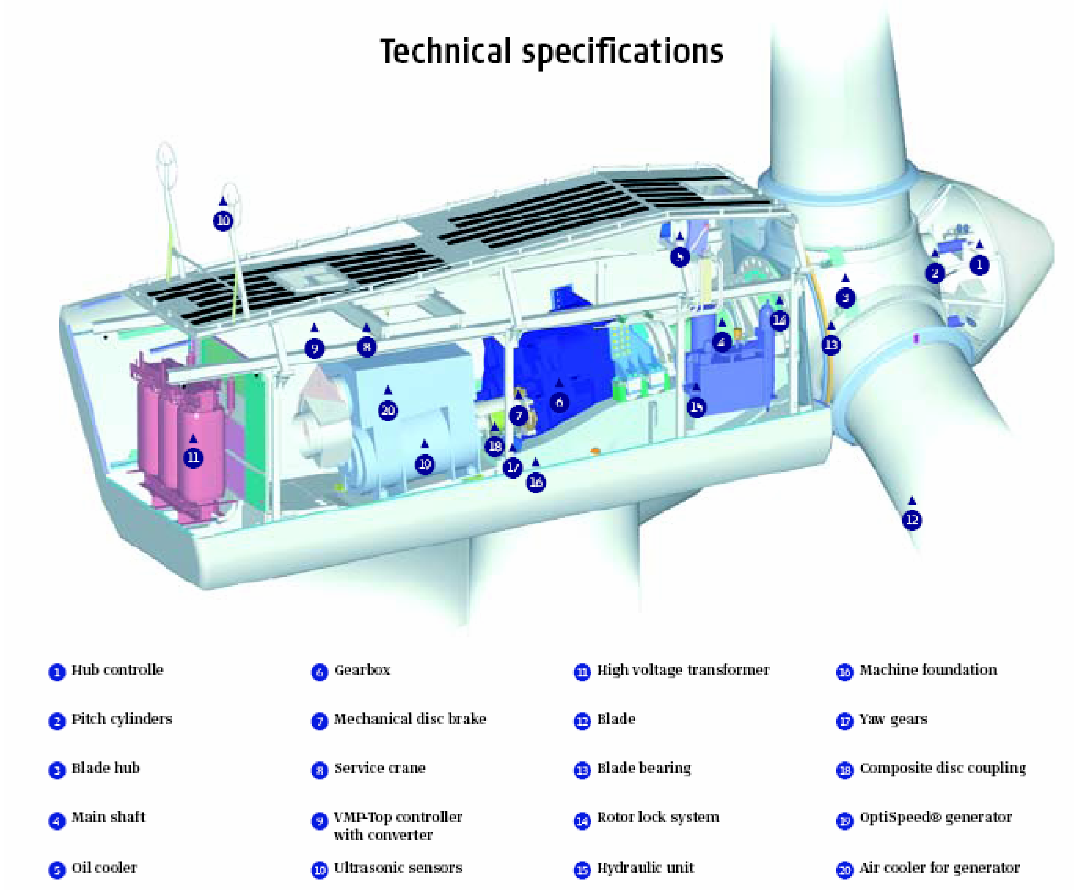
As turbines operate with pitching regulated speed, they can generate electric energy calmly and efficiently even when wind speed is higher than 4m/s. Under lowest load, rising rotary power by blast is saved and changed into electric power.
The wind turbine brakes by full feathering the blades. A parking brake is mounted on the gearbox high speed shaft.

This brake system is added to air dynamic main brake (pitching system) and emergency disk brake (parking brake) is installed, which is monitored as ordinary operating with help of the sensor.

All functions of the wind turbine are monitored and controlled by microprocessor based control units.

This control system – including the transformer - is placed in the nacelle. Changes in the pitch of the blades are activated by a hydraulic system, which enables the blades to rotate 95°. This system also supplies the pressure for the brake system.
The glass fiber reinforced nacelle cover protects all the components inside the nacelle against rain, snow, dust, sun, etc.

A detailed technical specification of VESTAS V80 is shown as followed.



<Figure 3> VESTAS V80 technical specifications

Output of the proposed project is expected 98,099MWh/year /year and it will be transmitted to KEPCO Pyeongchang transformer substation, through 22.9kV of transmission lines.

Table A.1 : Power Curves VESTAS V80-2.0 MW

Turbine	
Frequency	50/60 Hz
Rotor diameter	80 meter
Tip angle	Pitch regulated
Turbulence	10 %

Rotor	
Diameter	80 m
Swept area	5027 m2
Rotational speed static, rotor	16.7 RPM
Rotational speed, operation interval rotor	9.0 - 19.0 RPM
Rotational direction	Clockwise (front view)
Orientation	Upwind
Tilt	6°
Blade coning	2°
Number of blades	3
Aerodynamic brakes	Full feathering

Specification Vestas V80-2MW wind turbine		
Operational data	Cut-in wind speed	52 m/s
	Normal wind speed	15 m/s
	Cut-out wind Speed	25 m/s
Generator	Normal output	2000kW
	Operation data	50 Hz / 60 Hz 690V
Weight	Nacelle	67t
	Rotor	37t

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

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It is expected that 62,999 tCO2e/year will be reduced over 10 years of crediting period, from Dec 2008 to Nov 2018.

<Table A-2> Emission reductions

Year	Annual estimation of emission reductions in tonnes of CO2 e
Year 1 (2008. 12. 01 ~ 2009. 11. 30)	63,038
Year 2 (2009. 12. 01 ~ 2010. 11. 30)	63,038
Year 3 (2010. 12. 01 ~ 2011. 11. 30)	63,038
Year 4 (2011. 12. 01 ~ 2012. 11. 30)	63,038
Year 5(2012. 12. 01 ~ 2013. 11. 30)	63,038
Year 6 (2013. 12. 01 ~ 2014. 11. 30)	63,038
Year 7 (2014. 12. 01 ~ 2015. 11. 30)	63,038
Year 8 (2015. 12. 01 ~ 2016. 11. 30)	63,038
Year 9 (2016. 12. 01 ~ 2017. 11. 30)	63,038
Year 10 (2017.12. 01 ~ 2018. 11. 30)	63,038
Total estimated reductions (tonnes of tCO2 e)	63,038
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of tCO2 e)	630,380

A.4.5. Public funding of the project activity:

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No public funding, including official development assistance, is provided for this project activity.

