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

CONTENTS

Annexes

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:

>> Bundled Wind Power Project of Jeju Special Self-Governing Province in Korea
>> Version 07 of CDM-SSC-PDD
>> 31 December 2007

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

▫ **The purpose of the project activity**

>> Jeju Special Self-Governing Province Wind Power Project, a bundled wind power projects, is located in Haengwon-Ri and Sinchang-Ri of Jeju island. The purpose of this project is to generate electricity by using renewable wind resources to meet ever-increasing demand for energy in the region and to contribute effective development of wind power through utilizing environmental friendly energy sources such as wind.

>> The project has an installed capacity of 5.93MW and the expected annual electricity generation from the project is 12,727 MWh. The electricity from the projects is connected to the grid and subsequently displaces the equal amount of power generated main by coal-fired thermal power plant in the island. The estimated average annual greenhouse gas(GHG) emission reduction will be 9,201tCO2e. In the meantime, the emission amount of SO2, NOx and particulates associated with power generation from fossil fuels will be decreased significantly. Furthermore, the project does not result in degradation of any natural resource, health standards, etc at the project area.

>> In the absence of the project activity, equivalent power would have been generated and consumed based on the fossil fuel intensive grid resulting in greenhouse gas emissions into the atmosphere. Hence, the implementation of this project activity will facilitate in reduction of the ever increasing demand and supply gap of electricity through wind power generation and result in 9,201 tones of CO2 reductions annually.

▫ **The project contributes to sustainable development in the following ways:**

- Contribute to increase the renewable energy supply ratio by generation electricity with wind power which Korean government encourages industries to develop.
- Reduce GHG emission and other air pollutants occurring from fossil fuel extraction, processing, transportation and burning.
- Help in economic social development of remote villages in Haengwon and Sinchang by making investment.
- Arrange rural and infrastructural development in the areas surrounding the project
- Use the project area as an eco-tourism site.
- Encourage other local governments to adopt this technology and invest in wind energy.
- Create direct and indirect employments to the local communities and the local community obtains advanced technology support from the dispatched engineers by Vestas and NEG-Micon.

A.3. Project participants:

>> Table 1. Project participants of Bundled Wind Power Project of Jeju Special Self-Governing Province (Haengwon, Sinchang)

Name of Party involved	Private and/ or Public entity(ies) Project participants(*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participants (Yes/ No)
Republic of Korea (host)	• Public entity : Jeju Special Self-Governing Province • Public entity : Korea Energy Management Corporation	No

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

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

>>

A.4.1.1. Host Party(ies):

>> Republic of Korea

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

>> Jeju Special Self-Governing Province

A.4.1.3. City/Town/Community etc:

>> Haengwon wind power plant : Jeju-Si Gujwa-Eup Haengwon-Ri
>> Sinchang wind power plant : Jeju-Si Hangyung-Myon Sinchang-Ri

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

>> The project is located in Jeju Special Self Province is located in southern part of the Republic of Korea. The Haengwon wind power plant is 35km east of Jeju city and the Sinchang wind power plant is 45km west of Jeju city shown in the figure below. In the addition, Haengwon wind power plant(#10 to 15#) and Sinchang wind power plant started generating electricity to the grid on April 2003 and February 2006 respectively.

