CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

CONTENTS

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	■ The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. ■ As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	■ The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

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- Project Title: 3MW Shinan Wind power project
- Version: 01
- Date: 08 Dec 2008

A.2. Description of the small-scale project activity:

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Project Description

This project participant is Shinan wind power Co., Ltd. It is a subsidiary of Dongkuk S&C Co., Ltd.

Dongkuk S&C Co., Ltd. has an about 10% world market share of wind tower. Also they has been exporting wind tower to major wind power company like a VESTAS, Enercon, Gamesa, GE, Siemens, Mitsubishi heavy industries and etc.

Shinan Wind power plant is located in San 1-1, Gurim-ri, Bigeum-myeon, Shinan-gun, Jeollanam-do, Republic of Korea. Wind power generator has capacity 1,000kW × 3units. This project will generates 6,400MWh/yr with 24.4% efficiency and supplies the electricity to the grid.

This project site has advantageous terms for Wind Farm. It is spacious and has no obstruction like an island. Average wind velocity is 6.1m/s at a height of 70m.

Contribution to sustain

By using renewable local source of energy, the project will contribute to sustainable development in South Korea as follows:

- Power generation from wind power plants reduces consumption of fossil fuels, decreases imports of fossil fuel, and hence brings in national profits.
- As an alternative energy source, wind power does not emit air pollutants or wastes.
- As the renewable energy source, wind power does not deplete natural resources and therefore it will be used as alternative energy sustainable by future generations.
- There are no Green House Gas (GHG) emissions.
- Demonstrate replicable clean energy technology.

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)	• Private entity: Shinan wind power Co., Ltd.	No

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A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

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A.4.1.1. Host Party(ies):

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Republic of Korea

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

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Jeollanam-do

A.4.1.3. City/Town/Community etc:

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San 1-1, Gurim-ri, Bigeum-myeon, Shinan-gun

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

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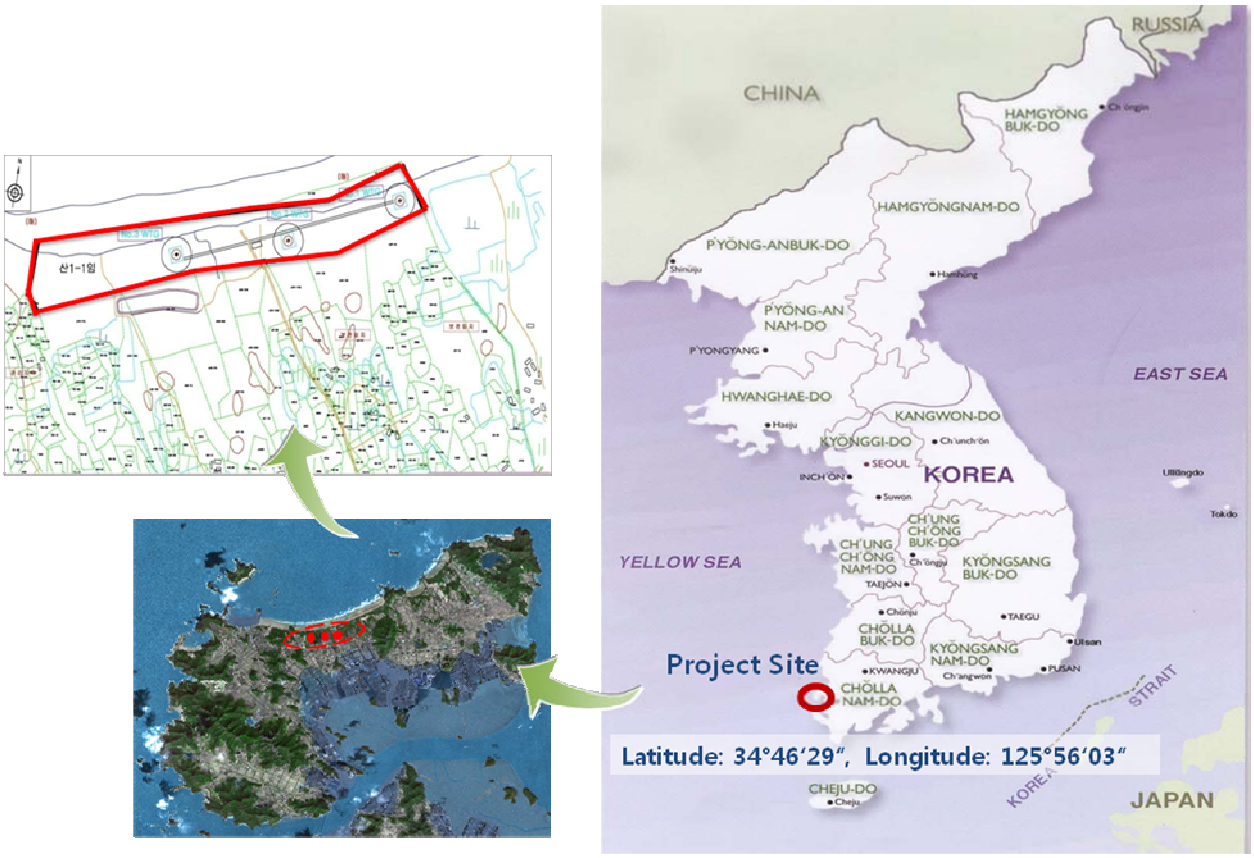
This project site is located in the East 125°56’03”, North 34° 46’29”. Also it is located in nearby seashore. There is no noise harshness from wind power generator because the roar of the sea offset the noise from wind power generator.



[Figure 1] the location of the project

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

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Type and Category of the project

Type: I – Renewable energy projects
Category: I.D – Grid connected renewable electricity generation

The project type, as defined in UNFCCC's Appendix B of "the simplified modalities and procedures for small-scale CDM project activities", is I.D: Renewable energy projects; Grid connected renewable electricity generation.

This project generates electricity utilizing renewable energy, wind, and supplies the electricity to the grid. Furthermore, the total capacity of the power plant is 3MW which is less than 15MW. Therefore, the methodology AMS I.D. is eligible for this project activity.

Applied Technology of the project

Rotor transforms kinetic energy of wind into rotational energy. And then induction generator produces power using rotational energy.

- Rotor system: transforms wind energy into rotational energy

- Power delivery system: delivers rotational energy to electricity transformation system.
- Electricity interconnection system: transforms rotational energy into electricity energy and makes produced power be satisfied in the quality of electricity interconnection
- Assistants system: control device, rotor, steel tower, structure and etc.

<Table 1> wind power electric equipment specification

Classification		Details
Manufacturer		Mitsubishi
Blade	Material	glassfiber reinforced plastics
	Rotor diameter	61.4m
	The number of blade	3
Generator (MWT-1000A)	Type	Induction generator
	Wind velocity	12.5m/s
	Output Voltage	600V
	Output power	1,000kW
	Rotational Speed	19.8rpm
	Cooling system	Air cooling
Steel Tower	Type	Tubular
	Height	66.9m

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

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Years	Estimation of annual emission reductions in tonnes of CO_2 e
Jun 2009~May 2010	3,901
Jun 2010~May 2011	3,901
Jun 2011~May 2012	3,901
Jun 2012~May 2013	3,901

Years	Estimation of annual emission reductions in tonnes of CO_2 e
Jun 2013~May 2014	3,901
Jun 2014~May 2015	3,901
Jun 2015~May 2016	3,901
Total estimated reductions (tonnes of CO_2 e)	27,310
Total number of crediting years	7
Annual average of the estimated reductions over the crediting period (tCO_2 e)	3,901

A.4.4. Public funding of the small-scale project activity:

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No public funding is provided for this project.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

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This project is not a part of any large scale project activity.

According to Appendix C of the simplified modalities and procedures for small-scale CDM project activities, debundling is defined as the fragmentation of a large project activity into smaller parts.

A proposed wind power project activity shall be deemed to be a debundled component of a large project activity if there is a registered small-scale CDM project activity or another small-scale CDM project activity requested for registration which has the conditions as follow:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

This project does not belong in above 4 things. Therefore, this is not a debundled part of large-scale project activities.

SECTION B. Application of a baseline and monitoring methodology

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

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Methodology Title: I. D: Grid connected renewable electricity generation (Version 13, 14 Dec 2007)

Reference: Appendix B of the simplified modalities and procedures for small-scale CDM project activities

B.2 Justification of the choice of the project category:

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The renewable energy projects include wind power generation and the maximum output capacity is required not to be over 15MW to be eligible for type I project activities. This project is to construct 3MW wind power project activities. Therefore, this project comes under type I project activities. If a kind of renewable energy project of type I is to supply electricity into a grid, this project belongs to I.D categories, specially. In case of Shinan Wind power project, it is among category I.D., because all of generated electricity is provided into grid system of Republic of Korea through connection line to the transformer substation located in Gurim-ri, Bigeum-myeon, Shinan-gun, Jeollanam-do.

B.3. Description of the project boundary:

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For the baseline determination, project boundary is related to CO_2 emissions from electricity generation in a fossil fuel fired power that is displaced due to this project activity. The spatial extent of the project boundary includes the project site and all the power plants connected physically to the grid of Korea Electric Power Corporation (KEPCO).

For calculation of baseline GHG emission from the project boundary does not include emission during plant construction, leakage from electricity transfer, and emission from transportation, mining, and pumping.

B.4. Description of baseline and its development:

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According to clause 9 of AMS I.D version 13, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2equ/kWh) calculated in a transparent and conservative manner as:

(a) A combined margin(CM), consisting of the combination of operating margin(OM) and build margin(BM) according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system".

OR

(b) The weighted average emissions (in kg CO_2equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Therefore the baseline for this project was calculated according to "Tool to calculate the emission factor for an electricity system(version 01.1)", on the authority of (a) as mentioned above. The baseline emission factor (EF_y) was calculated as a combined margin (CM), consisting of the combination of operating margin(OM) and build margin(BM) factors according to the following six steps. Intend to calculating this combined margin(CM), it were applied that the data originated from existing power plants that provide electricity to the current grid-connected electricity generation. Here, these data were collected from the "Statistics of Electric Power in KOREA published at the most recent 3-years (2005, 2006, 2007) (KEPCO)", and should be proper because the host country of this project, Republic of Korea, does not import/export electricity from/to other countries.

STEP 1. Identify the relevant electric power system

For the purpose of determining the electricity emission factors, a **project electricity system** is defined

by the spatial extent of the power plants that are physically connected through transmission and distribution lines to the project activity (e.g. the renewable power plant location or the consumers where electricity is being saved) and that can be dispatched without significant transmission constraints.

Similarly, a **connected electricity system**, e.g. national or international, is defined as an electricity system that is connected by transmission lines to the project electricity system. Power plants within the connected electricity system can be dispatched without significant transmission constraints but transmission to the project electricity system has significant transmission constraint.

If the DNA of the host country has published a delineation of the project electricity system and connected electricity systems, these delineations should be used. If such delineations are not available, project participants should define the project electricity system and any connected electricity system and justify and document their assumptions in the CDM-PDD. In doing, so the following criteria can be used to determine the existence of significant transmission constraints:

• In case of electricity systems with spot markets for electricity: there are differences in electricity prices (without transmission and distribution costs) of more than 5 percent between the systems during 60 percent or more of the hours of the year.