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:

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The project is a grid-connected zero-emission renewable power generation activity and meets all the following conditions stated in the Baseline Methodology (ACM0002 ver.7): "Consolidated baseline methodology for grid-connected electricity generation from renewable sources." For more information regarding the methodology please refer to http://cdm.unfccc.int/methodologies/PAmethodologies/approved.html

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

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Applicability

The wind power generation project is a renewable electricity generation activity to displace fossil fuel-fired power generation to supply electricity to the grid. Therefore the Project applies the consolidated baseline methodology ACM0002 to determine the project baseline and calculate GHG emission reductions achieved by wind power generation.

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

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According to the methodology ACM0002(ver.7), the only greenhouse gas accounted for in the calculation of the emission reductions is CO_2.

	Source	Gas	Included	Justification/Explanation
Baseline	Power plants connected to the Korea Power grid	CO_2	Yes	Included as per the ACM0002 methodology
		CH_4	No	Excluded for simplification. This is conservative.
		N_2O	No	Excluded for simplification. This is conservative.
Project Activity	Not applicable	CO_2	No	According to ACM0002, the project emission of renewable energy project activity is not considered.
		CH_4	No	
		N_2O	No	

The electricity produced by this project will be delivered to the grid system and replace the electricity

generated by fossil fuel in the grid. In Korea, Korea Electric Power Corporation (KEPCO) represent the grid system, therefore, the boundary of the project could be identified as KEPCO and the proposed project site.

Emission sources:
For the baseline determination only CO_2 emissions from electricity generation by fossil fuel fired power plant that is displaced due to the project activity are taken into account.

Spatial boundary:
The spatial extent of the project boundary includes Taegisan Wind farm Project site and all the power plants connected physically to the electricity system of KEPCO. The project site includes the turbines themselves and auxiliary electric equipments that are used to support the turbines operation.

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

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In accordance with the description in the approved baseline methodology ACM0002(version 7), for the project activities that do not modify or retrofit an existing electricity generation facility, baseline scenario is the following :

Electricity delivered to the grid by the project activity would have otherwise been generated by the operation of grid-connected power plants and by the addition of new generation sources, as reflected in the combined margin(CM) calculated latter.

The baseline scenario of the Taegisan 40MW Wind Power Project is establishment of a new generation sources on the Korea Power Grid to meet electricity demand. The project activity involves a construction of a zero-emission power source. Thus, the emission reductions are equal to the baseline emissions.

The analysis and description in B.5 and B.6 will support the baseline scenario shown above.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (assessment and demonstration of additionality): >>

The additionality of the project activity shall be demonstrated and assessed using latest version of the "Tool for the demonstration and assessment of additionality, version 4(EB36) agreed by the CDM Executive Board, which is available on the UNFCCC CDM website. The tool includes the following steps :
http://cdm.unfccc.int/methodologies/PAmethodologies/AdditionalityTools/Additionality_tool.pdf

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

Define realistic and credible alternatives to the project activity(s) that can be (part of) the baseline scenario through the following sub-steps :

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

In absence of the proposed project, reasonable and credible alternatives that are in accordance with current laws and regulations include:

1) The proposed project activity undertaken without being registered as a CDM project;

2) Construction of a power plant using other sources of renewable energy with equivalent amount of annual electricity generation; and

3) Provision of an equivalent amount of annual power output by the grid into which the project is connected. (Continuation of present situation)

Alternative 1) should be excluded among the realistic and credible alternative(s).

As shown in Step 2 investment analysis, if the proposed project would not undertaken as a CDM project and there aren't revenues from CERs, the potential economical efficiencgy of the project become worse and it won't attract investment from potential investors.

Alternative 2) is also unrealistic so it should be excluded among feasible one(s).

Beside wind farm project such as solar, geothermal power and biomass generation could be considered as grid-connected zero-emission renewable power generation activities. However the project developers and investors are not considering other way except wind power project in Hoengseong-gun and Pyeongchang-gun because of the given condition of the area. So given geographical and other conditions, other renewable energy generation should be excluded from feasible alternative(s).

In conclusion, as discussed in B4, the only practical and feasible baseline scenario that could provide output or services like the proposed project is the alternative 3).

Outcome of step 1a:

Alternative (3) is selected the realistic and credible alternative to the project activity and (1),(2) are excluded.

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.

In Korea there is no mandatory role or restriction at present for displacing the fossil fuel based power plants with renewable energies like wind power generation.

Additionally, the Korean government established "Act on the Promotion of the Development, Use and Diffusion of New and Renewable Energy"(revised in 27/09/2006. No 7998) to encourage use and develop the renewable energy sources in Korea in 2002.
This law is intended to improve the profitability and promote investment on renewable energy projects through preferential treatments for the electricity prices because in Korea, investing on those renewable energy projects is not much activated due to the high cost and low returns of those projects.
The law first established in 2002 to promote the diffusion of renewable energy. And according to decision of 22nd CDM EB meeting, it need not be taken into account in developing a baseline scenario. Therefore the law is not considered in this baseline calculation.

Outcome of step 1b:

In conclusion, alternative 3) is the only realistic and feasible one that is in compliance with legal and regulatory requirement.

Step 2. Investment analysis

Determine whether the proposed project activity is economically or financially less than at least one other alternative, identified in step 1, without the revenue from the sale of certified emission reductions (CERs). To conduct the investment analysis, use the following sub-steps :

Sub-step 2a : Determine appropriate analysis method

Determine whether to apply simple cost analysis, investment comparison analysis or benchmark analysis (sub-step 2b). If the CDM project activity generates no financial or economic benefits other than CDM related income, then apply the simple cost analysis (Option I). Otherwise, use the investment comparison (Option II) or the benchmark analysis (Option III). The proposed project employed benchmark analysis (Option III).