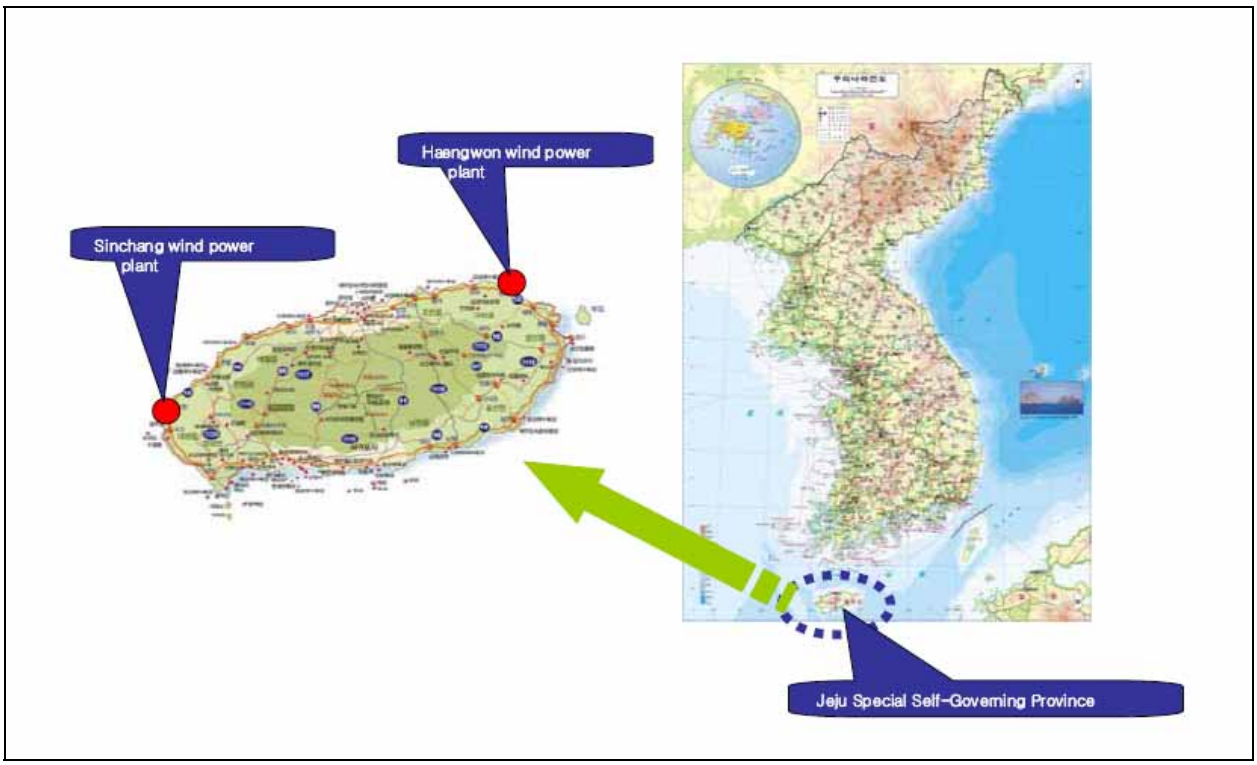


Figure 1 The location of Haengwon and Sinchang wind power plants

Figure 1-A The location of Haengwon and Sinchang wind power plants

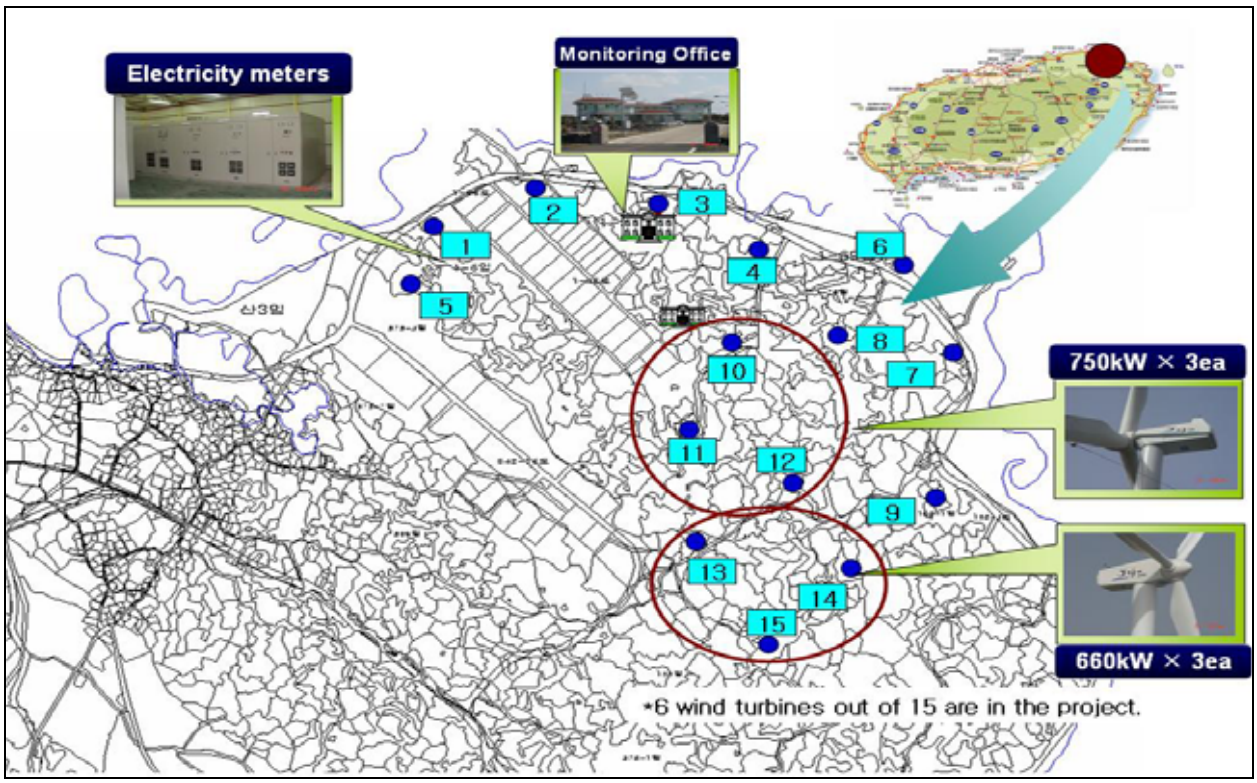


Figure 1-B The location of Haengwon wind turbines

As shown in Figure 1-B, in case of Haengwon wind power plant, the recently constructed 6 wind turbines(#10~#15, October 2001 ~ April 2003) out of total 15 wind turbines are included in the project boundary. The 9 wind turbines excluded from the project boundary must not be considered in the future CDM projects. This circumstance satisfies confirmation that the small-scale project activity is not a debundled component of a large scale project activity (Refer to A.4.5).

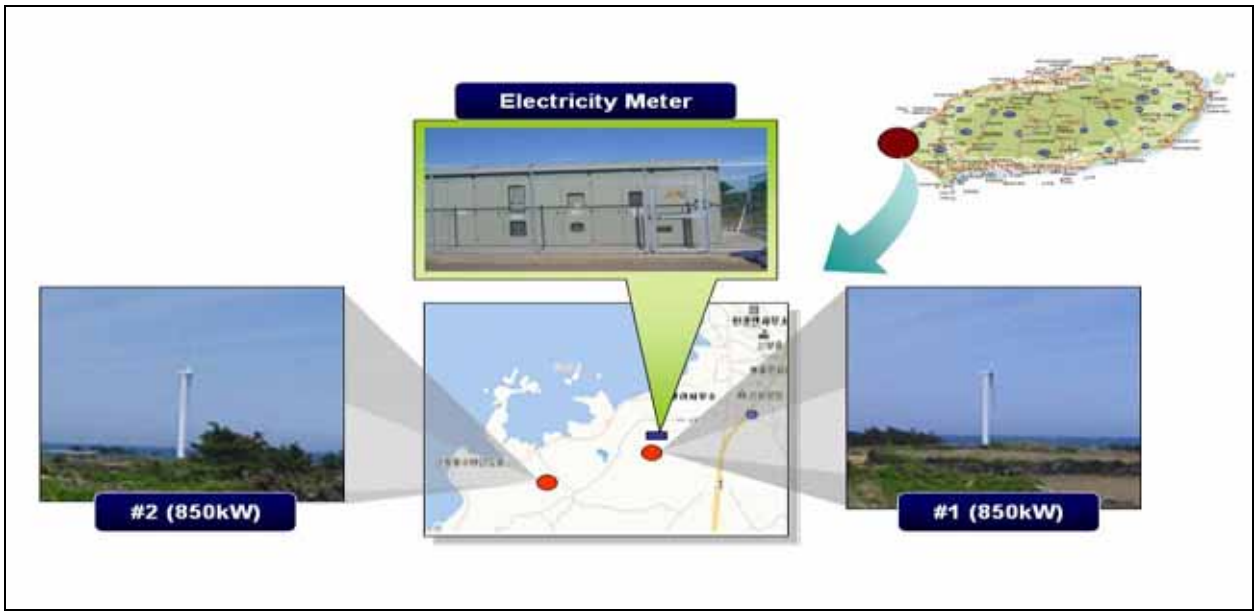


Figure 1-C The location of Sinchang wind turbines

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

>> The project falls into 'Renewable energy projects' of Type I of 'Appendix B of the simplified modalities and procedures for small-scale CDM project activities'. Additionally, the project falls into 'Grid connected renewable electricity generation' of category D and meets following criteria.

- ✓ The capacity of a project should be less than 15 MW;
- ✓ The project should concern renewable power generation and
- ✓ The electricity generated from the proposed project supply to a grid

Environmental safe and sound technology

The technology, which has used worldwide, used is safe on environment. Wind turbines installed in Haengwon-Ri are three 660kW turbines manufactured by Vestas and three 750kW turbines manufactured by NEG-Micon. In the meanwhile, two 850kW wind turbines manufactured by Vestas are for Sinchang-Ri. Wind turbines installed in Haengwon and Sinchang are most suitable wind turbines in regards to capacity and business confidence of manufacturers, electrical and mechanical characteristics of turbines, performance and feature of turbines, expected annual electricity generation and so on. Also, in terms of output control type, electricity generation and quality assurance, the introduced wind turbines have competitive power comparing to other turbines (Dec. 1998, Study on integrated wind park project in Jeju island). A technical specification of wind generator is summarized at table below.

Table 1 Specification of wind turbines

		660kW (Vestas)	**750 kW (NEG-Micon)**	**850 kW (Vestas)**
Design Wind Speed	Start up Wind Speed	4m/s	4m/s	4m/s
	Nominal Wind Speed	13m/s	13~16m/s	13m/s
	Stop Wind Speed	25m/s	25m/s	25m/s
Blade	Type	V-47	NM750/48	V-52
	The number of blade	3	3	3
	Diameter	47m	48.5m	52m
	Swept Area	1,735m^2	1,824 m^2	2,124 m^2
	Rotational Speed static	28.5RPM	22RPM	26RPM
Generator	Rated Voltage(VAC)	690	690	690
	Rated Current(A)	614	820/220	729
	Frequency(Hz)	60	60	60
Steel Tower	Corrosion Class (Outside and Inside)	Class II	Class II	Class II
	Height	45m	45m	49m
Output Control Type		Pitch control	Stall control	Pitch control
Noise Level(dB) at 150m		55.3	54.5	56.8
A detailed technical specification is available at http://www.vestas.com/vestas/global/en/Products/Wind_turbines/Wind_trubines.htm				

The total capacity of 8 wind turbines is 5.93MW. Based on "Study on Wind Power Resources in Jeju island (November 2001, University of Jeju)"and the amount of electricity generation to the grid in 2005 and 2006 (Operating data on Haengwon wind power plant and Sinchang wind power plant, 2005 & 2006, Jeju Special Self-Governing Province), the utilization rate is conservatively estimated as 24.5%. Thus the annual electricity generation is expected to be 12,727MWh.

The equipment such as the turbines and wings has been imported from Denmark. According to agreements between Jeju Special Self-Governing Province and the manufactures, the manufactures take responsibility of providing the personnel from the province with technical training for over 2 week and

training on O&M for over 1 month. In order to maintain and operate the facility, the personnel from the province were trained through the participation of the training courses. The local manpower including Mr. Boo of the province has been trained to operate and maintain the power plant. He participated the two training courses and has a plan to attend another training course in near future. Based on this participation of training programs, he has done many O&M works.

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

>>

Years	Annual estimation of emission reductions in tonnes of CO_2e
2007	767
2008	9,201
2009	9,201
2010	9,201
2011	9,201
2012	9,201
2013	9,201
2014	9,201
2015	9,201
2016	9,201
2017	8,434
Total estimated reductions (tonnes of CO_2e)	92,010
Total number of crediting years	10
Annual average over the crediting periods of estimated reductions (tonnes of CO_2e)	9,201

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

>> Project financing dose not involve ODA or public funding from Annex I countries.

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

- with the same project participants
- in the same project category and technology
- registered within the previous two year; and
- whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point

The project is not included any of above indicator.

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:

>> According to the list of the small-scale CDM project activity categories contained in Appendix B of the simplified modalities and procedures for small-scale CDM project activities, the Bundled Wind Power Project of Jeju Special Self-Governing Province corresponds to;

Type I: Renewable Energy Projects
Category D: Electricity Generation for a system

Thus, the methodology used in this project activity is AMS-I.D.-Grid Connected Renewable Electricity Generation (Version 11)

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

>> This category comprises renewable energy generation including wind that supply electricity to electricity distribution system that would have been supplied by at least one fossil fuel fired generating unit. The capacity of this project activity is 5.93MW delivering electricity to the grid. Thus, the proposed project activity satisfies Type I of small-scale project activity and falls into category I.D. It will remain under the limits of small-scale project activity type during every year of the crediting period.

B.3. Description of the project boundary:

>> For the baseline determination, the project boundary encompasses the physical, geographical site of the renewable generation source. According to version 06(19 May 2006) of ACM0002, the spatial extent of the project boundary includes the project site and all the power plants connected physically to the electricity system of Korea Electric Power Corporation(KEPCO).