• The transmission line is operated at 90% or more of its rated capacity during 90% percent or more of the hours of the year.

In this sense, it is clear that the project electricity system to be applied is the whole Korean national grid system since all power plants, including Shinan wind power plant, are physically connected to each other through transmission and distribution lines constituting the grid.

Therefore the Korean national grid has been chosen as relevant electricity power system for purpose of determining the electricity emission factors.

[Figure 2] Electric Power Grid Nationwide in Republic of Korea
Source: 2008 Annual Report, Korea Electric Power Corporation

STEP 2. Select an operating margin (OM) method

The calculation of the Operating Margin emission factor ($EF_{grid,OM,y}$) shall be calculated basis on one of the four following methods:

Option (a) Simple OM
Option (b) Simple adjusted OM
Option (c) Dispatch Data Analysis OM
Option (d) Average OM

If low-cost/must-run resources constitute less than 50% of total grid generation in average of the five most recent years, simple OM can be chosen.

Referring to the gross electricity generation rate by energy sources of the host country (Republic of Korea), the rate of low cost/must run power generation does not exceed 50% of the total grid. Actually, the most recent 5-year (2003~2007) average data shows that the rate of low cost/must run is 41.49%. (Source: KEPCO)

Therefore, for this project case, "Option (a) Simple OM" is available. <Table 2> is shown the yearly proportion of the generation of electricity based on the source of energy (Korea Electric Power Corporation, 2008).

<Table 2> Gross generation by energy sources

(Unit: million kWh)

Item \ Year		2003	2004	2005	2006	2007
Hydro*		6,887	5,861	5,189	5,219	5,042
Thermal	Domestic Coal*	5,398	4,603	4,484	4,312	4,470
	Bituminous Coal	114,878	122,556	129,174	134,894	150,204
	Heavy Oil	23,656	21,591	20,079	18,596	20,769
	Diesel Oil	2,870	474	412	599	446
	Gas	39,091	55,999	58,118	68,302	78,427
Nuclear*		129,672	130,715	146,779	148,749	142,937
Alternative*		-	350	404	511	829
Total		322,452	342,148	364,683	381,181	403,124
The rate of low cost/must run power generation (%)		41.49				

Source: Electricity statistics on Electricity quantity from Korea Electric Power Corporation, 2008
(* low-operating cost and must-run power plants)

And the Simple OM emission factor can be calculated using either of the two following data vintages for years(s) *y*:

• Ex ante option: A 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation, without requirement to monitor and recalculate the emissions factor during the crediting period, or

• Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required calculating the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.

On this PDD, *ex-ante* data were applied. The Simple OM emission factor is calculated as followed step 3.

STEP 3. Calculate the Operating Margin emission factor ($EF_{grid,OM,y}$)

The simple OM emission factor is calculated as the generation-weighed emissions per electricity unit of all generating units serving the system, excluding low-operating cost and must-run power plants. Low-operating cost and must run power plants include hydro, nuclear, low cost biomass, geothermal and domestic coal. And it is calculated based on data on fuel consumption and net electricity generation of each power plant /unit (Option A) as follows:

$$EF_{grid,OMSimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,j}}{\sum_{m} EG_{m,y}} \quad \textbf{(1)}$$

Where:

$EF_{grid,OMsimple,y}$	=	Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power plant / unit m in year y (mass or volume unit)
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (GJ / mass or volume unit)
$EF_{CO2,i,y}$	=	CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power plant / unit m in year y (MWh)
m	=	All power plants / units serving the grid in year y except low-cost / must-run power plants / units
i	=	All fossil fuel types combusted in power plant / unit m in year y
y	=	Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

The applied parameters are presented for estimation of Operating Margin emission factor ($EF_{grid,OM,y}$) at <Table Annex-1, 2, 3> in Annex 3.

STEP 4. Identify the cohort of power units to be included in the Build Margin emission factor ($EF_{grid,BM,y}$)

The sample group of power unit 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.

Project participants should use the set of power units that comprises the larger annual generation.

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

For this project case, *Option* 1 is taken to calculate the Build Margin emission factor, $EF_{grid,BM,y}$ *ex-ante*, and it is estimated as <Table 3> according with each regulation to compose proper sample group(*m*) that the electricity quantity of candidate sample groups and it ratio to total generation in Korea.

<Table 3> Sample Plant group(m) for determining Build margin Emission factor

Sample group(m) Classification	**Regulation 1**	**Regulation 2**	**Comments**
	"The five power plants that have been built most recently"	**"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."**	
Electricity quantity	33 MWh	84,736,759 MWh	Total generation is 385,990,619MWh in Korea (based on KEPCO's data of the year 2007)

Proportion (ratio to total generation in Korea)	0.00001%	21.953%	CDM registered Power plants generation is 376,177MWh.
Selected Group		**O**	

The annual generation of "the five power plants that have been built most recently" was 33MWh (0.00001% of total generation of the grid system), and the annual generation of "the power plants capacity additions in the electricity system that comprise 21.953% of the system generation and that have been built most recently" was 84,736,759MWh. Therefore, the latter was chosen for this project as a lager figure than the other one. It is presented at <Table Annex-4> in Annex 3 that the sample group of plants used in the Build Margin emission factor ($EF_{grid,BM,y}$).

STEP 5. Calculate the build margin emission factor ($EF_{grid,BM,y}$)

The build margin emissions factor is the generation-weighted average emission factor (tCO_2/MWh) of all power units m during the most recent year y for which power generation data is available, calculated as follows:

$$EF_{grid,BM,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}} \quad \textbf{(2)}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

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

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

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available

STEP 6. Calculate the combined margin emissions factor ($EF_{grid,CM,y}$)

The combined margin emissions factor is calculated using the following formula:

$$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM,y} + w_{BM} \cdot EF_{grid,BM,y} \quad \textbf{(3)}$$

Where:

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (tCO_2/MWh)

$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (tCO_2/MWh)

w_{OM} = Weighting of operating margin emissions factor (%)

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

•Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.

•All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

Alternative weights can be proposed, as long as $w_{OM} + w_{BM} = 1$, for consideration by the Executive Board, taking into account the guidance as described below. The values for $w_{OM} + w_{BM}$ applied by project participants should be fixed for a crediting period and may be revised at the renewal of the crediting period.

Depending on AMS I.D (Version13), baseline emissions should be obtained by the below equation

$$BE_y = (EG_y - EG_{baseline}) \cdot EF_y \quad (4)$$

where:
BE_y is the baseline emissions (in tCO_2)
EG_y is the electricity supplied by the project activity to the grid (in MWh)
$EG_{baseline}$ is the baseline electricity supplied to the grid in the case of modified or retrofit facilities (in MWh)
EF_y is the baseline emissions factor (in tCO_2/MWh)

However $EG_{baseline}$ is zero because there are no modified or retrofit facilities in this project. Therefore the baseline emissions (BE_y) can be calculated as follows;

$$BE_y = EG_y \cdot EF_y \quad (5)$$

The key information and data used for calculation of baseline emission by this project activity have been taken from following sources.

<Table 4> Key information and data used to determine the baseline scenario

Parameter	Value	Source
$EG_{m,y}$ **(MWh)** is the electricity delivered to the grid by source *m*.	Refer to <Table Annex-3>	Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO)
$FC_{i,m,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *m* in year(s) *y*, *m* refers to the power sources delivering electricity to the grid, not including low-operating cost and must-run power plants, and including imports to the grid	Refer to <Table Annex-1>	Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO)

Parameter	Value	Source
Net Calorific Values by Power Plant	Refer to <Table Annex-2>	Caloric value sourced from Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO) (net caloric value = Caloric value× net caloric value conversion factor)
Net Caloric Values Conversion Factor	Solid/Liquid fuel : 0.95 Gaseous fuel : 0.90	2006 IPCC Guidelines for National Greenhouse Gas Inventories
Fuels CO_2 Emission Factor ($EF_{CO2,i,i}$)	Refer to <Table Annex-5>	2006 IPCC Guidelines for National Greenhouse Gas Inventories 1.23
$EF_{grid,OM\ y}$ Operating Margin Emissions Factor (in ton CO_2/MWh) 2005~2007	0.6817	Calculated
$EF_{grid,BM,\ y}$ Build Margin Emissions Factor (in ton CO_2/MWh)	0.3933	Calculated
$EF_{grid,CM,y}$ Baseline Emissions Factor (in ton CO_2/MWh)	0.6096	Calculated

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 small-scale CDM project activity:

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The additionality on investment barrier

To prove additionality of the project, attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities was referred. According to attachment A to Appendix B of the simplified modalities and procedures for small-scale CDM project activities, project participants shall provide and explanation to show that the project activity would not have occurred anyway due to at least one of barriers such as investment barrier, technological barrier, barrier due to prevailing practice or other barriers.

The biggest barrier of the project is investment barrier because proposed wind power project requires high investment cost, but expectation of capital return is low. Due to these reasons, these wind power plants are not attractive alternative as power generation. It can be explained by calculating IRR (Internal Rate of Return). IRR is the discount rate which makes that present value of income flow and present value of cost flow same.

Benchmark rate of this project has applied **7.7%** based on the interest rate on the loan for this project.

Detail financial parameter and project IRRs of the Shinan wind power plant has described in the below tables.

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<Table 5> Investment analysis data

Content	Value	Remark
Total Investment Cost (Million won)	6,950	Shinan wind farm construction Investment cost list
Electricity supplied by the project activity to grid (MWh/year)	6,400	Feasibility Study Report of Shinan wind power
Unit price of electricity sales (won/KWh)	106.10	Electric Power Statistics Information System (www.kpx.or.kr/epsis): average in Jan~Jul 2008
Operation & Maintenance Cost (Million won/yr)	153	2.2% < The report published by the Ministry of Knowledge Economy, 2006. 3>
Corporation tax (Million won/yr)	33	Corporation tax Act. - if the taxable standard price is less than hundred million: 13%, exceed hundred million: 13million won + surplus × 25%
Estimated life time (year)	20	

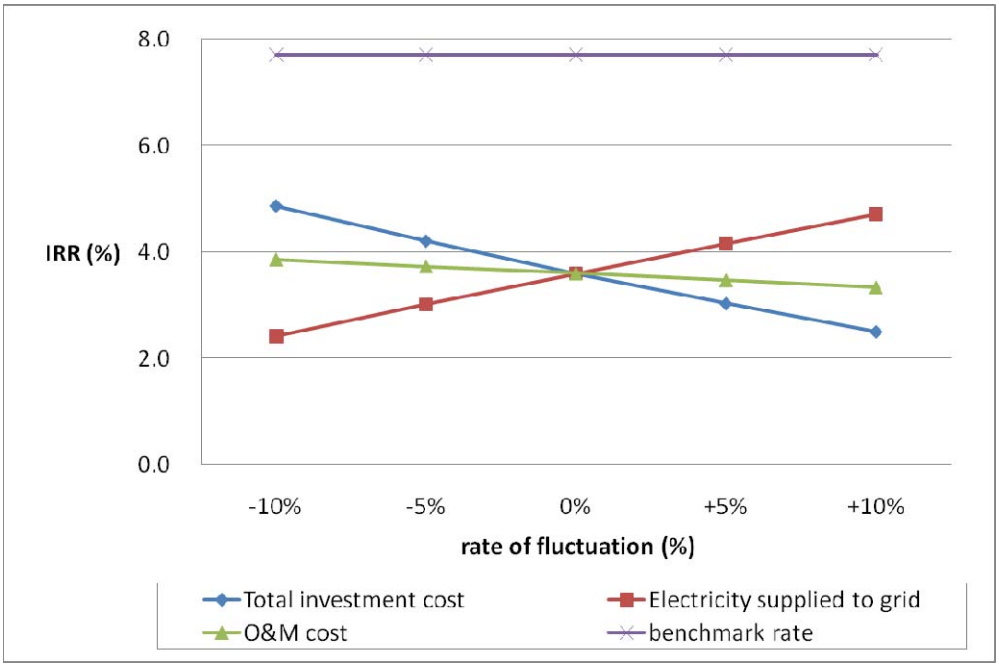
According to the result of investment analysis, IRR of the project is **3.60%** which is lower than 7. 7%, benchmark rate. Therefore this project cannot be considered financially attractive as well.