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

IRR(Internal rate of return) is employed as financial indicators for the project activity. And as a bench mark for IRR, 5.6% of average interest rate is used, which rate could be applied by local investors in the proposed project.
For the project activities, about 65% of total investment was raised from Rational Energy Utilization Funds of the host country (http://www.knrec.or.kr/) and domestic bank. And the interest rate of the loan is each 3.47% and 6.54% based on Feb 2007.

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

To calculate returns on sales of the generated electricity from the project, SMP (System Marginal Price) of wind power generation was used. And the recent official price data on the wind power generation provided by KPX is presented below. (http://epsis.kpx.or.kr/)

<Table B-2> Changes of SMPs

Year	2003	2004	2005	2006	2007
SMP (Won/kwh)	50.07	54.29	59.59	76.45	82.49

For the project activities, the average SMP of the latest 2 years, from Jan 2006 to Dec 2007 (2006.1 ~2007.12) was used.

IRR and NPV analysis came out as followings and more information for the analysis would be presented separately.

<Table B-3> Results from IRR & NPV analysis

	Without CER	**With CERs**	
		€10	**€20**
IRR	**3.7%**	**5.1%**	**6.5%**
NPV (Million Won)	**-11,925**	**-2,984**	**5,432**
1. Purchased Electricity : 79.47 won (Average SMP of during 2 years) (2006.1~2007.12) 2. Duration of operation : 20 years 3. Further details will be presented to DOE.			

As the table shows, project IRR(without CERs) of the proposed project is 3.7% and it is lower than the benchmark rate 5.6 % applied by the Government and domestic bank.
Therefore, the proposed CDM project activity is not financially attractive or feasible.

Sub-step 2d. Sensitivity analysis

Sensitive analysis was performed on following indicators which have a significant effect on the investment analysis of the proposed project.

- Venues from electricity sales (Sale price to the Grid)
- Amount of the generated electricity from the project activity

According to the sensitive analysis, if the SMP rises up within the range of -10%~+10%, the results comes out as below.

<Table B-4> Results from NPV analysis of the project

Without CERs	IRR	**NPV (Million Won)**

		3.7%	-11,925
Electricity Sale price	**+ 10%**	5.0%	-3,963
	- 10%	2.2%	-20,229
Electric generation amount	**+ 10%**	5.0%	-3,963
	- 10%	2.2%	-20,229

As shown in the table, the results from sensitive analysis show project IRR of the proposed project is lower than 5.6%, the average benchmark rate applied by the Government and domestic bank.

Outcome of step 2:
Those results from the analysis confirm that the project is not financially attractive or viable.

Step 3. Barrier analysis
For the proposed project, the barrier analysis is not carried out.

Step 4. Common Practice Analysis

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

In Korea, wind power plants were started to be constructed in high gear since the end of 2003 due to development of the wind power technologies and aggressive policy of Korean government.
According to KEMCO(Korea Energy Management Corporation), the total capacity facility of the wind power generation was 177.7MW and the net generation was 238,911MWh at the end of 2006.
In 2006, total electric generation of Korea was 381,180,709MWh and wind power held only 0.06% of it, of which portion is very low.

Following table shows the annual wind farm installations status in Korea until 2006.

<Table B-5> Status of annual wind farm installations

Year	~ 2000	2001	2002	2003	2004	2005	2006	Total
Capacity (MW)	5.9	2.0	4.8	5.5	49.9	30.7	78.9	177.7

In Korea, small scale wind power facilities with capacity of 1KW~750KW had been established until 2003 and MW scale facilities were started to establish since 2004.

<Table B-6> Status of wind farm installations in MW level

Title	Capacity	Completion	Remarks

Hangyeoung First phase wind power Project	6MW (1.5MW x 4)	2004.2	-
Gangwon Wind Park Project	98MW (2.0MW x 49)	2005.5	CDM registered (20 March 2006)
Yangyang Renewable Energy Project	3MW (1.5MW x 2)	2005.10	CDM registered (10 February 2007)
Youngduk Wind Park Project	39.6MW (1.65MW x 24)		CDM registered (02 June 2006)
Hangyeoung second phase SS-wind power Project	15MW (3.0MW x 5)	2007.11	CDM registered (17 October 2007)
K water Wind Power Project in Bang-a muri	3MW (1.5MW x 2)	2008.6	CDM registered (06 November 2007)

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

Table B-6 presents the status of wind power projects with capacity of MW level like the proposed project in Korea. As shown the table, the large scale of wind farms were all registered except "Hangyeoung 1st phase project 6MW(1.5MW x 4)" that was installed for the first time as a MW level project. (http://cdm.unfccc.int/Projects/projsearch.html)
Two large scale projects like the proposed project, of which capacity is beyond 15MW, both Gangwon and Youngduk Wind Park Project were registered CDM in 2006.

And three wind farm projects each capacity under 15MW were registered as small scale CDM projects in 2007. The "Hangyeoung 1st phase project 6MW (1.5MW x 4)" was promoted by Korea Southern Power Company as a pilot project and the "Hangyeoung 2st phase project 15MW (3.0MW x 5)" by the same company was registered as small scale CDM project.

The proposed project is a large scale one with exceeding 15MW and invested by Korea and Japan companies for commercial use and the project developers considered CDM project for their decision on investment. So the proposed project is not similar to "Hangyeoung 1st phase project 6MW(1.5MW x 4)" . Additionally the other projects on the Table B-6 was registered as CDM for revenues from CDM project, and these projects need not to be compared with the proposed project.
Moreover the generated output from wind power held only 0.06% of whole generation of Korea in 2006 and the wind power generation is not common or spread widely.

Step 5. Impact of CDM registration

Annually about 62,999 tonnes of CO2 e expected to be reduced through the project activities. Especially IRR of the projected will increase by 1.4%~2.8% provided tCO2 prices become €10~20, which makes the proposed project financially more attractive to the investors.