But the definition of electricity grid (spatial, inter-grid electricity supply) is not clear such as the case of Jeju island (included electricity transfers from connected electricity systems to the project electricity system, “electricity imports”), ACM0002 clearly states how to estimate the baseline (B.4).

In the calculation of GHG emissions from the plant included in project boundary, the emissions generated during construction period of the power plant, the emissions related to electricity transmission and distribution losses, the emissions related to fossil-fuel transportation, mining, etc. have not been considered for the baseline.

B.4. Description of baseline and its development:

>> Table 2 shows the key information and data for the baseline scenario.

Table 2 Key information and data for the baseline scenario

Parameter	Value	Source
GEN $_{j,y}$ (MWh) is the electricity delivered to the grid by source *j*.	Refer to Annex. 3 (Table 5)	2003~2005 Statistics of Electric Power in Korea (KEPCO)
F $_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*, *j* refers to the power sources delivering electricity to the grid, not including low-operation cost and must-run power plants, and including imports to the grid.	Refer to Annex. 3 (Table 1)	2003~2005 Statistics of Electric Power in Korea (KEPCO)
Net Calorific Values by Power Plant	Refer to Annex. 3 (Table 2-4)	2003~2005 Statistics of Electric Power in Korea (KEPCO)
Fuels Carbon Emission Factor (tC/TJ)	Refer to Annex. 3 (Table 6)	IPCC 1996 Revised Guidelines
Fraction of Carbon Oxidised (OXID)	Coal: 0.98 Oil and Oil product: 0.99 Gas: 0.995	IPCC 1996 Revised Guidelines
Operating Margin Emissions Factor (in ton CO_2/MWh) 2003 ~ 2005	0.7278	Calculated
Build Margin Emissions Factor (in ton CO2/MWh)	0.7086	Calculated
Baseline Emissions Factor (EF_y in ton CO_2/MWh)	0.7230	Calculated

According to step 9 of AMS I.D/version 11, the baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient(measured in kgCO2e/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 approved methodology ACM0002, or
(b) The weight average emissions of the current generation mix. The data of the year in which project generation occurs must be used.

In order to determine the baseline of this project, (a) of the above baseline approaches is chosen.
Therefore, the baseline of this project was established by ACM 0002/Version 06(19 May 2006). Based on "Project Boundary" of ACM0002, the spatial extent of this project boundary includes the project site and all power plants connected physically to the electricity system.

For the Build Margin(BM) emission factor, the spatial extent is limited to the project electricity system, except where recent or likely future additions to transmission capacity enable significant increases in imported electricity. In the case of Jeju island, when the BM emission factor is estimated, the amount of electricity supply from inland has not been rapidly increased over the last 3 years(refer to Table 3).

Table 3 Power generation status in Jeju island

Year	Electricity Imports	Steam Turbine	Internal Combustion	Combined Cycle	Gas Turbine	etc.	Total	Proportion of Electricity Imports(%)
2005	1,181,389	1,235,169	437,840	105,976	5,839	42,688	3,008,902	39%
2004	1,157,437	1,213,168	282,050	102,019	3,744	36,331	2,794,750	41%
2003	1,103,980	1,129,246	273,154	59,066	2,059	24,221	2,591,726	43%
*Unit : MWh				**Average over last 3 years**				**41%**

Source: Korea Power Exchange – Jeju (http://www.kpxj.or.kr/2007/sub/index.asp?nid=010100)

In addition, in the close future, it is anticipated that the rapid increase of electricity supply will not happen either. Nevertheless, the increase of electricity generation in the plan for electricity generation project in Jeju island effects on BM. Therefore, the estimation of the BM emission factor is considered by the situation of Jeju island.

For the Operating Margin(OM), the average amount of electricity supply from inland to Jeju island is occupied 41% of total electricity generation amount of Jeju island over last 3 years(refer to Table 3). When the OM emission factor is estimated which presents the current emission trend, in the basis of ACM0002, it should reflect the value of OM emission factor supplied to Jeju island by using a weighted average of OM(Inland) (Selected option (d) "the emission factor of the exporting grid,…" of the ACM0002)

OM emission factor = OM(Inland)*0.41 + OM(Jeju island)*0.59

OM(Operating Margin) and BM(Build Margin) are calculated by using the data from existing power plants that provide electricity with the current grid-connected electricity generation, and with this result, the EFy(Emission Factor) can be calculated. The steps for the baseline calculation methodology are as follows;

Step 1. Calculate the Operating Margin emission factor ($EF_{OM,y}$)

Based on the ACM0002, if low-cost/must-run resources including hydro, geothermal, wind, low-cost biomass, nuclear, solar and domestic coal generation supported by governmental fund constitute less than 50% of total grid generation in average of the five most recent years, simple OM can be chosen.

According to the Korea Power Exchange, the rate of the low cost/must run power generation does not exceed 50 % of the total grid shown in the Table 4. Therefore, option (a) Simple OM can be chosen.

Table 4 The Generation of Electricity based on the Source of Energy (Unit: 10^3MWh)

	2001	2002	2003	2004	2005
Hydro	4,151	5,311	6,887	5,861	5,189
Anthracite coal	7,007	6,675	6,960	5,787	5,790
Nuclear	112,133	119,103	129,672	130,715	146,779
Renewables	-	-	-	350	404

Others (bituminous coal, heavy oil, gas etc)	157,787	170,944	174,054	198,990	206,208
Total	281,078	302,033	317,573	341,703	364,370
low-cost & must run/total grid generation	0.44	0.43	0.46	0.42	0.43

Source: Electric Power Statistics Information System, http://epsis.kpx.or.kr/

As described in the ACM0002, the simple OM emission factor($EF_{OM,simple,y}$) is calculated as the generation-weighted emissions per electricity unit (tCO2/MWh) 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(anthracite coal). The OM is calculated as follows, using the full generation-weighted average for the most recent 3 years.

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

Where $F_{i,j,y}$ is the amount of fuel i (in a mass or volume unit) consumed by relevant power sources j in year(s) y,
j refers to the power sources delivering electricity to the grid, excluding low-operating cost and must-run power plants, and including imports to the grid,
$COEF_{i,j,y}$ is the CO_2 emission coefficient of fuel i (tCO_2 / mass or volume unit of the fuel), taking into account the carbon content of the fuels used by relevant power sources j and the percent oxidation of the fuel in year(s) y, and
$GEN_{j,y}$ is the electricity (MWh) delivered to the grid by source j.

The CO_2 emission coefficient $COEF_i$ is obtained as

$$COEFi = NCVi \cdot EFco2i \cdot OXIDi$$

Where:
NCV_i is the net calorific value (energy content) per mass or volume unit of a fuel i,
$OXID_i$ is the oxidation factor of the fuel (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),
$EF_{CO2,i}$ is the CO_2 emission factor per unit of energy of the fuel i.
Where available, local values of NCV_i and $EF_{CO2,i}$ should be used. If no such values are available, country-specific values (see e.g. IPCC Good Practice Guidance) are preferable to IPCC world-wide default values.

Based on ACM0002, the emission factor is calculated using a 3-year average, based on the most recent statistics available at the time of PDD submission.

According to the calculation formula and variables of the operating margin emission factor above, $EF_{OM,y}$ is 0.7278 ton CO_2/MWh. The detailed baseline information used in the calculation is presented in Annex 3.

Step 2. – Calculate the Build Margin emission factor ($EF_{BM,y}$)

The ACM0002 provides two options to project participants to calculate the BM emission factor as follows.

Option 1. Calculate the Build Margin emission factor $EF_{BM,y}$ *ex-ante* based on the most recent information available on plants already built for sample group *m* at the time of PDD submission. The sample group *m* consists of either the five power plants that have been built most recently, or 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.

Option 2. For the first crediting period, the Build Margin emission factor $EF_{BM,y}$ must be updated annually *ex-post* for the year in which actual project generation and associated emissions reductions occur. For subsequent crediting periods, $EF_{BM,y}$ should be calculated *ex-ante*, as described in option 1 above. The sample group *m* consists of either the five power plants that have been built most recently, or 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.

In addition, the ACM0002 provides that project participants should use from these two options that sample group that comprises the larger annual generation. In this project, Option 1 is selected. To select the sample group *m*, "the five power plants that have been built most recently" and "the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) which have been built most recently" were compared and the results are as follows.