Also sensitivity analysis of three major uncertain elements is performed have range of -10% to +10%. Three major uncertain elements are total investment cost, electricity supplied to grid and O&M cost. According to the result of sensitivity analysis, project IRR is still lower than benchmark rate.

Project IRR considering CERs benefit is **5.10%** which has increased 1.50% compared with the base case IRR, 3.60%. Therefore CERs benefit is one of the key factor to promote this project activity.

<Table 6> Sensitivity analysis

Contents	-10%	-5%	0%	+5%	+10%
	Fluctuation of IRR				
Total investment cost	4.87	4.21	3.60	3.03	2.51
Electricity supplied to grid	2.42	3.02	3.60	4.17	4.72
O&M cost	3.86	3.73	3.60	3.47	3.34



[Figure 3] Impacts of three major uncertain elements on IRR

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

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Calculation of Baseline Emission

Depending on "Tool to calculate the emission factor for an electricity system(Version 01.1)", baseline emissions should be obtained by the below equation (4)

$$BE_y = (EG_y - EG_{baseline}) \cdot EF_y \quad (4)$$

Where,

BE_y : Baseline emissions (in tCO_2)
EG_y : Electricity supplied by the project activity to the grid (in MWh)
$EG_{baselin e}$: Baseline electricity supplied to the grid in the case of modified or retrofit facilities (in MWh)
EF_y : Baseline emissions factor (in tCO_2/MWh)
y : Refers to a given year

However $EG_{baseline}$ is zero because there are no modified or retrofit facilities in this project. Therefore the baseline emissions (BE_y) can be calculated as follows;

$$BE_y = EG_y \cdot EF_y \quad (5)$$

The baseline emission factor (EF_y) calculations will be based on the "Tool to calculate the emission factor for an electricity system(Version01.1)".

$$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM\,y} + w_{BM} \cdot EF_{grid,BM,y} \quad (3)$$

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Where,

$EF_{grid,CM,y}$: Baseline emission factor (tCO_2/MWh)
w_{OM} : Operation Margin weight, which is 0.75 by default
w_{BM} : Build Margin weight, which is 0.25 by default
$EF_{grid,OM,y}$: Operational Margin emission factor (tCO_2/MWh)
$EF_{grid,BM,y}$: Build Margin emission factor (tCO_2/MWh)
Y : Refers to a given year

Operational Margin emission factor ($EF_{grid,OM,y}$) is obtained based on 'Simple OM method'. Build Margin emission factor ($EF_{grid,BM,y}$) is estimated as *Option* 1 ($EF_{BM,y}$ *ex-ante*).

The OM emission factors is calculated as follows,

$$EF_{grid,OMSimple,y} = \frac{\sum_{i,m} FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,j}}{\sum_{m} EG_{m,y}} \quad \textbf{(1)}$$

Where:

$EF_{grid,OMsimple,y}$ = Simple operating margin CO_2 emission factor in year y (tCO_2/MWh)
$FC_{i,m,y}$ = Amount of fossil fuel type i consumed by power plant/unit m in year y (mass or volume unit)
$NCV_{i,y}$ = Net calorific value (energy content) of fossil fuel type i in year y (GJ/mass or volume unit)
$EF_{CO2,i,y}$ = CO_2 emission factor of fossil fuel type i in year y (tCO_2/GJ)
$EG_{m,y}$ = Net electricity generated and delivered to the grid by power plant/unit m in year y (MWh)
m = All power plants/units serving the grid in year y except low-cost/must-run power plants/units
i = All fossil fuel types combusted in power plant/unit m in year y
y = Either the three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (ex ante option) or the applicable year during monitoring (ex post option), following the guidance on data vintage in step 2

The emission factor of Build margin is calculated using the following equation:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \cdot EF_{EL,m,y}}{\sum_{m} EG_{m,y}} \quad \textbf{(2)}$$

Where:

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

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Project Emissions

The project is a hydroelectric power project: it does not give rise to direct GHG emissions. Therefore, no formulae for calculation of direct emissions are provided here.

Leakage

GHGs emissions due to leakage are not estimated at this point of time from wind power generation.

Emission reduction

Project emission reduction can be estimated by following equation (6)

$$ER_y = BE_y - PE_y - L_y \quad (6)$$

Where
ER_y : The emission reductions by the project activity during a given year *y*
BE_y : Baseline emissions
PE_y : Project emissions
L_y : Emissions due to leakage

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

Data / Parameter:	EFy
Data unit:	tCO_2/MWh
Description:	CO_2 emissions intensity of the electricity displaced
Source of data used:	Calculated
Value applied:	0.6096 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value was calculated according to "Tool to calculate the emission factor for an electricity system (version 01.1)." Applied value was calculated by referring Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO) and Status of Generation facility (2008) (Korea Power Exchange).
Any comment:	-The same value will be applied during the first crediting period without updating. -For detail calculation method, refer to Annex 3.

Data / Parameter:	$EF_{OM, y}$
Data unit:	tCO_2/MWh
Description:	Operating Margin emission factor
Source of data used:	Calculated
Value applied:	0.6817 tCO_2/MWh
Justification of the choice of data or description of	This value was calculated according to "Tool to calculate the emission factor for an electricity system (version 01.1)." Applied value was calculated by referring Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO)

measurement methods and procedures actually applied :	and Status of Generation facility (2008) (Korea Power Exchange).
Any comment:	-This data will be calculated at the time of PDD submission and will not be changed during the first crediting period. - This value is ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period without update.

Data / Parameter:	$EF_{BM, y}$
Data unit:	tCO_2/MWh
Description:	Build Margin emission factor
Source of data used:	Calculated
Value of data	0.3933 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value was calculated according to "Tool to calculate the emission factor for an electricity system (version 01.1)." Applied value was calculated by referring Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO) and Status of Generation facility (2008) (Korea Power Exchange).
Any comment:	-This data will be calculated at the time of PDD submission and will not be changed during the first crediting period. - This value is ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period without update.

Data / Parameter:	$FC_{i,m,y}$
Data unit:	mass or volume unit
Description:	Amount of fossil fuel type i consumed by power plant / unit m in year y
Source of data used:	Statistics of electric power in KOREA (KEMCO)
Value of data	See the <Table Annex-1>
Justification of the choice of data or description of measurement methods and procedures actually applied :	Applied value was referred Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO).
Any comment:	- The same value will be applied during the first crediting period without updating.

Data / Parameter:	$NCV_{i,v}$
Data unit:	mass or volume unit
Description:	Amount of fossil fuel type i consumed by power plant / unit m in year y
Source of data used:	Statistics of electric power in KOREA (KEMCO)
Value of data	See the <Table Annex-2>
Justification of the	Applied value was referred Statistics of Electric Power in KOREA (2006, 2007,

choice of data or description of measurement methods and procedures actually applied :	2008) (KEPCO).
Any comment:	- $NCV_{i,v}$ is the $GCV_{i,v}$ multiplied the Net caloric values conversion factor. - $GCV_{i,v}$ value was referred Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO) and Net caloric values conversion factor was referred 2006 IPCC Guidelines for National Greenhouse Gas Inventories. - The same value will be applied during the first crediting period without updating.

Data / Parameter:	$EF_{CO2,i,y}$
Data unit:	tCO_2/TJ
Description:	CO_2 emission factor of fossil fuel type i in year y
Source of data used:	2006 IPCC Guidelines on National GHG Inventories
Value of data	See the <Table Annex-5>
Justification of the choice of data or description of measurement methods and procedures actually applied :	IPCC default values at the lower limit of the uncertainty at 95% confidence interval as provided in table 1.4 of Chpter1 of Vol.2(Energy)
Any comment:	- The same value will be applied during the first crediting period without updating.

The calculation of the OM and BM emission factors were submitted to DOE as an excel file. It's including following information:

- Information to clearly identify the plant
- The date of commissioning
- The fuel type(s) used
- The quantity of net electricity generation in the relevant year(s)
- The fuel consumption of each fuel type in the relevant year(s)
- Information of a low-cost/must-run plant

B.6.3 Ex-ante calculation of emission reductions:

>>

Baseline emission

The capacity of the project is 3MW and expected electricity supplied to the grid by the project is 6,400 MWh per year.

Baseline emission = electricity supplied to the grid by the project × emission coefficient

= 6,400MWh/yr × 0.6096tCO_2/MWh

= **3,901 tonCO_2/yr**

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Project emission

Project emission is zero

Ex-ante emission reduction

-Emission reduction = Baseline emission – Project emission
= 3,901 tonCO_2/yr – 0 tonCO_2/yr
= **3,901 tonCO_2/yr**

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

>>

Year	Estimation of project activity emissions (tCO_2e)	Estimation of baseline emissions (tCO_2e)	Estimation of leakage (tCO_2e)	Estimation of overall emission reductions (tCO_2e)
Jan 2009~Dec 2009	0	3,901	0	3,901
Jan 2010~Dec 2010	0	3,901	0	3,901
Jan 2011~Dec 2011	0	3,901	0	3,901
Jan 2012~Dec 2012	0	3,901	0	3,901
Jan 2013~Dec 2013	0	3,901	0	3,901
Jan 2014~Dec 2014	0	3,901	0	3,901
Jan 2015~Dec 2015	0	3,901	0	3,901
Total (tonnes of CO_2e)	**0**	**27,310**	**0**	**27,310**

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

B.7.1 Data and parameters monitored:

Data / Parameter:	EGy
Data unit:	MWh
Description:	Electricity supplied to the grid by the project
Source of data to be used:	Measured
Value of data	6,400MWh/yr
Description of measurement methods and procedures to be applied:	Read from watt-hour meter.
QA/QC procedures to be applied:	- Uncertainty of data is low - QA/QC procedure for this is planned. - The allowable error of data must be within ± 0.5%.
Any comment:	- Data will be measured hourly and recorded monthly. - Data will be kept for two years after the last issuance of CERs for this project activity.

	- Data will be aggregated weekly, monthly and yearly - Measured data will be double checked against receipt of sales - This data is electricity generated except electricity consumed in the plant and electricity imported for the project activity.