The project is jointly invested by POSCO E&C of Korea and Eurus Energy Japan, a foreign investor. They originally considered CDM promotion and it was one of the most important factors for the investment decision on the project. (Article 20, "Joint Development Agreement"(JDA) of POSCO E&C and Eurus Energy Japan)
Also registration of the project as one of the CDM projects in Kyoto Protocol will contribute to the diffusion of the environmentally friendly renewable energy projects in Korea.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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1. Baseline Emission Calculation

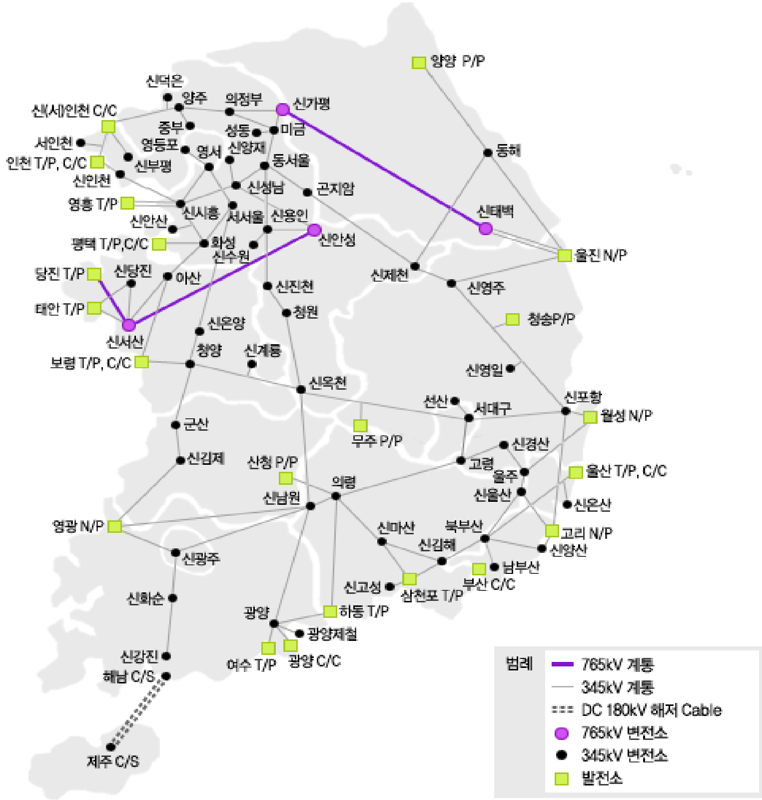
According to ACM0002(version 7) , baseline emission factor is calculated by “Tool to calculate the emission factor for an electricity system (ver 01). Baseline emission factor is calculated by combined margin (CM), which is weighted average of operating margin (OM) and build margin (BM).

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.



<Figure B-1> The national grid of Korea

Step 2. Select an Operating Margin (OM) Method

The calculation of the Operating Margin emission factor (EFOM,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 the above options, dispatch data analysis can't be applied in the project because dispatch data can't be obtained fully per hour. On the other hand, 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 42.88% of total KPX grid generation.

Simple OM emission factor ($EF_{OM,simple,y}$) 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 the "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 electricity unit (tCO2/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:

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

FCi,m,y = Amount of fossil fuel type i consumed by power plant / unit m in year y

NCVi,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.

EFCO2,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 1.2 of Chapter 1 of Vol. 2 (Energy) of the 2006 IPCC Guidelines on National GHG Inventories

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

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.

The build margin emission factor is calculated *ex-ante* and it is considered fixed along the crediting period.

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 74,372,455MWh and the annual generation of "the five power plants that have been built most recently" was 22,522MWh. Therefore, the former is lager figure than the latter, Option b is selected between the two options proposed by the methodology.
The detailed data used in the calculation are presented in Annex 3.

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 excluded 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:
(i) exclude power unit(s) that is (are) built more than 10 years ago from the group; and
(ii) include grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system.

Capacity additions from retrofits of power plants should not be included in the calculation of the build margin emission factor.

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

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

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

Here option 1 is chosen for the proposed project.

STEP 5. Calculate the build margin emission factor

According to the "Tool to calculate the emission factors for electricity system (Version 01)", the build margin emissions factor is the generation-weighted average emission factor (tCO2/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:
EFgrid,BM,y = Build margin CO2 emission factor in year y (tCO2/MWh)
EGm,y = Net quantity of electricity generated and delivered to the grid by power unit *m* in year y (MWh)
EFEL,m,y = CO2 emission factor of power unit *m* in year y (tCO2/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.

For the proposed project step 3 (a) Simple OM, option 1 is chosen.

For BM emission factor, EFEL,m,y was calculated by multiplying FCi,m,y(electricity consumption) by NCVi,y * EFCO2,i,y and divide it by power generation of each plant.
And then EFEL,m,y was multiplied by power generation of each plant and finally it was divided by total power generation.

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 the tool to calculate the emission factor for electricity system (Ver01), the combined emissions factor is calculated as follows:

*EFgrid, CM, y = EFgrid, OM, y * wOM + EFgrid, BM, y * wBM*

Where:
EFgrid,BM,y = Build margin CO2 emission factor in year y (tCO2/MWh)
EFgrid,OM,y = Operating margin CO2 emission factor in year y (tCO2/MWh)

wOM = Weighting of operating margin emissions factor (75% for wind project)
wBM = Weighting of build margin emissions factor (25% for wind project)

EFgrid,CM,y= 0.7282*0.75+0.3858*0.25 = 0.6426 (tCO2e/MWh)

(2) Calculate the baseline emissions (BE*y*)
Therefore, baseline emissions can be calculated as below:
BEy =EGy EFy*

2. Project emissions (PE*y*)
The emissions of the proposed project activity is zero, PE*y*=0

3. Leakage (L*y*)
According to the ACM0002 methodology, the leakage in the construction period of the proposed project is neglected. So the GHG emission within the project boundary is zero, i.e. L*y* =0.