Table 5 Sample plant group(m) for determining Build Margin emission factor

Sample group(m) / Classification	**"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."**	**Comments**
Electricity quantity	1,077GWh	1,057GWh	Total generation is 3,009 GWh in Jeju island (based on KEPCO's data of the year 2005)
Proportion (ratio to total generation in Jeju island)	35.8%	35.1%	
Selected Group	O		

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 1,057 GWh (35.1% of total generation of the Jeju island), and the annual generation of "the five power plants that have been built most recently" was 1,077 GWh. Therefore, the latter was chosen as a lager figure than the other one. The detailed data used in the calculation are presented in Annex 3.
The calculation of BM $_y$ is as follows;

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

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

According to the BM calculation formula and variables above, $EF_{BM,y}$ is defined as 0.7086 ton CO_2/MWh. The detailed information used in the calculation is presented in Annex 3.

Step 3. Calculate the baseline emission factor (EF_y)

Based on the results derived from Step 1, and Step 2, EF_y has been calculated using the following formula:

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

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

Based on the ACM0002, for wind and solar projects, the default weights are as follows: $w_{OM} = 0.75$ and $w_{BM} = 0.25$(owing to their intermittent and non-dispatchable nature).

Therefore, baseline emission factor (EF_y) is as shown below:

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

= 0.75 *0.7278 ton CO_2/MWh + 0.25 * 0.7086 ton CO_2/MWh = 0.7230 ton CO_2/MWh

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:

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

In the case of this project, a total expense of construction is 11.9 million USD (1 USD = 1,000 won), O&M cost (operation & maintenance cost) is 407,000 USD per year. Especially, as for the unit cost of purchase for Haengwon wind power and Sinchang wind power is 76.17 (http://epsis.kpx.or.kr/) won/kWh that are applied average SMP (System Marginal Price) in 2006.

According to the Act on the Promotion of the Development and Use of New and Renewable Resources of Energy (amended in March 2002), the government compensates difference between the System Marginal Price by Korea Power Exchange and the standard price that is pre-determined by the government to attract to promote the diffusion of renewable energy.

On the other hand, the 22nd CDM Executive Board meeting report defines “Clarifications on the consideration of national and/or sectoral polices and circumstances in baseline scenarios” which allows not to be taken into account in developing a baseline scenario, national or sectoral policies that give

comparative advantages to less emissions-intensive technologies like renewable electricity generation only if the policies have been adopted after 11 November 2001.

In this regard, the project, in developing the baseline scenario, excluded the government subsidy (compensation) for renewable electricity generation which had been adopted in March 2002.

Therefore, the table below shows NPV analysis without such subsidy.

Plant Name	Total Expenses (unit: one million won)	Operation & Maintenance Cost including tax (unit: one million won /year)	Unit Cost of Purchase (unit: won/kWh)	Purchased Electricity (unit :one million won	NPV (unit : one million won)
Haengwon wind power	8,700	275	76.17	691	-3,977
Sinchang wind power	3,200	132	76.17	278	-1,532
* Crediting period is for 10 years except construction period. * The discount rate of Haengwon wind power project and Sinchang wind power project is 7.00 * Discount rate and other variables are adopted from the execution design report of individual plant. * Raw data (Excel sheet) for economical analysis is submitted to the DOE.					

Moreover, in order to consider factors that can influence the financial analysis, sensitivity analysis could be conducted as below.

Cases	plant name	NPV (one million won)
When discount rate is 7% and utilization rate is 24.5% and price of purchasing electricity is 76.17 won/kWh	Haengwon wind power	-3,977
	Sinchang wind power	-1,532
(1) When discount rate is 4.83%	Haengwon wind power	-3,124
	Sinchang wind power	-1,232
(2) When discount rate is 10%	Haengwon wind power	-4,843
	Sinchang wind power	-1,835
(3) When 5% increase of utilization rate	Haengwon wind power	-2,376
	Sinchang wind power	-884
(4) When 10% increase of price of purchasing electricity	Haengwon wind power	-3,193
	Sinchang wind power	-1,214

As a result of economical analysis, NPV is lower than 0. It means that it does not have economical attraction. In addition, there are risks of difficulty in retrieving the investment. Investment retrieval depends on when power plants operate and how much power is generated. Power generation depends on operation time of power plants.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

>> According to combined margin under AMS I.D, the project activity mainly reduces carbon dioxide through substitution of grid electricity generation with fossil fuel fired power plants by renewable electricity. Therefore, 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:

$ER_y = BE_y - PE_y - L_y$

Where the baseline emissions(BE_y in tCO_2) are the product of the baseline emissions factor (EF_y in tCO_2/MWh) calculated in the Step 3 of B.4., time the electricity supplied by the project activity to the grid(EG_y in MWh).

$BE_y = EG_y * EF_y$

Based on the ACM0002 and AMSI.D., PE_y and L_y are considered as 0. Therefore, the emission reductions by the project activity are equal to baseline emission,

ER_y = 12,727MWh*0.7230 ton CO_2/MWh − 0 − 0 = 9,201 ton CO_2

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

Data / Parameter:	**Utilization rate**
Data unit:	%
Description:	Annual proportion of wind power plant operation
Source of data used:	Calculated
Value applied:	24.5
Justification of the choice of data or description of measurement methods and procedures actually applied :	Data is conservatively determined based “Study on Wind Power Resources in Jeju island (November 2001, University of Jeju)”and the amount of electricity generation to the grid in 2005 and 2006 (Operating data on Haengwon wind power plant and Sinchang wind power plant, 2005 & 2006, Jeju Special Self-Governing Province)
Any comment:	N/A

Data / Parameter:	**EF_y** *(Combined Margin emission factor)*
Data unit:	ton CO_2/MWh
Description:	CO_2 emission intensity of the electricity displaced
Source of data used:	Calculated
Value applied:	0.7230
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value is calculated based on the version 6 of the ACM0002. Required values for the calculation were referred to the Statistics of Electric Power provided by the Korea Power Exchange.
Any comment:	This value is calculated at the time of PDD submissions and will not be changed during the crediting period. For the details of the calculation, refer to Annex 3

Data / Parameter:	$EF_{OM,y}$
Data unit:	ton CO_2/MWh
Description:	Operating Margin emission factor
Source of data used:	Calculated
Value applied:	0.7278
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value is calculated based on the version 6 of the ACM0002. Required values for the calculation were referred to the Statistics of Electric Power provided by the Korea Electric Power Corporation.
Any comment:	Simple Operating Margin is used, by including Imports. This value is calculated at the time of PDD submissions and will not be changed during the crediting period. For the details of the calculation, refer to Annex 3.

Data / Parameter:	$EF_{BM,y}$
Data unit:	ton CO_2/MWh
Description:	Build Margin emission factor
Source of data used:	Calculated
Value applied:	0.7086
Justification of the choice of data or description of measurement methods and procedures actually applied :	The value is calculated based on the version 6 of the ACM0002. Required values for the calculation were referred to the Statistics of Electric Power provided by the Korea Electric Power Corporation.
Any comment:	This value is calculated at the time of PDD submissions and will not be changed during the crediting period. For the details of the calculation, refer to Annex 3

B.6.3 Ex-ante calculation of emission reductions:

>> Ex-ante calculation of Project emissions, baseline emission and leakage emissions is conducted as follows:

Baseline Emissions

The capacity of this bundled wind project is 5.93MW and coefficient of utilization is 24.5%. Therefore, expected electricity production is 12,727MWh per year. Emission Factor(EF_y) is 0.7230 ton CO_2/MWh and for detail calculation method, refer to Annex 3.

Baseline Emission = electricity produced by the project * emission factor

= 12,727MWh * 0.7230 ton CO_2/MWh = 9,201 ton CO_2/year

Project emission

According to ACM0002 and AMS-I.D., project emission is zero.

Leakage emission

According to ACM0002 and AMS-I.D., leakage emission is zero.

Ex-ante emission reduction

Emission reduction = baseline emissions – project emissions – leakage = 9,201 ton CO_2/year

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

Year	Emission of project activity emissions (tCO_2 e)	Estimation of baseline emissions (tCO_2 e)	Estimation of leakage (tCO_2 e)	Estimation of overall emission reductions (tCO_2 e)
2007	0	767	0	767
2008	0	9,201	0	9,201
2009	0	9,201	0	9,201
2010	0	9,201	0	9,201
2011	0	9,201	0	9,201
2012	0	9,201	0	9,201
2013	0	9,201	0	9,201
2014	0	9,201	0	9,201
2015	0	9,201	0	9,201
2016	0	9,201	0	9,201
2017	0	8,434	0	8,434
Total (tCO_2 e)	0	92,010	0	92,010

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

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Electricity supplied to the grid by the project
Source of data to be used:	Measured
Value of data	
Description of measurement methods and procedures to be applied:	Read values in the Watt-hour meter
QA/QC procedures to be applied:	- QA/QC procedure of this is planned. - The allowable error of the data must be within ±0.5%.
Any comment:	- Date will be measured hourly and recorded monthly. - Data will be kept for two years after the last issuance of CERs for this project activity in paper form and electric form. - Data will be aggregated monthly and yearly. - This data is only the amount of electricity generation except the electricity consumed in the plant and electricity imported for the project activity.