Quality control (QC) and quality assurance (QA) procedures

1. Monitoring equipment

1-1. Electricity measuring meters shall be set up transparently in accordance with "Law regarding measurement" and "Act on operation of electricity market" and shall be sealed after affirmation of Korea Power Exchange.
1-2. The meters shall be approved through the certified official process (the valid period for the authorized certification: 7 years.)
1-3. The meters shall be calibrated when they are installed, and re-calibrated every three years after installation regularly.

2. Measure & Archive

2-1. The amount of electricity transmitted to the grid shall be measured automatically by established meters. The measured data are simultaneously transferred to Hydroelectric Power Plant and Korea Power Exchange.
2-2. The measured amount of electricity shall be collected daily, weekly, and monthly and shall be archived in electronic way.
2-3. The collected data in article 2-2. shall be compared with those of Korea power Exchange.
2-4. If the two data compared in article 2-3. are different, the operation condition of electricity meters and other equipments shall be examined. In case meters are improperly operated, internal audits and correction procedure shall be implemented and be certified by the final decision-maker and Korea Power exchange.

3. Management of monitoring and electricity safety

3-1. The person in charge of monitoring and electricity safety shall attend the following courses three times per year.
- Course on 'Law regarding measurement'
- Course on 'Act on operation of electricity market
- Course on Electricity safety

3-2. In case of absence of the responsible person, the second responsible person shall be selected.
3-3. If the responsibility for monitoring and electricity safety is transferred to another person, it is needed to be approved by the final decision-maker.

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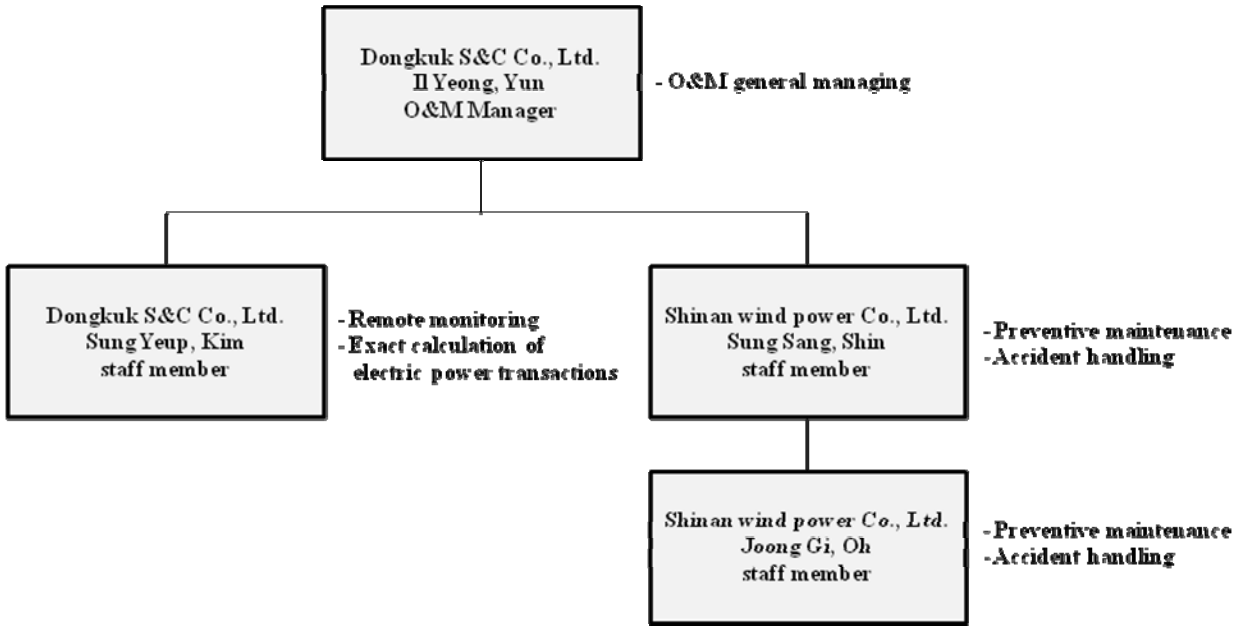
B.7.2 Description of the monitoring plan:

>>

Applied monitoring methodology for the project is AMS I.D. and electricity produced will be monitored. Also, related facility including watt-meter will be managed properly. Operational and management structure is as follow figure.



[Figure 4] The operational and management structure

When accident occurs, accident alarm will be sent to the personal mobile phone by internet phone service.

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

>>

- Date of completion of the application of the methodology
: 01/08/2008
- Responsible person/entity
: Dr. Jung, Jae-soo / Ecoeye Co., ltd

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:

>>

Starting date of this project is the date on the construction. Construction date of the project is 2008 Oct 7th.

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

>>

Expected operational lifetime of the project activity is 20years.

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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:

>>
01/01/2009

C.2.1.2. Length of the first crediting period:

>>
7years

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

>>

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

>>

According to the "Act on Assessment of Impacts of Works on Environment, Traffic, and Disasters, etc.", one of the laws in Korea, the proposed project activity does not need to environmental impact assessment.

If any power plant using solar, wind or fuel cell as a power source has the design capacity over than 100,000kW, the environmental impacts induced by such a plant have to be estimated, in accordance with the "Act on Assessment of Impacts of Works on Environment, Traffic, and Disasters, etc".

In this project case, the design capacity of generation is planned as just 3MW, which is much less amount than the lowest limit capacity, 100,000kW. Therefore, It is not necessary for this project to perform obligatory 'environmental impacts assessment (EIA)' in conformity with the legal restriction

Although this project didn't have duty to be conducted in general procedure of EIA, project participant has tried to anticipate the expected environmental impacts on the air pollution and noise harshness.

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:

>>

No fossil fuel is used to generate electricity. Only kinetic energy of wind is utilized for generation. Therefore there is no other emission source causing air pollution. Also there is no noise harshness from wind power generator because the roar of the sea offset the noise from wind power generator.

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SECTION E. Stakeholders' comments

>>

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

>>

Stakeholders of the project are local Residents, Jeollanam-do provincial government, Korean Power Exchange and Korean Electricity Power Corporation.

The process getting comments

1) The local press reports the proposed project

method	content	date
News release	 연합뉴스홈 | 블로그 | 축제장터 연합뉴스 검색 기사 신안 검색 상세검색 하기 통합검색 기사 사진 영상 그래픽 보도자료 인물 축제 기사검색 내용보기 | 인쇄 신안군 '천일염.풍력발전' 투자협약 체결 (신안=연합뉴스) 조근영 기자 = 전남 신안군이 천일염 사업 및 신 재생에너지 사업 투자 대상으로 각광 받고 있다. 신안군은 3일 오전 군청 회의실에서 박우량 군수 등이 참석한 가운데 동국 S&C, 솔섬식품㈜와 풍력발전, 천일염 유통 및 가공공장 건립을 위한 투자협약을 체결했다. 동국 S&C는 2천800억 원을 투입해 육상에 3MW, 해상에 90MW 규모의 풍력발전 단지를 연말과 2011년 각각 완공 예정으로 조만간 공사에 들어갈 예정이다. 솔섬식품㈜는 50억 원을 들여 신안 농수산물을 이용해 장류 및 젓갈류 가공공장을 2012년까지 건립할 계획이다. 이번 투자협약을 통해 풍력발전단지와 천일염 유통 및 가공공장에서 180억 원의 지방재정 확충과 100여 명의 고용 창출 효과가 기대된다고 군은 설명했다. 군은 총 발전량 93MW의 풍력발전 단지가 조성 될 경우 연간 21만 6천640MW의 전력이 생산돼 신안군 인구보다 많은 6만 1천950가구가 안심하고 전기를 쓸 수 있을 것으로 예상하고 있다. 박우량 신안군수는 "신안지역은 일조량이 풍부해 태양광을 이용한 염전이 발달, 전국 최대의 갯벌 천일염의 65.1%를 생산하고 있고 사면이 바다와 인접해 전국에서 풍력발전을 할 수 있는 몇 안 되는 지역으로 각광 받고 있다"고 밝혔다. chogy@yna.co.kr (끝) <저작권자(c)연합뉴스, 무단전재-재배포금지.> [2008-06-03 10:18 송고] Title: Shinan-Gun conclude agreement on investment in wind power plants Content: Dongkuk S&C Co., Ltd. has 3MW wind power plant construction plan in Shinan-Gun. It will be completed by end of the year. Source: YonhapNews, http://www.yonhapnews.co.kr/	03 Jun 2008

method	content	date
News release	ENERGY & ENVIRONMENT E2NEWS 로그인 회원가입 ID/PW 찾기 실시간뉴스 · 산 업 · 정 책 · 기 업 · 이투기획 · 고객센터 기사검색 에너지정책 | R&D | 신재생 | 금융 | 해외자원개발 | 에너지 절약 정 책 에너지정책 R&D 신재생 금융 해외자원개발 에너지 절약 신재생 기사보내기 프린트 기사목록 신안군 비금도에 3MW 규모 풍력발전소 건립 동국S&C, 연내준공 목표 착공 준비…서남해안 관광명소 탄생할 듯 이상복 기자 (lsb@e2news.com) [2008-09-01 09:30] 윈드타워(Wind Tower) 1위 업체인 동국S&C(동국산업 자회사)가 연내 준공을 목표로 전남 신안군 비금도에 1MW급 풍력발전기 3기를 건립할 예정인 것으로 밝혀졌다. 서남해안 도서지역에 풍력발전소가 세워지는 것은 이번이 처음으로, 발전소가 준공되면 현지의 풍부한 관광자원과 더불어 지역명소로 발돋움할 전망이다. 31일 신안군과 업계 관계자들에 따르면 이 회사는 비금면 명사십리 해수욕장(원평해수욕장) 인근에 모두 3MW 용량의 풍력발전기를 세우기로 하고 현재 착공 이전의 기초작업을 벌이고 있다. 발전단지 예정 부지는 목포시 크기에 육박하는 섬으로 알려진 비금도로, 이미 송전탑을 통해 육상의 전력이 공급되고 있어 계통연계에 문제가 없는 것으로 전해졌다. 익명을 요구한 관계자는 "인근 안좌변전소와 연결된 2만2900V의 계통에 계통이 연결될 것으로 알고 있다"며 "제주나 강원도처럼 풍질이 훌륭하지는 않지만 사업성은 충분한 것으로 판단된다"고 말했다. 이번 사업과 관련, 해당 지자체와 사업자 측은 매우 조심스런 반응을 보이고 있다. 2년전 인근 지역에서 추진됐던 사업이 주민 반대로 무산된 경험이 있기 때문이다. 신안군 관계자는 "발전소 조성 계획은 인지하고 있지만 군 차원에서 구체적 내용을 밝히는 것은 조심스럽다"고 말했고, 동국S&C 측은 "관광자원화에 따른 경제적 효과를 지역사회가 이해했으면 좋겠다"고 밝혔다. 한편 이번 사업에는 일본 미쓰미씨중공업의 기어드형 발전기가 공급될 것으로 알려졌지만 해당사 측은 확인을 거부했다. 비금도는 목포에서 서쪽으로 약 54Km 떨어진 곳에 위치해 있으며 '섬 모양이 큰 새가 날아가는 것 같다'고 하여 비금도(飛禽島)라는 현재의 지명이 붙었다. 인구는 약 4800여명이며 농업과 어업, 관광업에 종사하고 있다.  안내도 중앙 좌측에 3기의 풍력발전기가 들어서는 비금면 원평해수욕장이 있다. (그림-신안군) E2 ISSUE 주유소 판매가 실시, 정유업계… 국가 표준 개발, 대세는 민간… "지역냉방에 가스냉방 수준의… 수소연료전지 지속가능성 '딜… 불황속 美 백수 속출, "그린 컬… 지난시리즈특집 - 연중캠페인 - 글로벌마켓 - 유가전망 - 2006 국정감사 - 2006 에너지 전시회 - 에너지효율 향상 제언 Title: Foundation of 3MW wind power plant at Bigeum-myeon. Shinan-Gun Content: Dongkuk S&C Co., Ltd., one of the first wind tower companies, has 3units of 1MW wind power generator construction plan in Shinan-Gun. It will be completed by end of the year. It is the first wind power plants construction in islands off the southwest coast. After completed it will be a tourist attraction. Source: E2NEWS, http://www.e2news.com/	01 Sep 2008