4. Emission reductions (ER*y*)
The emission reduction (*ER**y***) by the project activity during a given year y is the difference between baseline emissions (*BE**y***), project emissions (*PE**y***) and emissions due to leakage(*L**y***), as follows:

ER**y**=BE**y**-PE**y**-L**y**

Since PE**y** and L**y** are zero as described before, ER*y* can be calculated as follows:

ER**y**=BE**y**=EG**y*** EF**y**

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

Data / Parameter:	$F_{i,j,y}$
Data unit:	Mass or volume unit
Description:	Fuel consumption *i* : bituminous, heavy oil, diesel, LNG *j* : power source delivering electricity to the grid (excluding low-operating cost and must-run power plants) *y*: 2004, 2005, 2005
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
Data unit:	kcal/ mass or volume unit
Description:	Net calorific value of fuel *i* : bituminous, heavy oil, diesel oil, LNG
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:	$EF_{CO2,i}$
Data unit:	kg C/GJ
Description:	CO_2 emission factor of fuel *i* *i* : bituminous, heavy oil, diesel oil, LNG
Source of data used:	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	Bituminous = 25.80, heavy oil = 21.10, diesel oil =20.20, LNG=15.30
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC world-wide default value
Any comment:	

Data / Parameter:	$OXID_i$
Data unit:	-
Description:	Oxidation factor of fuel *i* *i* : bituminous, heavy oil, diesel oil, LNG
Source of data used:	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value applied:	Bituminous = 0.98, heavy oil = 0.99, diesel oil =0.99, LNG =0.995
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC world-wide default value
Any comment:	

Data / Parameter:	$GEN_{j,y}$
Data unit:	MWh
Description:	Electricity delivered to the grid by source *j* *j* : power source delivering electricity to the grid (excluding low-operating cost and must-run power plants) *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:	$F_{i,m,y}$
Data unit:	Mass or volume unit
Description:	Fuel consumption *i* : bituminous, heavy oil, diesel, LNG *m*: sample group consisting of power plant capacity additions that comprises 20% of system generation and that have been built most recently. *y*: 2006
Source of data used:	2006 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 BM emission factor.
Any comment:	

Data / Parameter:	$GEN_{m,y}$
Data unit:	MWh
Description:	Electricity delivered to the grid by sample group *m* power plants *m*: sample group consisting of power plant capacity additions that comprises 20% of system generation and that have been built most recently. *y*: 2006
Source of data used:	2006 STATISTICS OF ELECTRIC POWER IN KOREA
Value applied:	See ANNEX 3
Justification of the choice of data or	It is used to calculate BM emission factor.

description of measurement methods and procedures actually applied :	
Any comment:	

B.6.3 Ex-ante calculation of emission reductions:

>>

Project Emissions

Since the proposed project is wind power generation project, the emissions are not considered.
Therefore
PEy = 0.

Baseline Emissions

According to section B.6.1, baseline emissions are calculated as follows.

$BE_y = EG_y * EF_y$ = 98,099MWh x 0.6426 tCO_2e/MWh = 63,038 tCO_2e/ year

Leakage

According to ACM0002, Ly = 0

Emission Reductions

According to Section B.6.1, the annual emission reduction results to be :

$ER_y = BE_y - PE_y - L_y$ = = 63,038- 0 - 0 = 63,038 tCO_2e/year

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

>>

The total emission reductions of the project are 630,380 tCO_2e during the crediting period.

Year	Estimation of project activity emissions (tCO2 e)	Estimation of baseline emissions (tCO2 e)	Estimation of leakage (tCO2 e)	Estimation of overall emission reductions (tCO2 e)
Year 1	0	63,038	0	63,038
Year 2	0	63,038	0	63,038
Year 3	0	63,038	0	63,038
Year 4	0	63,038	0	63,038
Year 5	0	63,038	0	63,038
Year 6	0	63,038	0	63,038
Year 7	0	63,038	0	63,038
Year 8	0	63,038	0	63,038
Year 9	0	63,038	0	63,038
Year 10	0	63,038	0	63,038
Total (tCO2e)	0	630,380	0	630,380

<Table B-7> Emission reductions of the project

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:	**EGy**
Data unit:	MWh
Description:	Electricity supplied to the grid by the project
Source of data to be used:	Measured by meters
Value of data applied for the purpose of calculating expected emission reductions in section B.5	98,099 MWh
Description of measurement methods and procedures to be applied:	Hourly measurement and monthly recording. 100% of data will be monitored and archived.
QA/QC procedures to be applied:	The Measurement will be in compliance with the National Guidelines and requirement of the KPX(Korea Power Exchange) for accuracy and reliability. The calibration will be carried out according to relevant national standards and regulations by authorized organisation. Double checked by receipt of sales.
Any comment:	-

B.7.2 Description of the monitoring plan:

>>

Monitoring plan is setting up the series of monitoring works on GHG emission reduction of the proposed project.

Monitoring plan includes followings.

- Establishing and keeping the appropriate and transparent monitoring system for the generated electricity from the project
- Measuring instrument management, maintenance and quality control.
- Role and demands of the person in charge of monitoring
- Dada management and storage system
- Preparations and coping with the third parties audit

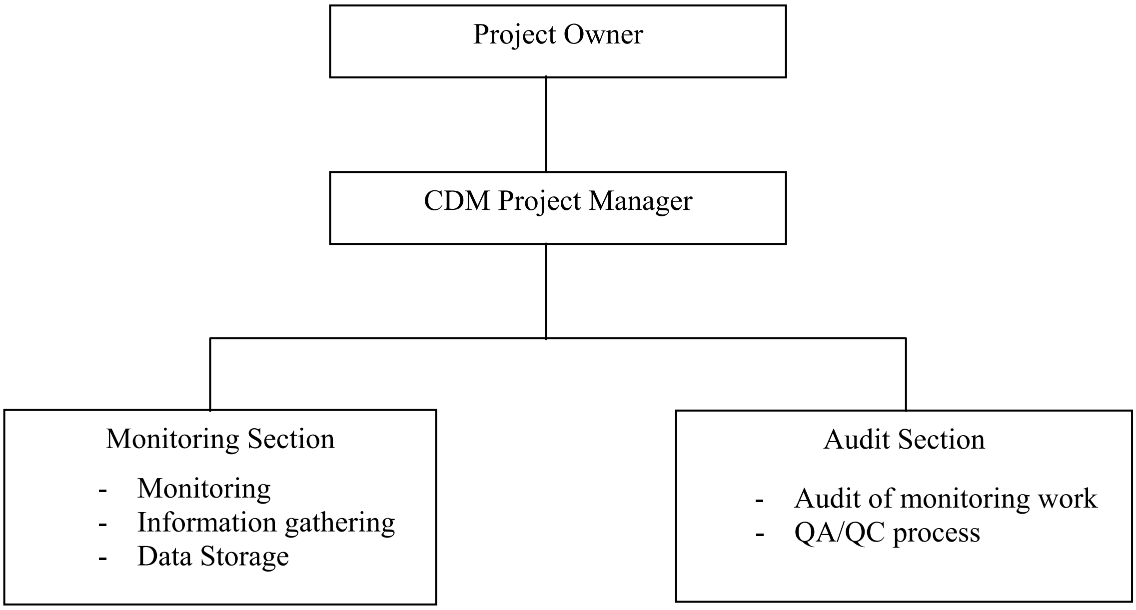
1. Monitoring Organization

The generated electricity supplied to the KEPCO grid is the main data to be monitored.
Project owner will appoint the CDM project manager who is in charge of all related matters including monitoring of reduction, collecting and keeping of the data, QA/QC and audit.
Under the CDM project manager there are two sections: monitoring section and auditor section