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

1) Monitoring equipment

- Electricity measuring meter 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 the Korea Power Exchange and Korea Electric Safety Corporation.
- The meter shall be authorized through the due formal certifying process (the valid period for the authorized certification: 7 years)
- The meter shall be calibrated when they are installed, and re-calibrated from every three years after installation.

2) Monitoring of electricity generations

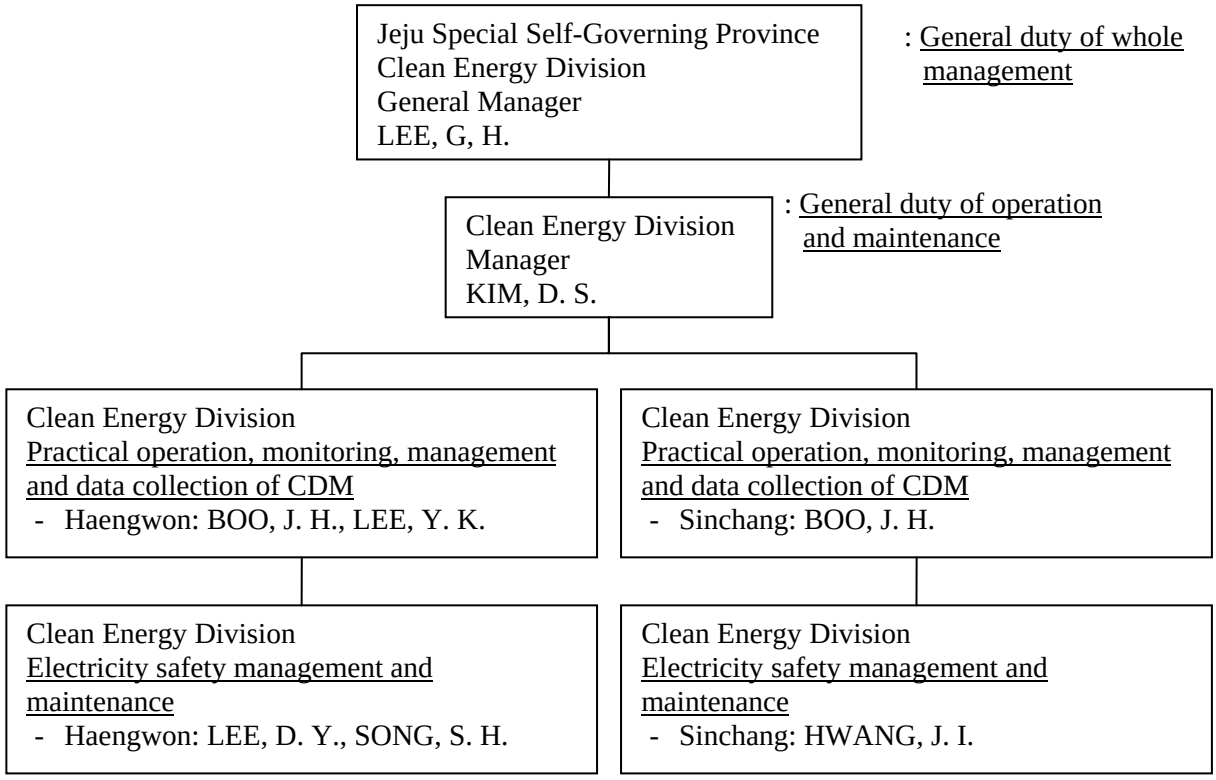
- The amount of electricity transmitted to the grid shall be measured automatically by established meter. The measured data are simultaneously transferred to wind power plant, Korea Power Exchange and Jeju special governing province monitoring system.
- The measured amount of electricity shall be collected daily, weekly, and monthly and shall be achieved in electronic way. The collected data shall be compared with those of Korea Power Exchange. If the data are different, the operation condition of electricity meters and other equipments shall be examined. In case meters are improperly operated equipments, internal investigation and correction procedure shall be followed and be certified by the final decision maker, Korea Power Exchange and Korea Electric Safety Corporation.

3) Management of monitoring and electricity safety

- the person in charge of monitoring and electricity safety shall attend the courses on 'Law regarding measurement', 'Act on operation of electricity market' and 'electricity safety' once a year.
- In case of absence of the responsible person, the second responsible person shall be selected.
- If the responsibility for monitoring and electricity safety is transferred to another person, that will be approved by the final decision-maker.

B.7.2 Description of the monitoring plan:

>> Since the project is a grid connected renewable energy project, emission reduction quantity depends on the units of energy generated from wind power based on power plant and exported to the grid. Based on the monitoring methodology of AMS I.D., the methodology covers monitoring of units exported and the other parameters affecting the quantity of power export and CO2 emissions thereof. The net emission reductions will result from the units of power supplied to the grid. The monitoring will be based on the framework shown below.



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 to the project activity is in 23 March 2007. The contact information of the persons responsible for the application of the baseline and monitoring methodology to the project activity is Mr. Dongsik Shin of the Korea Energy Management Corporation.

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:

>> Haengwon wind power plant : 17 January 2001
Sinchang wind power plant : 17 August 2004

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

>> The estimated operational life time is approximately 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:

>> Not Applicable

C.2.1.2. Length of the first crediting period:

>> Not Applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

>> 01/December/2007

C.2.2.2. Length:

>> 10 years

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 Impact of Works on Environment, Traffic, and Disasters*, any plant facility whose power source is solar power, wind power or fuel cell that is more than 100MW shall be carried out the Environmental Impact Assessment (EIA). This project which is bundled by 4.23 MW and 1.7MW is not required to execute EIA.

However, in the process of local consultations, the communities raised issues of noise, shadow, and migration route of migratory birds from the wind power plants. In order to minimise the concerns, the project participants asked a study to the Jeju University. The recommendations to mitigate the impact of Jeju University such as limitation of hub height, location of turbines and distance between turbine and village have been implemented by the project participants and accepted by the local stakeholders.

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:

>> N/A

SECTION E. Stakeholders' comments

>>

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

>> The stakeholders identified for the project are following:

- Local representatives
- Local government
- Local communities

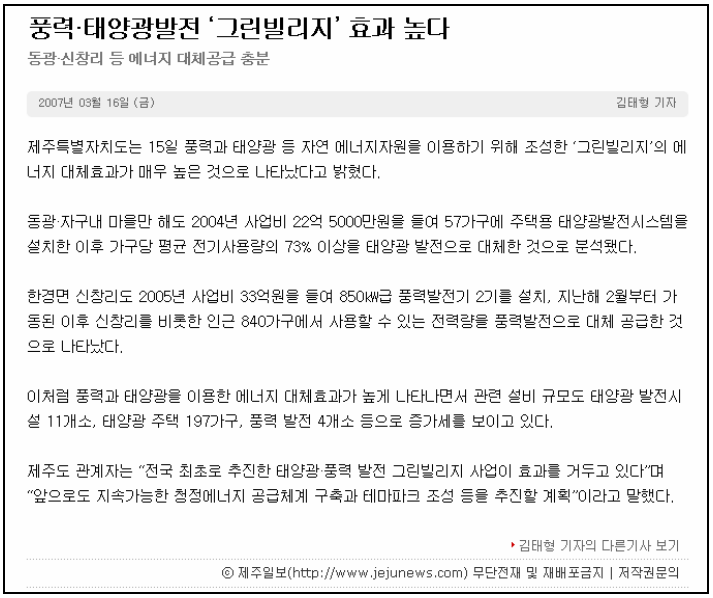
The government have held several public hearings regarding the project to invite opinions of the identified stakeholders. In the public hearings, some comments from the stakeholder were received shown in E.2. Especially, for Sinchang power plant, local community in Sinchang-Ri tried to elicit voluntarily investment efforts on the power plant among local residents. The resident in Sinchang purchased the land for construction of the power plant and donated to Jeju Special Governing Province.

Jeju Special Self-Governing Province held first community consultation meeting for construction of Haengwon wind power plant in early 1997 and the local residents with Mr. Lim Sang-yook

(representative of Haengwon-Ri) supported additional installation of wind power turbines in a regular community meeting on 17 January 2001. And the province held a community consultation meeting for construction of Sinchang power plant on 14 August 2004 with Mr. Kang Soon-Kwan(representative of Sinchang-Ri) and 100 residents at present. From 2004 to 2006, total 29 meetings with representative of Sinchang-Ri and local resident participant were held in order to discuss issues on deciding location of power plant, purchasing land and so on. Through those meeting, people in Haengwon-Ri and Sinchang-Ri came to realise the issues associated with the project, and started supporting construction.