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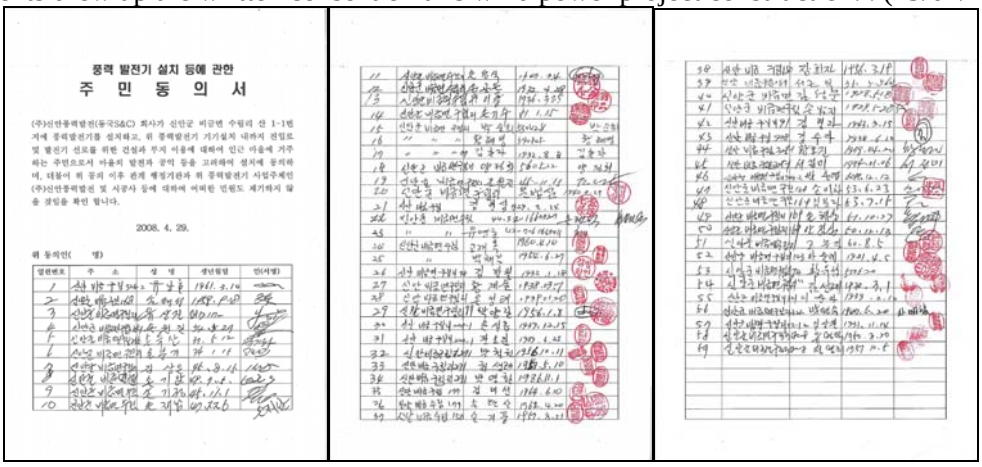
2) Written consent by local residents

Local residents drew up the written consent on this wind power project construction. . (29/04/2008)


풍력 발전기 설치 등에 관한
주 민 동 의 서

2008. 4. 29.

[Figure 5] written consent on this wind power project construction

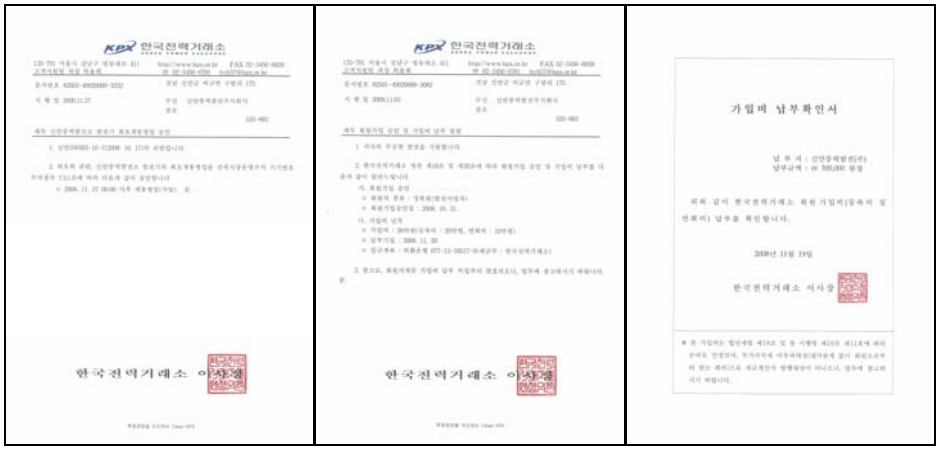
3) Request for permission relative to this project

The organizations like a Jeollanam-do provincial government, Korean Power Exchange and Korean Electricity Power Corporation issue the permission when project participant satisfied their terms.

E.2. Summary of the comments received:

>>

stakeholder	How to invite and compile comments
Local Residents	There is no special comment.
Jeollanam-do provincial government	There is no special comment. And the permit of the Electricity Enterprise was issued. 

Korean Power Exchange	There is no special comment. And they approval PP can “synchronizing”. 
Korean Electricity Power Corporation	There is no special comment. And they accept PP using the distribution equipment. 

* We submitted above documents to DOE.

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

>>

There are no special comments.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Shinan wind power Co., Ltd.
Street/P.O.Box:	175, Gulim-ri
Building:	
City:	Bigum-myeon, Shinan-gun
State/Region:	Jeollanam-do
Postfix/ZIP:	535-883
Country:	The Republic of Korea
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding invested for this project.

Annex 3

BASELINE INFORMATION

<Table Annex-1> Data on fuel consumption for plants in the Operating Margin

Year	Plant		Amount of fossil fuel($FC_{i,m,y}$)			
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)
2005	Honam	#1	870,214	961	278	-
		#2	912,497	338	185	-
	Samchonpo	#1	1,534,223	-	1,220	-
		#2	1,731,265	-	626	-
		#3	1,723,152	-	377	-
		#4	1,632,334	-	1,029	-
		#5	1,516,654	-	1,415	-
		#6	1,546,663	-	1,001	-
	Yonghung	#1	2,081,972	-	4,541	-
		#2	1,761,395	-	2,903	-
	Boryeong	#1	1,440,343	-	761	-
		#2	1,388,532	-	551	-
		#3	1,589,150	-	90	-
		#4	1,421,343	-	603	-
		#5	1,587,999	-	156	-
		#6	1,260,305	-	627	-
	Taean	#1	1,508,570	-	621	-
		#2	1,323,078	-	395	-
		#3	1,494,175	-	650	-
		#4	1,383,297	-	365	-
		#5	1,411,398	-	742	-
		#5	1,504,962	-	417	-
	Hadong	#1	1,513,930	-	284	-
		#2	1,410,099	-	792	-
		#3	1,422,196	-	472	-
		#4	1,511,054	-	567	-
		#5	1,345,648	-	614	-
		#6	1,520,774	-	331	-
	Dangjin	#1	1,438,702	-	637	-
		#2	1,437,473	-	632	-
		#3	1,549,041	-	141	-
		#4	1,544,010	-	134	-
		#5	499,714	-	5,701	-

Year	Plant		Amount of fossil fuel($FC_{i,m,y}$)			
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)
		#6	38,671	-	1,779	-
	Ulsan	#1	-	70,183	750	-
		#2	-	67,296	585	-
		#3	-	53,085	662	-
		#4	-	375,417	1,971	-
		#5	-	363,992	1,676	-
		#6	-	352,776	1,708	-
	Youngnam	#1	-	359,910	844	-
		#2	-	190,085	584	-
	Yosu	#1	-	106,919	434	-
		#2	-	218,356	346	-
	Pyongtaek	#1	-	293,214	118	3,553
		#2	-	321,188	140	2,641
		#3	-	308,042	132	1,784
		#4	-	311,245	138	2,047
	Namjeju	#1	-	14,628	15	-
		#2	-	15,031	12	-
	Jeju	#1	-	12,564	12	-
		#2	-	129,516	-	-
		#3	-	122,866	48	-
	Seoul	#4	-	-	-	49,143
		#5	-	-	1	108,761
	Incheon	#1	-	-	-	4,365
		#2	-	-	-	8,505
		#3	-	-	372	746
		#4	-	-	400	6,620
	Pyongtaek C/C	C/C	-	-	1	110,953
	Ilsan	C/C	-	-	-	533,188
	Bundang	C/C	-	-	-	671,944
	Ulsan	C/C	-	-	-	470,131
	Seoincheon	C/C	-	-	335	989,645
	Shinincheon	C/C	-	-	-	1,458,763
	Boryeong	C/C	-	-	-	1,161,510
	Incheon	C/C	-	-	-	281,813
	Busan	C/C	-	-	-	1,211,144
	Hallim	C/C	-	-	29,686	-
	Anyang	C/C	-	-	-	261,202

Year	Plant		Amount of fossil fuel($FC_{i,m,y}$)			
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)
	Bucheon	C/C	-	-	-	261,705
	POSCO POWER	C/C	-	-	-	445,253
	G S Bugog	C/C	-	-	-	297,976
	Yulchon	C/C	-	-	159	194,534
	Namjeju	D/P	-	56,727	37	-
	Jeju	G/T	-	-	2,869	-
	Jeju	D/P	-	31,808	72	-
2006	Honam	#1	781,139	1,113	279	
		#2	859,736	1,251	359	
	Samchonpo	#1	1,696,271		860	
		#2	1,508,082		1,362	
		#3	1,519,385		457	
		#4	1,521,263		1,818	
		#5	1,665,339		977	
		#6	1,770,348		428	
	Yonghung	#1	2,004,193		2,548	
		#2	2,129,118		2,545	
	Boryeong	#1	1,638,140		306	
		#2	1,389,425		1,137	
		#3	1,323,779		514	
		#4	1,610,928		82	
		#5	1,296,455		541	
		#6	1,553,273		518	
	Taean	#1	1,354,832		514	
		#2	1,532,209		162	
		#3	1,338,967		575	
		#4	1,548,909		133	
		#5	1,542,775		544	
		#6	1,294,577		1,113	
		#7	61,910		4,799	
	Hadong	#1	1,373,049		515	
		#2	1,543,074		293	
		#3	1,549,094		153	
		#4	1,376,612		796	
		#5	1,554,524		242	
		#6	1,371,801		690	
	Dangjin	#1	1,380,527		966	

Year	Plant		Amount of fossil fuel($FC_{i,m,y}$)			
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)
		#2	1,570,077		161	
		#3	1,402,916		433	
		#4	1,386,317		1,549	
		#5	1,456,458		745	
		#6	1,216,582		3,051	
		#7	1,008		505	
	Ulsan	#1		72,243	605	
		#2		80,187	469	
		#3		96,459	518	
		#4		360,919	3,729	
		#5		375,985	3,678	
		#6		378,331	3,694	
	Youngnam	#1		107,090	1,016	
		#2		95,127	1,494	
	Yosu	#1		99,129	281	
		#2		215,957	291	
	Pyongtaek	#1		261,458	141	3,997
		#2		277,025	166	5,687
		#3		303,858	134	3,891
		#4		245,602	103	3,473
	Namjeju	#1		11,406	17	
		#2		9,772	14	
		#3		46,504	2,509	
	Jeju	#1		8,603	23	
		#2		113,679	64	
		#3		117,464	67	
	Seoul	#4			1	69,383
		#5			1	152,891
	Incheon	#1				6,945
		#2				5,223
		#3			311	15,426
		#4			311	12,454
	Pyongtaek C/C	C/C			45	84,054
	Ilsan	C/C			1,384	556,504
	Bundang	C/C				720,381
	Ulsan	C/C				536,196
	Seoincheon	C/C			1,066	1,199,196