The former, monitoring section manager will undertake information gathering, storage and monitoring required according to the monitoring plan. The gathered information is recorded and sent to the CDM project manager and auditor section monthly.

The latter, auditor section manager will audit the monitoring section's work and proceed QA/QC process according to the monitoring plan.
CDM project manager will take the responsibility for entire compliance of the monitoring plan including confirmation of monitoring plan, data calculation and report.

Following figure describes the operational structure to perform the monitoring plan.



<Figure 5> Operational and management structure

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)

>>

CDM project manager should report the outline and fulfillment of entire monitoring plan to the project owner regularly at least twice a year.
And the project manager report to the owner whenever important changes of monitoring plan or fulfillment happen.

1. Monitoring Equipment

Electricity meters for measuring the amount of electricity shall be set up transparently in accordance with the Korean law "Law regarding measurement" and "Act on operation of electricity market", shall be sealed after confirmation on the correct set up of the meters by Korea Power Exchange.
The meters shall be investigated according to "Act on operation of electricity market" by certificated examination standard.
And calibration regarding sealing of the meters shall be performed regularly every two years after the installation.

The proposed project will be maintained in accordance with the process defined on the "Law regarding measurement" and "Act on operation of electricity market".

2. Data Collection and Management

The amount of electricity transmitted to the grid shall be measured automatically by the established meters as described above. The measured variables are simultaneously transferred to central control system of the Taegisan wind power plant.
The measured amount of electricity shall be collected daily, weekly, and monthly and shall be archived in electronic way.

Additionally, according to "Act on operation of electricity market", KPX shall keep and maintenance the transmitted data from the electricity meters of the proposed project in its data base.
And the measured amount of electricity shall be compared with those of KPX to ensure quality of the data. If the two variables compared are different, the electricity meters and other equipment shall be checked if they are working properly by internal investigation and procedures regulated in the related laws. Then the results will be reported to the CDM project manager for appropriate follow-up measures.

Even after the internal investigation and procedures in related laws, if the reason why those two variables are different is not found, then data stored in the electricity meters of Taegisan will be used in the first place according to "Act on operation of electricity market"

3. Training

CDM project manager shall make the person in charge of monitoring and electricity safety attend the following courses more than once a year until 3 years after the project began to operate.

- Course on 'Law regarding measurement' or Korean (Industrial) Standards㉿
- Course on 'Act on operation of electricity market
- Course on 'Electricity safety'

After finishing those courses above, the person in charge of monitoring and electricity safety shall pass on what he has learned to other steps and shall report the result to the CDM project manager.

If possible, CDM project manager shall not replace the person in charge of monitoring and electricity safety to another one. And when the manager changes the responsible person inevitably, he shall appoint a replacement who has been approved.
Details for this, they will follow the internal rules of the Taegisan wind power plant.

5. Monitoring report and Verification

CDM project manager will confirm the amount of electricity transmitted to the grid and GHG reductions monthly and monitoring report will be prepared by the project developer or the nominated third party. The project developer or the nominated third party shall make the contents and form of the monitoring report correspond to those of the registered PDD.
All these documents will be verified by DOE.

Date of completion of the methodology application:

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

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:

>>
01/10 /2007

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

>>
20 years

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

C.2.1. Renewable crediting period

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

>>
01 /12/ 2008

C.2.1.2. Length of the first crediting period:

>>
10 years

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>>
N/A

C.2.2.2. Length:

>>
N/A

SECTION D. Environmental impacts

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

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According to Article 4, paragraph 3 of "Act on Assessment of lmpacts of Works on Environment, Traffic, Disasters, etc." and its enforcement decree(Article 2, paragraph 3), any plant facility whose power source is solar power, wind power or fuel cell is more than 100,000kW shall be carried out EIA (Revised 2005.9.16). As facility capacity of the proposed project is 40,000MW, it is not required to be performed EIA.

However, Prior Environmental Review (PER) was performed as specified in "National Land Planning and Utilization Act" (Article 6, subparagraph 2) and the enforcement decree (Article 7, paragraph 1)of "Framework Act on Environmental Policy".

PER was performed by an environmental impact assessment agency, Taeil Environment Co., Ltd (President Changho Cho, tienv@chollian.net, Tel. 82-2-489-5747). Additionally Review for impacts on natural scenery and Review for ecology of fauna and flora were performed respectively in 2006 and 2007 by Taeil Environment Co., Ltd and UPEHCO Korea Co., Ltd for the proposed project.

The PER covers the sectors of natural environment, residential environment, and social/economical environment as follows,

- Natural environment: Weather, Topography, Geology, Fauna, and Flora
- Residential environment: Land utilization, Air quality, Water quality, Soil, Waste, Noise, Vibration, Recreation, Scenery, and Radio interference

The PER report on natural scenery (2007) mainly contains followings.

Review Scope: Within a radius of 2 km, the orbit of the site.

- Minimizing the damage of geographical features and skyline by building the road along the ridge of Taegi Mt.
- Harmonizing the colours of the facilities with natural scenery by matching their colours with sky blue for a distant view.
- Expected influence on the scenery is insignificant as the some transaction lines are to be constructed underground

The Review for ecology of fauna and flora (2006.7) mainly contains followings.

On site inspection: 17-20. April 2007

Review Scope : Within a radius of 1 km, the orbit of the site with direct or indirect influences.