제주, 풍력발전의 메카로 뜬다

Figure 2 Announcement in Hankyoreh news (14 February, 2001)



풍력·태양광발전 '그린빌리지' 효과 높다

동광·신창리 등 에너지 대체공급 충분

2007년 03월 16일 (금) 김태형 기자

제주특별자치도는 15일 풍력과 태양광 등 자연 에너지자원을 이용하기 위해 조성한 '그린빌리지'의 에너지 대체효과가 매우 높은 것으로 나타났다고 밝혔다.

동광·자구내 마을만 해도 2004년 사업비 22억 5000만원을 들여 57가구에 주택용 태양광발전시스템을 설치한 이후 가구당 평균 전기사용량의 73% 이상을 태양광 발전으로 대체한 것으로 분석됐다.

한경면 신창리도 2005년 사업비 33억원을 들여 850㎾급 풍력발전기 2기를 설치, 지난해 2월부터 가동된 이후 신창리를 비롯한 인근 840가구에서 사용할 수 있는 전력량을 풍력발전으로 대체 공급한 것으로 나타났다.

이처럼 풍력과 태양광을 이용한 에너지 대체효과가 높게 나타나면서 관련 설비 규모도 태양광 발전시설 11개소, 태양광 주택 197가구, 풍력 발전 4개소 등으로 증가세를 보이고 있다.

제주도 관계자는 "전국 최초로 추진한 태양광·풍력 발전 그린빌리지 사업이 효과를 거두고 있다"며 "앞으로도 지속가능한 청정에너지 공급체계 구축과 테마파크 조성 등을 추진할 계획"이라고 말했다.

› 김태형 기자의 다른기사 보기

Figure 3 Announcement in Jeju-ilbo news (16 March, 2007)

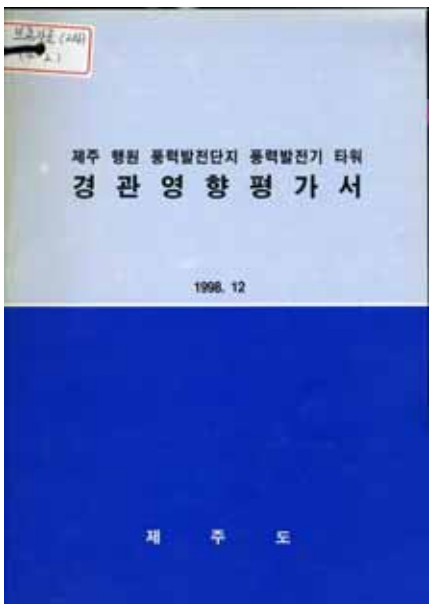


Figure 4 Environmental impact study on wind turbine and public hearing (December, 1998)

E.2. Summary of the comments received:

>> Summary of comments received is shown below:

- The noises from the power plants may adversely affect local communities including local surroundings.
- The power plants should be appropriately away from villages.
- The location of power plants may be an obstacle against the migration of migratory birds.
- The local communities would like to be informed schedules and costs of the project.

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

>> In regards to the noises, the Jeju University recommended that based on the noise measurement the location of power plants should be located at least 500m away from the village. Therefore, the power plants were built over 500 m away from the village. Also, according to a study of Jeju University, the location of the power plants were settled with careful consideration and the height of them were limited to minimise any disturbance to migrating activity of birds. In addition, the province conducted pavement works to the power plants to minimize the local environment due to the construction works.

To contribute sustainable development in the local level, the province has provided financial assistances to the local communities in Haengwon-Ri and Sinchang-Ri. The province has supported residents in Haengwon-Ri with 50% of electric bill (60,000 USD/yr) for 401 houses and installation of high energy efficient products (25,000 USD/yr) which sums up to 85,000 USD annually. Also, resident in Sinchang-Ri has been provided with 75% of electric bill for 634 houses which estimates to 103,000 USD annually.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Jeju Special Self-Governing Province
Street/P.O.Box:	2 Munyeon-Ro
Building:	
City:	Jeju City
State/Region:	Jeju Special Self-Governing Province
Postfix/ZIP:	690-700
Country:	Republic of Korea
Telephone:	82-64-710-2538
FAX:	82-64-710-2539
E-Mail:	bjhesp@hanmail.net
URL:	http://www.jeju.go.kr
Represented by:	
Title:	Governor
Salutation:	Mr
Last Name:	Kim
Middle Name:	
First Name:	Tae Hwan
Department:	Jeju Special Self-Governing Province
Mobile:	
Direct FAX:	82-64-710-2539
Direct tel:	82-64-710-2538
Personal E-Mail:	bjhesp@hanmail.net

Organization:	Korea Energy Management Corporation
Street/P.O.Box:	1157, Pungdukchun-2-dong, Suji-Gu
Building:	
City:	Yongin City
State/Region:	Gyonggi
Postfix/ZIP:	448-994
Country:	Republic of Korea
Telephone:	82-31-260-4831
FAX:	82-31-260-4559
E-Mail:	jhwoo@kemco.or.kr
URL:	http://www.kemco.or.kr
Represented by:	
Title:	President
Salutation:	Mr
Last Name:	Lee
Middle Name:	
First Name:	Kisub
Department:	Korea Energy Management Corporation
Mobile:	
Direct FAX:	82-31-260-4831
Direct tel:	82-31-260-4559
Personal E-Mail:	jhwoo@kemco.or.kr

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding to constitute a diversion of official assistance, nor to count towards any financial obligation from Parties included Annex I.

Annex 3

BASELINE INFORMATION

Baseline Information

<Table -1> Data on fuel consumption for plants

Energy sources	Plant Name		Fuel consumption 2003 (ton)	Fuel consumption 2004 (ton)	Fuel consumption 2005 (ton)
Bituminous	Honam	#1	633,609	885,758	870,214
		#2	832,014	783,300	912,497
	Samchonpo	#1	1,535,849	1,624,500	1,534,223
		#2	1,680,305	1,564,986	1,731,265
		#3	1,634,224	1,467,177	1,723,152
		#4	1,710,195	1,538,768	1,632,334
		#5	1,430,182	1,707,777	1,516,654
		#6	1,436,503	1,734,977	1,546,663
	Boryeong	#1	1,263,072	1,599,557	1,440,343
		#2	1,311,401	1,555,055	1,388,532
		#3	1,478,200	1,427,263	1,589,150
		#4	1,355,767	1,560,014	1,421,343
		#5	1,468,153	1,397,343	1,587,999
		#6	1,343,310	1,559,785	1,260,305
	Taean	#1	1,466,761	1,438,094	1,508,570
		#2	1,333,563	1,509,379	1,323,078
		#3	1,459,118	1,415,585	1,494,175
		#4	1,358,587	1,539,502	1,383,297
		#5	1,243,228	1,547,217	1,411,398
		#6	1,335,853	1,531,751	1,504,962
	Hadong	#1	1,476,164	1,389,739	1,513,930
		#2	1,377,617	1,515,681	1,410,099
		#3	1,362,366	1,501,027	1,422,196
		#4	1,483,166	1,397,482	1,511,054
		#5	1,375,276	1,501,672	1,345,648
		#6	1,473,500	1,379,396	1,520,774
	Dangjin	#1	1,369,223	1,502,885	1,438,702
		#2	1,360,761	1,523,605	1,437,473
		#3	1,488,422	1,404,465	1,549,041
		#4	1,501,207	1,434,844	1,544,010
		#5	–	-	499,714
		#6	–	-	38,671
	Yonghung	#1	–	1,114,254	2,081,972
		#2	–	459,217	1,761,395

Energy sources	Plant Name		Fuel consumption 2003 (kl)	Fuel consumption 2004 (kl)	Fuel consumption 2005 (kl)
Heavy Oil	Honam	#1	3,528	606	961
		#2	641	1,714	338
	Ulsan	#1	113,103	73,408	70,183
		#2	104,734	65,316	67,296
		#3	109,039	71,305	53,085
		#4	361,447	420,739	375,417
		#5	484,842	513,497	363,992
		#6	327,005	527,083	352,776
	Youngnam	#1	250,280	347,107	359,910
		#2	223,269	248,049	190,085
	Yosu	#1	173,830	181,712	106,919
		#2	85,905	316,523	218,356
	Pyongtaek	#1	343,765	204,664	293,214
		#2	325,723	209,664	321,188
		#3	329,779	179,921	308,042
		#4	361,331	192,294	311,245
	Namjeju	#1	12,520	16,510	14,628
		#2	12,216	16,040	15,031
	Jeju	#1	10,363	15,306	12,564
		#2	107,856	118,473	129,516
		#3	124,954	124,160	122,866
	Incheon	#1	22,390	-	-
		#2	22,656	-	-
		#3	24,998	-	-
		#4	23,774	-	-
	Namjeju	D/P	56,401	57,808	56,727
	Jeju	D/P	-	-	31,808
Energy sources	**Plant Name**		**Fuel consumption 2003 (kl)**	**Fuel consumption 2004 (kl)**	**Fuel consumption 2005 (kl)**
Diesel Oil	Honam	#1	409	300	278
		#2	366	335	185
	Samchonpo	#1	1,144	1,674	1,220
		#2	657	744	626
		#3	838	814	377
		#4	299	785	1,029
		#5	2,118	230	1,415
		#6	1,570	652	1,001
	Boryeong	#1	968	311	761
		#2	934	616	551
		#3	59	574	90
		#4	307	179	603