Year	Plant		Amount of fossil fuel($FC_{i,m,y}$)			
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)
	Shinincheon	C/C				1,641,038
	Boryeong	C/C				998,683
	Incheon	C/C				484,606
	Busan	C/C				1,396,417
	Hallim	C/C			48,475	
	Anyang	C/C				230,969
	Bucheon	C/C			215	225,713
	POSCO POWER	C/C				408,018
	G S Bugog	C/C				389,811
	Yulchon	C/C				315,132
	Namjeju	D/P		51,347	111	
	Jeju	G/T			8,264	
	Jeju	D/P		52,907		
2007	Honam	#1	866,853	889	281	
		#2	846,931	811	262	
	Samchonpo	#1	1,631,706		296	
		#2	1,804,695		384	
		#3	1,755,374		434	
		#4	1,543,140		677	
		#5	1,850,764		315	
		#6	1,714,320		619	
	Yonghung	#1	1,902,557		3,320	
		#2	2,296,289		1,779	
		#3	119,883		3,964	
		#4				
	Boryeong	#1	1,466,761		811	
		#2	1,655,488		169	
		#3	1,648,008		187	
		#4	1,347,303		646	
		#5	1,629,904		195	
		#6	1,490,809		387	
	Taean	#1	1,524,391		410	
		#2	1,434,221		374	
		#3	1,521,349		350	
		#4	1,320,380		422	
		#5	1,342,358		676	
		#6	1,535,931		491	

Year	Plant		Amount of fossil fuel($FC_{i,m,y}$)			
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)
		#7	1,430,171		2,321	
		#8	919,055		3,636	
	Hadong	#1	1,582,726		178	
		#2	1,396,830		637	
		#3	1,424,033		375	
		#4	1,572,409		292	
		#5	1,486,776		452	
		#6	1,585,307		109	
	Dangjin	#1	1,512,904		269	
		#2	1,358,316		543	
		#3	1,516,065		119	
		#4	1,519,231		342	
		#5	1,279,796		1,038	
		#6	1,281,318		878	
		#7	1,059,612		6,681	
		#8	467,807		4,873	
	Ulsan	#1		107,844	406	
		#2		108,381	483	
		#3		120,571	576	
		#4		341,170	3,525	
		#5		370,712	4,711	
		#6		216,409	3,021	
	Youngnam	#1		174,082	1,232	
		#2		122,249	796	
	Yosu	#1		121,572	332	
		#2		257,420	367	
	Pyongtaek	#1		269,284	114	3,316
		#2		359,870	140	6,339
		#3		349,481	157	4,874
		#4		255,443	117	4,047
	Namjeju	#1				
		#2				
		#3		124,559	225	
		#4		127,900	341	
	Jeju	#1		1,049	4	
		#2		70,122	112	
		#3		98,846	34	

Year	Plant		Amount of fossil fuel($FC_{i,m,y}$)			
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)
	Seoul	#4			1	75,080
		#5			1	206,908
	Incheon	#1				30,402
		#2				31,528
		#3			354	41,270
		#4			201	18,892
	Pyongtaek C/C	C/C			67	151,414
	Ilsan	C/C				635,260
	Bundang	C/C			3	660,899
	Ulsan	C/C				649,494
	Seoincheon	C/C				1,495,687
	Shinincheon	C/C				1,761,001
	Boryeong	C/C				1,121,251
	Incheon	C/C				494,690
	Busan	C/C				1,552,997
	Hallim	C/C			17,753	
	Anyang	C/C				289,384
	Bucheon	C/C				269,651
	POSCO POWER	C/C				660,445
	G S Bugog	C/C				371,586
	Yulchon	C/C				292,336
	Namjeju	D/P		35,297	238	
	Jeju	G/T			850	
	Jeju	D/P		49,613		

Source: Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO)

<Table Annex-2> Net Caloric Value

year	Plant		Net Caloric value($NCV_{i,y}$)			
			Coal (kcal/kg)	**Heavy oil (kcal/l)**	**Diesel oil (kcal/l)**	**L. N. G (kcal/kg)**
2005	Honam	#1	5,122	9,343	8,368	
		#2	5,107	9,362	8,364	
	Samchonpo	#1	5,618		8,399	
		#2	5,628		8,439	
		#3	5,602		8,550	
		#4	5,603		8,496	
		#5	5,079		8,183	
		#6	5,107		8,550	
	Yonghung	#1	5,824		8,488	
		#2	5,750		8,500	
	Boryeong	#1	5,539		8,496	
		#2	5,525		8,496	
		#3	5,588		8,303	
		#4	5,596		8,311	
		#5	5,588		8,312	
		#6	5,606		8,312	
	Taean	#1	5,700		8,257	
		#2	5,708		8,249	
		#3	5,707		8,242	
		#4	5,699		8,270	
		#5	5,730		8,242	
		#5	5,716		8,256	
	Hadong	#1	5,703		8,493	
		#2	5,697		8,481	
		#3	5,698		8,533	
		#4	5,699		8,491	
		#5	5,695		8,526	
		#6	5,695		8,481	
	Dangjin	#1	5,664		8,392	
		#2	5,664		8,469	
		#3	5,638		8,402	
		#4	5,644		8,387	
		#5	5,809		8,458	
		#6	5,910		10,540	
	Ulsan	#1		9,405	8,660	
		#2		9,408	8,657	
		#3		9,413	8,663	
		#4		9,501	8,666	
		#5		9,494	8,666	
		#6		9,480	8,662	
	Youngnam	#1		7,108	8,495	
		#2		7,342	8,496	
	Yosu	#1		9,462	8,442	

year	Plant		Net Caloric value($NCV_{i,y}$)			
			Coal (kcal/kg)	**Heavy oil (kcal/l)**	**Diesel oil (kcal/l)**	**L. N. G (kcal/kg)**
		#2		9,447	8,441	
	Pyongtaek	#1		9,407	8,496	11,608
		#2		9,409	8,513	11,585
		#3		9,412	8,502	11,647
		#4		9,413	8,502	11,604
	Namjeju	#1		9,384	8,853	
		#2		9,385	8,842	
	Jeju	#1		9,435	8,441	
		#2		9,433		
		#3		9,429	8,491	
	Seoul	#4				11,702
		#5			8,617	11,707
	Incheon	#1				11,729
		#2				11,723
		#3			8,516	11,727
		#4			8,506	11,723
	Pyongtaek C/C	C/C			8,503	11,727
	Ilsan	C/C				11,710
	Bundang	C/C				11,723
	Ulsan	C/C				11,475
	Seoincheon	C/C			8,740	11,709
	Shinincheon	C/C				11,712
	Boryeong	C/C				11,727
	Incheon	C/C				11,711
	Busan	C/C				11,700
	Hallim	C/C			8,524	
	Anyang	C/C				11,723
	Bucheon	C/C				11,702
	POSCO POWER	C/C				11,721
	G S Bugog	C/C				12,381
	Yulchon	C/C			10,384	11,721
	Namjeju	D/P		9,383	8,526	
	Jeju	G/T			8,473	
	Jeju	D/P		9,435	8,506	
2006	Honam	#1	5,164	9,318	8,472	
		#2	5,137	9,332	8,426	
	Samchonpo	#1	5,640		8,373	
		#2	5,645		8,373	
		#3	5,565		8,373	
		#4	5,568		8,363	
		#5	4,974		8,550	
		#6	4,993		8,550	
	Yonghung	#1	5,768		8,447	

year	Plant		Net Caloric value($NCV_{i,y}$)			
			Coal (kcal/kg)	**Heavy oil (kcal/l)**	**Diesel oil (kcal/l)**	**L. N. G (kcal/kg)**
		#2	5,782		8,454	
	Boryeong	#1	5,479		8,412	
		#2	5,478		8,496	
		#3	5,552		8,496	
		#4	5,533		8,496	
		#5	5,552		8,312	
		#6	5,542		8,312	
	Taean	#1	5,683		8,312	
		#2	5,679		7,952	
		#3	5,684		8,216	
		#4	5,680		8,232	
		#5	5,638		8,232	
		#6	5,662		8,232	
		#7	5,667		8,130	
	Hadong	#1	5,670		8,396	
		#2	5,662		8,482	
		#3	5,660		8,481	
		#4	5,671		8,384	
		#5	5,665		8,466	
		#6	5,669		8,456	
	Dangjin	#1	5,588		8,526	
		#2	5,611		8,529	
		#3	5,592		8,556	
		#4	5,581		8,564	
		#5	5,743		8,507	
		#6	5,814		8,450	
		#7	5,527		8,535	
	Ulsan	#1		9,419	8,664	
		#2		9,427	8,664	
		#3		9,423	8,664	
		#4		9,529	8,664	
		#5		9,531	8,664	
		#6		9,533	8,664	
	Youngnam	#1		9,631	8,403	
		#2		9,605	8,419	
	Yosu	#1		9,465	8,358	
		#2		9,456	8,356	
	Pyongtaek	#1		9,222	8,496	11,647
		#2		9,233	8,496	11,647
		#3		9,260	8,501	11,573
		#4		9,208	8,501	11,667
	Namjeju	#1		9,413	8,525	
		#2		9,412	8,504	

year	Plant		Net Caloric value($NCV_{i,y}$)			
			Coal (kcal/kg)	**Heavy oil (kcal/l)**	**Diesel oil (kcal/l)**	**L. N. G (kcal/kg)**
		#3		9,403	8,491	
	Jeju	#1		9,377	8,429	
		#2		9,454	8,524	
		#3		9,455	8,524	
	Seoul	#4			8,617	11,716
		#5			8,617	11,594
	Incheon	#1				11,733
		#2				11,725
		#3			8,533	11,716
		#4			8,532	11,722
	Pyongtaek C/C	C/C			8,503	11,727
	Ilsan	C/C			8,540	11,715
	Bundang	C/C				11,723
	Ulsan	C/C				11,381
	Seoincheon	C/C			8,740	11,723
	Shinincheon	C/C				11,723
	Boryeong	C/C				11,730
	Incheon	C/C				11,698
	Busan	C/C				11,716
	Hallim	C/C			8,506	
	Anyang	C/C				11,726
	Bucheon	C/C			10,381	11,711
	POSCO POWER	C/C				11,728
	G S Bugog	C/C				11,727
	Yulchon	C/C				12,039
	Namjeju	D/P		9,734	8,462	
	Jeju	G/T			8,352	
	Jeju	D/P		9,136		
2007	Honam	#1	5,186	9,311	8,497	
		#2	5,190	9,311	8,493	
	Samchonpo	#1	5,545		8,373	
		#2	5,537		8,373	
		#3	5,525		8,349	
		#4	5,540		8,349	
		#5	4,865		8,550	
		#6	4,864		8,550	
	Yonghung	#1	5,745		8,391	
		#2	5,739		8,457	
		#3	5,822		7,878	
		#4				
	Boryeong	#1	5,519		8,496	
		#2	5,515		8,496	

year	Plant		Net Caloric value($NCV_{i,y}$)			
			Coal (kcal/kg)	**Heavy oil (kcal/l)**	**Diesel oil (kcal/l)**	**L. N. G (kcal/kg)**
		#3	5,518		8,655	
		#4	5,513		8,944	
		#5	5,520		8,655	
		#6	5,518		8,655	
	Taean	#1	5,733		8,174	
		#2	5,733		8,387	
		#3	5,734		8,388	
		#4	5,727		7,963	
		#5	5,686		8,361	
		#6	5,695		8,347	
		#7	5,717		8,044	
		#8	5,722		7,256	
	Hadong	#1	5,647		8,492	
		#2	5,645		8,456	
		#3	5,627		8,469	
		#4	5,639		8,519	
		#5	5,652		8,492	
		#6	5,640		8,495	
	Dangjin	#1	5,660		8,610	
		#2	5,663		8,606	
		#3	5,657		8,617	
		#4	5,659		8,635	
		#5	5,713		8,620	
		#6	5,737		8,613	
		#7	5,725		8,621	
		#8	5,742		8,596	
	Ulsan	#1		9,413	8,664	
		#2		9,420	8,664	
		#3		9,360	8,664	
		#4		9,508	8,664	
		#5		9,511	8,664	
		#6		9,502	8,664	
	Youngnam	#1		9,643	8,402	
		#2		9,643	8,403	
	Yosu	#1		9,464	8,368	
		#2		9,462	8,370	
	Pyongtaek	#1		9,445	8,534	11,650
		#2		9,448	8,530	11,653
		#3		9,447	8,518	11,650
		#4		9,460	8,517	11,651
	Namjeju	#1				
		#2				
		#3		9,411	8,201	