- Building appropriate plans including greening around the site and afforestation with similar species to minimise the influences on flora.
- Planning for replant following completion of engineering works.
- Expected damage against ecosystem is little if any by utilizing the existing road.

Collectively the summary Preliminary Environmental Assessment Report of the project is as follows.

Construction Phase :

Land Use
The construction work of the project will have some influences on the local ecological environment such as intensified soil erosion, decline of soil fertility, and weakening of the anti-eclipse ability of the regolith. Although the overall area of the wind farm is quite large, the actual construction area of the project is comparatively small. By strictly managing the construction action, building bulkheads at the slope faces, backfilling the excavated soil and rock, and restoring the destroyed ground and vegetation, we could limit the disturbance and damage of the land surface to a minimal scope, and enforce the ecological environment protection for the project operation and the sustainable development.

Noise
The noise pollution mainly comes from the instantaneous demolition noise, manual drills, cement mixers, and transportation vehicles during construction period, and aerodynamic interaction between the wind and turbine blades during operation period. Since the demolition times are limited and all equipments will be operated during daytime hours, the noise levels will be controlled and naturally attenuated by ambient conditions within the standards.

Waste water and sewage
The sewage is mainly composed of the water produced by flushing and maintaining the construction machinery, and daily life waste generated by the operation staff. Since the wind farm operation system is relatively independent and assembly automated, we could collect and process the construction sewage by setting up the constructor battalion, and septic tank in living regions, and sedimentation and separating-oil pond in the construction region. Before the waste water and sewage for irrigating the farmland and forest land is discharged, it will be processed no impact on the surrounding environment.

Dust and Air Quality
The air impact during the construction period mainly comes from flying dust produced by excavating land and transportation vehicles, and some exhaust discharge from using and moving construction machinery. Regarding this problem, the project owner will use enclosed transportation vehicles with strictly managed schedule and route. Moreover, by strengthening the construction control, advocating civilized construction, and regularly spraying and cleaning the branch roads, material dump sites and other construction work surfaces, the influences could be reduced under the construction standards set by governments and environmental protection departments.

Operation Phase :

Interference with Communications
The communication interference mainly comes from turbine blades and power transmission and distribution. Electromagnetic wave and microwave generated by wind power blades may disturb television and broadcast signals, cellular wireless communication, and various navigational and air traffic control systems. But at present, the most commonly used blade materials, fiberglass and wood, have very weak disturbance on communication, which could be adjusted by the inexpensive direction receiver/transmitter.
Corona noise produced from the power transmission and distribution mainly interferes with the low frequency signals used for AM wireless broadcast, especially during storms. All the routes and layouts of transmission and distribution are designed to keep enough distances with the sensitive region, such as inhabited areas and telecommunication lines. There is no interference expected.

Radiation of electromagnetism
Radiation of electromagnetism arising from working turbines is considered insignificant in terms of intensity, and would unlikely bring negative impacts on residents' health because of the distant distance between wind farm and residential area. Meanwhile, according to the investigation on all the residents near wind farms, there is no disturbance on local radio, television or electric equipments. By conclusion, disturbance on radio and TV, etc., will unlikely occurs.

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:

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SECTION E. Stakeholders' comments

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

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For the promotion of the proposed project Gangwon Province, Eurus Energy Japan and POSCO E&C entered into an "Agreement on Joint Development" on Feb 2006 and established Taegisan Wind Power Corporation Ltd., (SPC).
Taegisan Wind Power Co Ltd. held executive meetings and presentations several times with local public offials, residents and local stakeholders to collect their opinions.

A meeting was held with the head of Hoengseong-gun and related public officials, representatives of residents and staffs in charge of Hoengseong-gun in Feb 2006.
During 21 Dec ~ 22 Dec 2006, presentation meetings were held respectively in Hoengseong-gun and Pyeongchang-gun with local residents and stakeholders to present the proposed project and collect their opinions.

10 persons of the local government interested including head of the Organization for investment inducement on Gangwon Province (President Mr Chun-soo, Park), Sae-jong Yoon, the local assembly man of Hoengseong and head of Dunnae-myun and 26 residents attended the presentation meeting held in Dunnae-myun office in Hoengseong-gun on 21 December.
In the meeting, a presentation on the project activities was made to the attendances and there was question-and-answer session over the project.

< Hoengseong-gun, Taegisan Wind Power Plant project Presentation (21/21/2006) >

And at the presentation meeting held in Pyeongchang-myun office in Pyeongchang-gun on 22 December, 10 persons of the local government interested including head of the Organization for attracting investment in Gangwon Province (President Mr Chun-soo, Park) and 36 residents attended.
In the meeting, a presentation on the project activities was made to the attendances and there was question-and-answer session over the project.

< Pyeongchang-gun, Taegisan Wind Power Plant project Presentation (21/21/2006) >

Besides the project developers informed the object of the project as well as its future plan though various media : Gangwon Daily News, Yonhap News, EBN Industrial News, KBS Wonju station etc.

E.2. Summary of the comments received:

>>

Summary of the comments raised by the persons of the local government interested, stakeholders and residents of Hoengseong-gun and Pyeongchang-gun is as follows.

a. Noises from the generator
b. Benefit to the local residents by constructing the wind farms
c. Danger of natural disasters from constructing the wind farms

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

>>

Explanations and follow up measures taken/being taken to above comments from stakeholders are bleow.

a. On the matter of noises, the project developers informed that when the hub of generators is 80meters high, if it is far from the residential areas more than 365meters, then the noise level become under 45dBA, which meets the requirement of noise control regulation.
   And they also explained that the generators of the project are located far from the residential areas therefore, there is no influence against the residential areas.

b. On the matter of giving back to the community, the project developers explained that they expected the project would much contribute to boost tourism, create new jobs and stimulate local economy.
   And also they promised to make the local residents and local construction companies get involved into the construction and operation of the power plant for the development local community.
   Additionally Taegisan Wind Power Co. Ltd., promised to give financial support to local agricultural products processing plant and now they are under discussion for concrete steps.

c. On the third matters regarding the natural disasters, the project developers presented the result from Prior Environmental Review (PER) on the expected project sites and the areas where transmission lines would go through. And they explained the reflection of these matters to the design of the plant.
   As roads already have been built to the summit of Taegi Mt mostly, additional destroy of the forest due to the project nearly would not happen and the transmission lines would be constructed along with the existing roads and especially the block which goes through the communities will be constructed underground to minimise inconveniences and complaints of stakeholders.