	#5	152	422	156
	#6	356	350	627
Taean	#1	319	999	621
	#2	730	310	395
	#3	193	390	650
	#4	628	254	365
	#5	994	329	742
	#6	1,011	230	417
Hadong	#1	390	533	284
	#2	445	145	792
	#3	613	670	472
	#4	302	737	567
	#5	435	318	614
	#6	223	689	331
Dangjin	#1	926	294	637
	#2	787	211	632
	#3	510	605	141
	#4	746	528	134
	#5	-	-	5,701
	#6	-	-	1,779
Ulsan	#1	484	114	750
	#2	1,061	82	585
	#3	500	554	662
	#4	1,450	1,238	1,971
	#5	1,740	931	1,676
	#6	1,525	1,603	1,708
Youngnam	#1	1,024	837	844
	#2	270	274	584
Yosu	#1	370	571	434
	#2	86	436	346
Pyongtaek	#1	167	247	118
	#2	195	232	140
	#3	111	240	132
	#4	123	225	138
Namjeju	#1	20	6	15
	#2	24	13	12
Jeju	#1	23	7	12
	#2	65	73	-
	#3	-	41	48
Seoul	#4	-	1	-
	#5	4	3	1
Incheon	#1	6	-	-
	#2	6	-	-
	#3	247	149	372
	#4	170	171	400
Pyongtaek C/C		96,032	21	1

	Ilsan	C/C	40,006	-	-
	Bundang	C/C	-	-	-
	Ulsan	C/C	63,295	-	-
	Seoincheon	C/C	44,792	88	335
	Shinincheon	C/C	47,393	-	-
	Boryeong	C/C	97,106	-	-
	Hallim	C/C	16,286	28,796	29,686
	Anyang	C/C	-	-	-
	Bucheon	C/C	-	-	-
	K I E Co.	C/C	103,057	-	-
	L G Bugog	C/C	67,273	-	-
	Namjeju	D/P	84	80	37
	Jeju	D/P	-	-	72
	Busan		1,213	2,687	-
	Yonghung	#1	-	27,916	4,541
		#2	-	18,314	2,903
	Yulchon	C/C	-	596	159
	Jeju	G/T	-	2,232	2,869
Energy sources	**Plant Name**		**Fuel consumption 2003 (ton)**	**Fuel consumption 2004 (ton)**	**Fuel consumption 2005 (ton)**
LNG	Pyongtaek	#1	2,727	2,095	3,553
		#2	2,402	2,515	2,641
		#3	2,238	3,791	1,784
		#4	2,370	3,217	2,047
	Seoul	#4	32,670	22,409	49,143
		#5	126,211	117,908	108,761
	Incheon	#1	25,930	10,523	4,365
		#2	28,612	11,094	8,505
		#3	34,035	4,235	746
		#4	24,093	526	6,620
	Pyongtaek C/C		76,012	98,846	110,953
	Ilsan	C/C	530,874	593,548	533,188
	Bundang	C/C	598,396	653,880	671,944
	Ulsan	C/C	189,997	347,076	470,131
	Seoincheon	C/C	1,012,670	1,209,806	989,645
	Shinincheon	C/C	1,405,724	1,587,638	1,458,763
	Boryeong	C/C	571,742	988,548	1,161,510
	Incheon	C/C	-	-	281,813
	Anyang	C/C	325,207	270,559	261,202
	Bucheon	C/C	266,577	258,596	261,705
	K I E Co.	C/C	381,684	467,583	445,253
	GS Bugog	C/C	121,037	260,653	297,976
	Busan	C/C	234,533	1,298,418	1,211,144
	Yulchon	C/C	-	7,388	194,534

Source : Statistics of Electric Power in KOREA (2004, 2005, 2006) (KEPCO)

<Table -2> Net Caloric Values by Power Plant in 2003

Plant Name		Caloric value (by source in 2003)			
		Coal (kcal/kg)	Heavy oil (kcal/l)	Diesel oil (kcal/l)	L. N. G (kcal/kg)
Honam	#1	5,693	9,859	8,844	-
	#2	5,655	9,901	8,847	-
Samchonpo	#1	5,846	-	9,009	-
	#2	5,844	-	9,011	-
	#3	5,862	-	8,948	-
	#4	5,855	-	8,992	-
	#5	5,766	-	9,000	-
	#6	5,765	-	9,000	-
Boryeong	#1	6,066	-	8,942	-
	#2	6,075	-	8,944	-
	#3	6,254	-	8,749	-
	#4	6,254	-	8,777	-
	#5	6,254	-	8,749	-
	#6	6,239	-	8,749	-
Taean	#1	6,181	-	9,013	-
	#2	6,192	-	9,013	-
	#3	6,188	-	9,013	-
	#4	6,198	-	9,013	-
	#5	6,155	-	9,013	-
	#6	6,167	-	9,013	-
Hadong	#1	6,149	-	8,941	-
	#2	6,144	-	8,984	-
	#3	6,146	-	8,912	-
	#4	6,145	-	8,957	-
	#5	6,148	-	8,871	-
	#6	6,142	-	8,839	-
Dangjin	#1	6,102		8,892	-
	#2	6,121		8,904	-
	#3	6,129		8,889	-
	#4	6,118		8,893	-
Ulsan	#1	-	9,861	9,018	-
	#2	-	9,856	9,047	-
	#3	-	9,862	9,035	-
	#4	-	9,921	9,120	-
	#5	-	9,912	9,120	-
	#6	-	9,921	9,120	-
Youngnam	#1	-	9,196	8,997	-
	#2	-	9,043	8,993	-
Yosu	#1	-	9,979	8,975	-

	#2	-	9,983	8,970	-
Pyongtaek	#1	-	9,838	8,974	-
	#2	-	9,844	8,972	12,955
	#3	-	9,845	8,977	12,929
	#4	-	9,842	8,976	12,950
Namjeju	#1	-	9,852	8,900	-
	#2	-	9,853	8,958	-
Jeju	#1	-	10,009	9,238	-
	#2	-	9,945	8,928	-
	#3	-	9,943	8,928	-
Seoul	#4	-	-	9,070	13,013
	#5	-	-	7,515	13,003
Incheon	#1	-	9,828	7,526	13,018
	#2	-	9,833	8,986	13,018
	#3	-	9,822	8,993	13,017
	#4	-	9,830	8,988	13,015
Pyongtaek	C/C	-	-	8,926	13,026
Ilsan	C/C	-	-	8,966	13,021
Bundang	C/C	-	-	-	13,030
Ulsan	C/C	-	-	9,053	13,007
Seoincheon	C/C	-	-	9,151	12,999
Shinincheon	C/C	-	-	9,150	13,005
Boryeong	C/C	-	-	9,131	13,016
Busan	C/C	-	-	9,242	12,997
Hallim	C/C	-	-	8,964	-
Anyang C/C	(Other co.)	-	-	-	13,033
Bucheon C/C	(")	-	-	-	13,022
K I E Co.	(")	-	-	9,092	13,014
L G Bugog	(")	-	-	9,033	13,018
Namjeju	D/P	-	9,852	8,881	-

Source : Statistics of Electric Power in KOREA (2004) (KEPCO)