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year	Plant		Net Caloric value($NCV_{i,y}$)			
			Coal (kcal/kg)	**Heavy oil (kcal/l)**	**Diesel oil (kcal/l)**	**L. N. G (kcal/kg)**
		#4		9,410	8,515	
	Jeju	#1		9,412	8,458	
		#2		9,420	7,906	
		#3		9,419	8,490	
	Seoul	#4			7,411	11,727
		#5			8,617	11,727
	Incheon	#1				11,727
		#2				11,730
		#3			8,514	11,730
		#4			8,483	11,730
	Bundang fuel cell					11,673
	Pyongtaek C/C	C/C			8,503	11,739
	Ilsan	C/C				11,725
	Bundang	C/C			8,716	11,728
	Ulsan	C/C				11,610
	Seoincheon	C/C				11,739
	Shinincheon	C/C				11,735
	Boryeong	C/C				11,735
	Incheon	C/C				11,726
	Busan	C/C				11,727
	Hallim	C/C			8,533	
	Anyang	C/C				11,741
	Bucheon	C/C				11,898
	POSCO POWER	C/C				11,756
	G S Bugog	C/C				11,734
	Yulchon	C/C				11,732
	Kwangyang	C/C				-
	Namjeju	D/P		9,419	8,323	
	Jeju	G/T			8,447	
	Jeju	D/P		9,396		

Source: Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO)

<Table Annex-3> Electricity delivered to the grid by power plants ($EG_{m,y}$) and *EF* for each plant

Year	Plant		Net electricity generated $EG_{m,y}$ (MWh)	EF for each plant ($tonCO_2/MWh$)
2005	Honam	#1	1,787,715	0.9363
		#2	1,875,790	0.9318
	Samchonpo	#1	3,810,079	0.8484
		#2	4,323,618	0.8448
		#3	4,343,666	0.8330
		#4	4,112,297	0.8341
		#5	3,542,728	0.8158
		#6	3,643,969	0.8130
	Yonghung	#1	5,623,299	0.8101
		#2	4,658,862	0.8163
	Boryeong	#1	3,547,140	0.8433
		#2	3,433,608	0.8377
		#3	4,124,745	0.8068
		#4	3,698,705	0.8061
		#5	4,121,314	0.8069
		#6	3,283,477	0.8068
	Taean	#1	3,992,112	0.8075
		#2	3,484,251	0.8126
		#3	3,957,054	0.8079
		#4	3,653,534	0.8088
		#5	3,744,413	0.8099
		#5	3,999,847	0.8062
	Hadong	#1	3,997,914	0.8094
		#2	3,732,583	0.8070
		#3	3,769,077	0.8060
		#4	3,989,315	0.8092
		#5	3,553,901	0.8085
		#6	4,037,763	0.8040
	Dangjin	#1	3,797,307	0.8045
		#2	3,798,078	0.8037
		#3	4,081,017	0.8020
		#4	4,079,557	0.8005
		#5	1,318,670	0.8360
		#6	96,365	0.9478
	Ulsan	#1	262,393	0.8027
		#2	255,812	0.7883
		#3	200,518	0.7964

Year	Plant		Net electricity generated	EF for each plant
			$EG_{m,y}$ (MWh)	($tonCO_2$/MWh)
		#4	1,549,091	0.7312
		#5	1,500,935	0.7307
		#6	1,454,644	0.7299
	Youngnam	#1	1,022,470	0.7931
		#2	531,006	0.8337
	Yosu	#1	430,310	0.7458
		#2	904,597	0.7218
	Pyongtaek	#1	1,258,662	0.7004
		#2	1,376,342	0.6994
		#3	1,321,167	0.6975
		#4	1,338,204	0.6964
	Namjeju	#1	44,602	0.9738
		#2	44,654	0.9994
	Jeju	#1	36,266	1.0341
		#2	532,700	0.7249
		#3	502,189	0.7294
	Seoul	#4	207,498	0.6301
		#5	444,324	0.6515
	Incheon	#1	16,450	0.7075
		#2	37,727	0.6008
		#3	-	-
		#4	29,202	0.6396
	Pyongtaek C/C	C/C	659,932	0.4482
	Ilsan	C/C	2,873,958	0.4939
	Bundang	C/C	3,742,073	0.4785
	Ulsan	C/C	3,131,075	0.3917
	Seoincheon	C/C	7,001,031	0.3764
	Shinincheon	C/C	10,543,280	0.3684
	Boryeong	C/C	8,221,926	0.3766
	Incheon	C/C	2,055,016	0.3651
	Busan	C/C	9,076,327	0.3549
	Hallim	C/C	100,346	0.7665
	Anyang	C/C	1,433,901	0.4854
	Bucheon	C/C	1,404,160	0.4959
	POSCO POWER	C/C	2,571,095	0.4615
	G S Bugog	C/C	2,189,808	0.3830
	Yulchon	C/C	1,300,627	0.3989
	Namjeju	D/P	268,073	0.6280

Year	Plant		Net electricity generated	EF for each plant
			$EG_{m,y}$ (MWh)	($tonCO_2$/MWh)
	Jeju	G/T	5,069	1.4577
	Jeju	D/P	151,759	-
2006	Honam	#1	1,622,639	0.9340
		#2	1,782,016	0.9313
	Samchonpo	#1	4,161,219	0.8620
		#2	3,703,880	0.8622
		#3	3,779,585	0.8387
		#4	3,816,997	0.8328
		#5	3,761,205	0.8259
		#6	4,065,091	0.8150
	Yonghung	#1	5,337,432	0.8129
		#2	5,727,937	0.8065
	Boryeong	#1	3,988,848	0.8434
		#2	3,423,101	0.8341
		#3	3,409,486	0.8082
		#4	4,133,946	0.8080
		#5	3,364,148	0.8022
		#6	3,987,488	0.8093
	Taean	#1	3,556,797	0.8116
		#2	4,035,753	0.8081
		#3	3,528,613	0.8086
		#4	4,069,820	0.8101
		#5	4,013,235	0.8125
		#6	3,381,867	0.8131
		#7	159,677	0.8976
	Hadong	#1	3,607,063	0.8092
		#2	4,068,036	0.8049
		#3	4,079,158	0.8056
		#4	3,631,374	0.8061
		#5	4,092,625	0.8065
		#6	3,610,222	0.8077
	Dangjin	#1	3,598,820	0.8040
		#2	4,115,891	0.8021
		#3	3,666,490	0.8020
		#4	3,610,984	0.8041
		#5	3,946,931	0.7947
		#6	3,392,395	0.7836
		#7	1,474	2.3058

Year	Plant		Net electricity generated	EF for each plant
			$EG_{m,y}$ (MWh)	($tonCO_2$/MWh)
	Ulsan	#1	275,016	0.7879
		#2	306,668	0.7832
		#3	376,132	0.7675
		#4	1,511,557	0.7257
		#5	1,583,846	0.7213
		#6	1,589,838	0.7232
	Youngnam	#1	359,205	0.9149
		#2	323,595	0.9043
	Yosu	#1	403,547	0.7367
		#2	906,849	0.7126
	Pyongtaek	#1	1,123,901	0.6879
		#2	1,198,620	0.6875
		#3	1,304,568	0.6899
		#4	1,052,228	0.6884
	Namjeju	#1	34,448	0.9864
		#2	28,686	1.0148
		#3	179,033	0.8082
	Jeju	#1	24,748	1.0328
		#2	462,023	0.7357
		#3	479,676	0.7323
	Seoul	#4	306,558	0.6028
		#5	685,011	0.5883
	Incheon	#1	32,932	0.5625
		#2	24,366	0.5714
		#3	78,669	0.5325
		#4	62,414	0.5446
	Pyongtaek C/C	C/C	497,441	0.4507
	Ilsan	C/C	3,038,165	0.4890
	Bundang	C/C	4,059,300	0.4730
	Ulsan	C/C	3,608,435	0.3845
	Seoincheon	C/C	8,726,521	0.3666
	Shinincheon	C/C	11,797,500	0.3707
	Boryeong	C/C	7,089,662	0.3757
	Incheon	C/C	3,648,288	0.3533
	Busan	C/C	10,455,401	0.3557
	Hallim	C/C	175,356	0.7147
	Anyang	C/C	1,286,480	0.4786
	Bucheon	C/C	1,241,795	0.4845

Year	Plant		Net electricity generated $EG_{m,y}$ (MWh)	EF for each plant ($tonCO_2$/MWh)
	POSCO POWER	C/C	2,338,128	0.4653
	G S Bugog	C/C	2,911,683	0.3569
	Yulchon	C/C	2,276,276	-
	Namjeju	D/P	239,690	0.6603
	Jeju	G/T	15,986	1.3123
	Jeju	D/P	252,764	0.6045
2007	Honam	#1	1,806,765	0.9343
		#2	1,773,852	0.9303
	Samchonpo	#1	3,903,591	0.8687
		#2	4,398,382	0.8515
		#3	4,311,704	0.8431
		#4	3,840,729	0.8345
		#5	4,074,103	0.8284
		#6	3,823,174	0.8177
	Yonghung	#1	5,020,901	0.8174
		#2	6,081,490	0.8128
		#3	320,502	0.8457
		#4		
	Boryeong	#1	3,604,642	0.8421
		#2	4,120,511	0.8303
		#3	4,214,892	0.8086
		#4	3,438,773	0.8099
		#5	4,162,530	0.8101
		#6	3,817,024	0.8078
	Taean	#1	4,055,394	0.8078
		#2	3,796,670	0.8118
		#3	4,039,811	0.8094
		#4	3,504,214	0.8089
		#5	3,523,988	0.8121
		#6	4,036,733	0.8123
		#7	3,868,817	0.7934
		#8	2,528,587	0.7824
	Hadong	#1	4,140,667	0.8089
		#2	3,681,670	0.8030
		#3	3,727,907	0.8056
		#4	4,115,014	0.8075
		#5	3,905,190	0.8067
		#6	4,158,792	0.8057