Taegisan Wind Power Co. Ltd., collect comments from local communities around the project sites regularly and on occasion and they reflected those issues to company policy and design of the plant if necessary.
Also, community people can directly appeal to the country offices in Hoengseong-gun or Pyeongchang-gun and or to the Taegisan Wind Power Co. Ltd if they have any opinion about the wind farm project. Beside these direct ways, Taegisan Wind Power Co. Ltd collected comments on the progress or overall of the project after the announcement of the proposed project through mass media.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

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URL:	http://www.eurus-energy.com/
Represented by:	
Title:	General Manager
Salutation:	Mr.
Last Name:	Masaru
Middle Name:	
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City:	Seoul
State/Region:	Seoul
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E-Mail:	taeseon@poscoenc.com
URL:	http://www.poscoenc.com/
Represented by:	
Title:	Manager
Salutation:	Mr
Last Name:	Cha
Middle Name:	
First Name:	Tae Seon
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Mobile:	82-17-812-0206

Direct FAX:	--
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

This project will not receive public funding.

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.

(Unit:MWh, Gross)

year	Low cost/must run					Total grid generation	Low cost/must run ratio
	Hydro	Coal (Anthracite)	Nuclear	Alternative	Total		
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%

*Alternative energy: Geothermal, Wind, Low-cost biomass, Solar, LFG
*Source: 2006 Statistics of Electric Power in Korea, KEPCO, 2007.05.

Carbon Emission Factor and Oxidation factor of fuel

Carbon Emission Factor (unit: kgC/GJ)	
Bituminous coal	25.80
Heavy Oil	21.10
Diesel Oil	20.20
LNG	15.30

Source: 1996 Revised IPCC Guideline

Fraction of Carbon Oxidised	
Coal	0.98
Oil and Oil product	0.99
Gas	0.995

Source: 1996 Revised IPCC Guideline

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

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

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

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

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)	
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
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

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

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)	
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
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
	$\Sigma_m EG_{m,y}$=	**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.

$$EF_{grid,OMsimple,y} = \Sigma_{i,m} FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y} / \Sigma_m EG_{m,y} = \mathbf{0.7219}$$

Operating Margin for 2005(continued)

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

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

Operating Margin for 2005(continued)

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)	
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
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

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

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)	
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
#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
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
	$\Sigma_m EG_{m,y}$ =	**195,045,066**																**$\Sigma_{i,m} FC_{i,m,y}$ * $CV_{i,y}$ * $EF_{CO2,i,y}$ =**	**142,804,311**

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

$$EF_{grid,OMsimple,y} = \Sigma_{i,m} FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y} / \Sigma_m EG_{m,y} = \mathbf{0.7322}$$

Operating Margin for 2004(continued)

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

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

Operating Margin for 2004 (continued)

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)	
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
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

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

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)	
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
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
	$\Sigma_m EG_{m,y}$=	**187,513,847**																**$\sum_{i,m} FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ =**	**136,991,906**

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

$$\mathbf{EF_{grid,OMsimple,y} = \Sigma_{i,m} FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y} / \Sigma_m EG_{m,y} = \quad 0.7306}$$

Build Margin (BM) calculation

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

< Choice of Sample group m >

Net Generation (MWh)		Percentage	Selected
Grid total	365,368,967	100.00%	
Sample group m - five plants	22,522	0.01%	
Sample group m - 20% plants	74,623,499	20.42%	O

Carbon Emission Factor and Oxidation factor of fuel

Carbon Emission Factor (unit: kgC/GJ)	
Bituminous coal	25.80
Heavy Oil	21.10
Diesel Oil	20.20
LNG	15.30

Source: 1996 Revised IPCC Guideline

Fraction of Carbon Oxidised	
Coal	0.98
Oil and Oil product	0.99
Gas	0.995

Source: 1996 Revised IPCC Guideline

BM for the proposed project activity

Build margin for 2006: 0.3858 tCO_2/MWh

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

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)	$FE_{EL,m,y}$ (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	2006.12	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	2006.10	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	2006.10	Solar	106	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Namhae solar	2006.10	Solar	297	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Hanlajeunggong solar	2006.10	Solar	287	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Top infra	2006.09	Solar	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Enepark	2006.09	Solar	85	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yongheng solar	2006.09	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	2006.09	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	2006.09	Heavy oil-therma	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	2006.08	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	2006.06	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	2006.06	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	2006.06	Solar	619	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Jangseong	2006.05	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	2006.04	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	2006.04	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	2006.03	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	2006.02	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	2005.12	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	2005.12	Solar	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Dangjin #5	2005.11	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	2005.10	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	2005.07	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	2005.07	nternal combustic	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	2005.07	Hydro	1,740	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Donghwa	2005.07	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	2005.04	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	2005.04	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	2005.03	Biogas	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Yongdam	2004.12	Hydro	23,972	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0

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

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)	$FE_{EL,m,y}$ (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)			
Maebongsan-wind power	2004.12	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 pow	2004.12	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	2004.11	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	2004.11	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	2004.11	Solar	216	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Ulchin #5	2004.07	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	2004.07	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	2004.07	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	2004.03	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	2004.03	Wind	18,371	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Chunsang	2004.02	Hydro	183	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Cheongju LFG	2004.02	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	2003.12	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	2003.06	LFG	12,768	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Hoicheon ENC	2003.05	LFG	4,501	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0.0000	0
Muju	2003.04	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)	2003.04	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	2003.03	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	2002.12	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	2002.05	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	2002.05	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	2001.11	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	2001.11	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	2001.10	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	2001.10	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
		$\Sigma_m EG_{m,y}$=	**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.

$EF_{grid,BM,,y}=\Sigma_m EG_{m,y} * EF_{EL,m,y}/\Sigma_m EG_{m,y}$= 0.3858

Annex 4

MONITORING INFORMATION

Please refer to section B.7