Year	Plant		Net electricity generated	EF for each plant
			$EG_{m,y}$ (MWh)	($tonCO_2$/MWh)
	Dangjin	#1	3,968,103	0.8088
		#2	3,595,927	0.8019
		#3	4,010,715	0.8014
		#4	4,009,178	0.8037
		#5	3,443,482	0.7965
		#6	3,497,359	0.7882
		#7	2,904,680	0.7886
		#8	1,297,925	0.7853
	Ulsan	#1	406,685	0.7916
		#2	407,321	0.7955
		#3	458,584	0.7812
		#4	1,418,034	0.7296
		#5	1,540,400	0.7316
		#6	899,604	0.7314
	Youngnam	#1	688,935	0.7748
		#2	474,475	0.7896
	Yosu	#1	497,053	0.7334
		#2	1,071,405	0.7195
	Pyongtaek	#1	1,147,515	0.7085
		#2	1,553,162	0.7031
		#3	1,502,099	0.7037
		#4	1,095,986	0.7070
	Namjeju	#1	-	
		#2	-	
		#3	484,459	0.7661
		#4	500,222	0.7623
	Jeju	#1	3,019	1.0379
		#2	280,454	0.7455
		#3	396,186	0.7430
	Seoul	#4	357,572	0.5598
		#5	962,861	0.5729
	Incheon	#1	148,821	0.5446
		#2	157,042	0.5354
		#3	205,530	0.5399
		#4	95,143	0.5350
	Pyongtaek C/C	C/C	909,449	0.4445
	Ilsan	C/C	3,506,350	0.4830
	Bundang	C/C	3,741,296	0.4710

Year	Plant		Net electricity generated $EG_{m,y}$ (MWh)	EF for each plant ($tonCO_2$/MWh)
	Ulsan	C/C	4,383,453	0.3911
	Seoincheon	C/C	10,895,505	0.3664
	Shinincheon	C/C	12,533,994	0.3748
	Boryeong	C/C	7,839,371	0.3816
	Incheon	C/C	3,696,784	0.3567
	Busan	C/C	11,616,221	0.3564
	Hallim	C/C	61,752	0.7457
	Anyang	C/C	1,615,090	0.4783
	Bucheon	C/C	1,523,068	0.4789
	POSCO POWER	C/C	3,788,598	0.4659
	G S Bugog	C/C	2,767,811	0.3581
	Yulchon	C/C	2,083,451	0.3743
	Namjeju	D/P	164,390	0.6430
	Jeju	G/T	1,294	1.6864
	Jeju	D/P	235,626	0.6254

Source: Statistics of Electric Power in KOREA (2006, 2007, 2008) (KEPCO)

<Table Annex-4> Sample group plants used in the Build Margin calculation and CO_2 Emission Factor of the Build Margin

Year	No.	Plant name		Technology	Type of Fossile Fue	year operation	Net electricity generated (EGm,y)	CO_2 emission factor ($EF_{EL,m,y}$)	Results
							MWh in 2007	tCO2/MWh	EF for each plant (tonCO2eq./MWh)
	1	Hanbit Sungsan the second solar		solar		2007.12	-		
	2	Taein gangjin solar		solar		2007.12	6		
	3	Suni gangjin solar		solar		2007.12	11		
	4	Korea yeongcheon solar		solar		2007.12	17		
	5	Solar yungam solar		solar		2007.12	-		
	6	Changwhan yeongduk solar		solar		2007.12	5		
	7	Samsung jindo		solar		2007.12	9		
	9	Hwaseong heat & power		combined		2007.12			
	10	Dangjin	#8	steam power	Bituminous coal	2007.12	1,297,925	0.7853	0.0120
	11	SP solar yonggwang		solar		2007.11	38		
	12	Dongyang energy sinan		solar		2007.11	268		
	13	Ef yungam solar		solar		2007.11	40		
	14	Dongwon gangjin solar		solar		2007.11	214		
	15	Solec yonggwang solar		solar		2007.11	120		
	16	Solar jungeub solar		solar		2007.11	92		
	17	Sinbuk yungam solar		solar		2007.11	178		
	18	Hyein haenam solar		solar		2007.11	364		
	19	Samlangjin solar		solar		2007.11	646		
2	20	Hyosung daegi-wind power		wind		2007.11	42		
	19	Nonhyun heat & power		combined		2007.10			
	20	Wuriyungam solar		solar		2007.08	267		
0	21	Hwasung solar		solar		2007.08	309		
	22	Yeongju the first solar		solar		2007.08	230		
	23	Muan solar		solar		2007.08	622		
0	24	Jangheung solar		solar		2007.08	125		
	25	Gomun		small hydro power		2007.08	2,996		
	26	Taean	#8	steam power	Bituminous coal	2007.08	2,528,587	0.7824	0.0233
7	27	Dangjin	#7	steam power	Bituminous coal	2007.06	2,904,680	0.7886	0.0270
	28	Munkyung solar		solar		2007.06	2,563		
	29	Younggwang solar park		solar		2007.06	853		
	30	Yungam Solar		solar		2007.06	770		
	31	Wonjungsu		small hydro power		2007.05			
	32	baegok		small hydro power		2007.05	1,001		
	33	damyangho		small hydro power		2007.05	1,771		
	34	Juam		small hydro power		2007.05			
	35	Namjeju	#4	thermal	heavy oil	2007.03	500,222	0.7623	0.0045
	36	Eco energy		solar		2007.03	231,029		
	37	hapcheon		small hydro power		2007.02	6,777		
	38	Jeonju-resource recovery facility				2007.02	13,059		
	39	Seoul Marin(suncheon)		solar		2007.02	1,223		
	40	Mirae energy		solar		2007.02	165		
	41	Seomjingang		small hydro power		2007.02			
	42	samcheonpo		small hydro power		2007.02			
	43	dalbang		small hydro power		2007.02			
	44	Taean	#7	steam power	Bituminous coal	2007.02	3,868,817	0.7934	0.0362
	45	Yeongju the second solar		solar		2007.01	646		
	46	Hyundaedaesan		combined		2007.01			

	1	Cheongsong pumping	#2	pumping		2006.12	145,042		
	2	S&P Solar		solar		2006.10	995		
	3	Bundang fuel cell		fuel cell	LNG	2006.10	1,959	0.4243	0
	4	Yonnggwang Solar park		solar		2006.10	853		
	5	Namhae Solar		solar		2006.10	1,462		
	6	HanlaJeunggong Solar		solar		2006.10	1,292		
2	7	Yungam Solar		solar		2006.09	770		
	8	Enepark		solar		2006.09	416		
	9	Yongheng solar		solar		2006.09	1,214		
0	10	Cheongsong pumping	#1	pumping		2006.09	164,069		
	11	Namjeju	#3	thermal	heavy oil	2006.09	484,459	0.7661	0.0044
	12	yangyang(pumping)	#4	pumping		2006.08	91,270		
0	13	Donghae solar		solar		2006.08	1,118		
	14	Kangwon-wind power		wind		2006.07			
	15	yangyang pump windpower		wind		2006.06			
	16	Hadongho		small hydro power		2006.06	1,832		
6	17	yangyang (pumping)	#3	pumping		2006.06	56,495		
	18	Goheung Solar		solar		2006.06	1,233		
	19	Jangseong		small hydro power		2006.05	648		
	20	yangyang (pumping)	#2	pumping		2006.04	103,698		
	21	Dangjin	#6	thermal	Bituminous coal	2006.04	3,497,359	0.7882	0.0325
	22	Sinchang-wind power		wind		2006.03	3,572		
	23	yangyang (pumping)	#1	pumping		2006.02	106,973		

	1	Janghengdam		small hydro power		2005.12			
	2	Suncheon Solar		solar		2005.12	1,259		
	3	Samcheonpo solar energy		solar		2005.12	131		
	4	Dangjin	#5	steam power	Bituminous coal	2005.10	3,443,482	0.7965	0.0324
	5	yangyang pump small hydro		small hydro power		2005.10			
	6	Taean solar energy		solar		2005.10	118		
	7	Jeju DP		internal combustion	heavy oil	2005.07	235,626	0.6254	0.0017
	8	WunjeongLFG		internal combustion	LFG	2005.07	11,415		
	9	Yulchon		combined	LNG	2005.07	2,083,451	0.3743	0.0092
	10	Incheon		combined	LNG	2005.07	3,696,784	0.3567	0.0156
	11	Daegok		small hydro power		2005.07	1,278		
	12	Donghwa		small hydro power		2005.07	2,481		
2	13	Ulchin	#6	nuclear		2005.04	7,911,305		
	14	Hanrye		LFG	LFG	2005.04	5,102		
	15	Busan Bio-gas		internal combustion	LFG	2005.03	1,551		
	16	Sungnam		small hydro power		2004.12			
0	17	Yungduk-wind power		wind		2004.12			
	18	Yongdam		small hydro power		2004.12	24,928		
	19	Maebongsan-wind power		wind		2004.12	11,058		
0	20	Daegwanryung-wind power		wind		2004.12	4,288		
	21	Yongheng	#2	steam power	Bituminous coal	2004.11	6,081,490	0.8128	0.0583
	22	new solar energy		solar		2004.11	224		
	23	Yongheng	#1	steam power	Bituminous coal	2004.07	5,020,901	0.8174	0.0484
5	24	Ulchin	#5	nuclear		2004.07	8,025,928		
	25	Busan		combined combustion	LNG	2003.05/2004.03	11,616,221	0.3564	0.0489
	26	Chunsang		small hydro power		2004.02	240		
	27	Cheongju LFG		internal combustion		2004.02	5,808		
	28	Daejon Geumgodong		internal combustion		2003.06	9,160		
	29	Hoicheon ENC		internal combustion		2003.05	2,826		
	30	Andong		small hydro power		2003.09			
	31	Gunsan-wind power		wind		2002.11/2003.09	7,958		
	32	Sangwon ENC		internal combustion		2001.12/2003.03/2003.06			
	33	Muju		small hydro power		2003.04	637		
	34	Yonggwang	#6	nuclear		2002.12	7,859,224		
	35	Taean	#6	steam power	Bituminous coal	2002.05	4,036,733	0.8123	0.0387
	36	Yonggwang	#5	nuclear		2002.05	8,601,736		
Total							**84,736,759**		**0.3933**

Source: Statistics of Electric Power in KOREA (2007) (KEPCO), Current status of power generating facility (2007, Korea power exchange)

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<Table Annex-5> Fuels CO_2 Emission factor

Fuel Type	$EF_{CO2,I,y}$ (tCO2/TJ)
Gasoline	**67.5**
Diesel oil	**72.6**
residual fuel oil	**75.5**
LNG	**54.3**
bituminous coal	**89.5**
Anthracite	**94.6**

Source: 2006 IPCC Guidelines

Annex 4

MONITORING INFORMATION

Refer to Section B.7

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