<Table -3> Net Caloric Values by Power Plant in 2004

Plant Name		Caloric value (by source in 2004)			
		Coal	Heavy oil	Diesel oil	L. N. G
		(kcal/kg)	(kcal/l)	(kcal/l)	(kcal/kg)
Honam	#1	5,493	9,814	8,848	-
	#2	5,430	9,817	8,850	-
Samchonpo	#1	5,527	-	9,012	-
	#2	6,275	-	9,010	-
	#3	6,530	-	9,006	-
	#4	6,507	-	9,004	-
	#5	4,829	-	9,000	-
	#6	4,773	-	9,000	-
Yonghung	#1	5,892	-	8,927	-
	#2	5,852	-	8,720	-
Boryeong	#1	5,924	-	8,770	-
	#2	5,922	-	8,910	-
	#3	5,943	-	8,749	-
	#4	5,945	-	8,749	-
	#5	5,931	-	8,749	-
	#6	5,937	-	8,749	-
Taean	#1	5,980	-	8,765	-
	#2	5,977	-	8,699	-
	#3	5,975	-	9,004	-
	#4	5,967	-	8,721	-
	#5	5,996	-	8,912	-
	#6	5,996	-	8,804	-
Hadong	#1	6,032	-	9,002	-
	#2	6,025	-	8,975	-
	#3	6,046	-	8,983	-
	#4	6,097	-	8,993	-
	#5	5,982	-	8,983	-
	#6	5,935	-	8,983	-
Dangjin	#1	6,011	-	8,880	-
	#2	6,000	-	8,889	-
	#3	5,976	-	8,897	-
	#4	5,966	-	8,898	-
Ulsan	#1	-	9,893	9,010	-
	#2	-	9,901	9,010	-
	#3	-	9,896	9,010	-
	#4	-	9,972	9,120	-
	#5	-	9,963	9,120	-
	#6	-	9,959	9,120	-
Youngnam	#1	-	7,432	8,865	-
	#2	-	7,679	8,876	-
Yosu	#1	-	10,011	8,924	-
	#2	-	10,009	8,956	-

Pyongtaek	#1	-	9,877	8,917	12,920
	#2	-	9,879	8,941	12,907
	#3	-	9,902	8,907	12,910
	#4	-	9,903	8,915	12,956
Namjeju	#1	-	9,900	9,333	-
	#2	-	9,901	8,846	-
Jeju	#1	-	9,897	8,961	-
	#2	-	9,912	8,936	-
	#3	-	9,919	8,928	-
Namjeju	D/P	-	9,901		-
Seoul	#4	-	-	9,070	13,011
	#5	-	-	9,070	13,014
Incheon	#1	-	-		13,038
	#2	-	-		13,039
	#3	-	-	8,951	13,038
	#4	-	-	8,949	13,021
Pyongtaek C/C		-	-	8,758	13,033
Ilsan	C/C	-	-	-	13,017
Bundang	C/C	-	-	-	13,026
Ulsan	C/C	-	-	-	12,920
Seoincheon	C/C	-	-	9,211	13,010
Shinincheon	C/C	-	-	-	13,017
Boryeong	C/C	-	-	-	13,025
Busan	C/C	-	-	-	13,004
Hallim	C/C	-	-	8,972	-
Anyang	C/C	-	-	-	13,025
Bucheon	C/C	-	-	-	13,013
K I E Co.	C/C	-	-	-	13,023
L G Bugog	C/C	-	-	-	13,028
Yulchon	C/C	-	-	11,731	13,014
Namjeju	D/P	-	-	8,867	-
Jeju	G/T	-	-	8,948	-

Source: Statistics of Electric Power in KOREA (2005) (KEPCO)

<Table -4> Net Caloric Values by Power Plant in 2005

Plant Name		Caloric value			
		Coal (kcal/kg)	Heavy oil (kcal/l)	Diesel oil (kcal/l)	L. N. G (kcal/kg)
Honam	#1	5,392	9,835	8,809	-
	#2	5,376	9,854	8,804	-
Samchonpo	#1	5,913	-	8,841	-
	#2	5,924	-	8,883	-
	#3	5,897	-	9,000	-
	#4	5,898	-	8,943	-
	#5	5,347	-	8,614	-
	#6	5,376	-	9,000	-
Yonghung	#1	6,131	-	8,935	-
	#2	6,053	-	8,947	-
Boryeong	#1	5,830	-	8,943	-
	#2	5,816	-	8,943	-
	#3	5,882	-	8,740	-
	#4	5,890	-	8,748	-
	#5	5,882	-	8,749	-
	#6	5,901	-	8,749	-
Taean	#1	6,000	-	8,692	-
	#2	6,009	-	8,684	-
	#3	6,007	-	8,676	-
	#4	5,999	-	8,705	-
	#5	6,032	-	8,676	-
	#6	6,017	-	8,691	-
Hadong	#1	6,003	-	8,940	-
	#2	5,997	-	8,928	-
	#3	5,998	-	8,982	-
	#4	5,999	-	8,938	-
	#5	5,995	-	8,975	-
	#6	5,995	-	8,928	-
Dangjin	#1	5,962	-	8,834	-
	#2	5,962	-	8,915	-
	#3	5,935	-	8,844	-
	#4	5,941	-	8,828	-
	#5	6,115	-	8,904	-
	#6	6,221	-	11,095	-
Ulsan	#1	-	9,900	9,116	-
	#2	-	9,903	9,113	-
	#3	-	9,908	9,119	-
	#4	-	10,001	9,122	-
	#5	-	9,993	9,122	-
	#6	-	9,979	9,118	-
Youngnam	#1	-	7,482	8,942	-
	#2	-	7,729	8,943	-
Yosu	#1	-	9,960	8,887	-

	#2	-	9,944	8,886	-
Pyongtaek	#1	-	9,903	8,943	12,898
	#2	-	9,905	8,961	12,872
	#3	-	9,907	8,949	12,942
	#4	-	9,909	8,949	12,893
Namjeju	#1	-	9,878	9,318	-
	#2	-	9,879	9,307	-
Jeju	#1	-	9,932	8,885	-
	#2	-	9,929	-	-
	#3	-	9,925	8,938	-
Seoul	#4	-	-	-	13,002
	#5	-	-	9,070	13,008
Incheon	#1	-	-	-	13,032
	#2	-	-	-	13,025
	#3	-	-	8,964	13,030
	#4	-	-	8,954	13,026
Namjeju	D/P	-	9,877	8,975	-
Jeju	G/T	-	-	25,589	-
Jeju	D/P	-	9,932	8,954	-
Pyongtaek C/C		-	-	8,950	13,030
Ilsan	C/C	-	-	-	13,011
Bundang	C/C	-	-	-	13,025
Ulsan	C/C	-	-	-	12,750
Seoincheon	C/C	-	-	9,200	13,009
Shinincheon	C/C	-	-	-	13,013
Boryeong	C/C	-	-	-	13,030
Incheon	C/C	-	-	-	13,012
Busan	C/C	-	-		13,000
Hallim	C/C	-	-	8,973	-
Anyang	C/C	-	-	-	13,025
Bucheon	C/C	-	-	-	13,003
POSCO POWER	C/C	-	-	-	13,024
G S Bugog	C/C	-	-	-	13,756
Yulchon	C/C	-	-	10,930	13,023

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

<Table -5> CEF Calculation for the Operating Margin in 2003, 2004, 2005

Plant Name		MWh Produced in 2003	MWh Produced in 2004	MWh Produced in 2005	CEF (tCO2/MWh) 2003	CEF (tCO2/MWh) 2004	CEF (tCO2/MWh) 2005
Honam	#1	1,372,873	1,855,554	1,787,715	0.9770	0.9681	0.9695
	#2	1,784,483	1,625,399	1,875,790	0.9735	0.9682	0.9649
Samchonpo	#1	3,745,916	3,974,202	3,810,079	0.8844	0.8339	0.8786
	#2	4,110,134	3,839,080	4,323,618	0.8812	0.9435	0.8748
	#3	4,051,427	3,652,769	4,343,666	0.8722	0.9674	0.8626
	#4	4,250,404	3,811,371	4,112,297	0.8686	0.9690	0.8637
	#5	3,606,167	4,147,957	3,542,728	0.8445	0.7330	0.8447
	#6	3,609,696	4,185,213	3,643,969	0.8468	0.7298	0.8419
Yonghung	#1	-	2,986,382	5,623,299	-	0.8347	0.8388
	#2	-	1,172,450	4,658,862	-	0.8846	0.8452
Boryeong	#1	3,237,526	4,014,109	3,547,140	0.8731	0.8704	0.8732
	#2	3,380,013	3,915,285	3,433,608	0.8696	0.8675	0.8674
	#3	4,090,927	3,746,265	4,124,745	0.8331	0.8351	0.8354
	#4	3,754,883	4,097,489	3,698,705	0.8326	0.8345	0.8348
	#5	4,063,865	3,660,240	4,121,314	0.8330	0.8350	0.8356
	#6	3,709,092	4,093,207	3,283,477	0.8332	0.8343	0.8354
Taean	#1	3,995,111	3,780,097	3,992,112	0.8367	0.8393	0.8361
	#2	3,651,716	3,975,123	3,484,251	0.8341	0.8367	0.8414
	#3	3,994,351	3,732,363	3,957,054	0.8333	0.8356	0.8366
	#4	3,708,360	4,048,258	3,653,534	0.8375	0.8367	0.8375
	#5	3,370,362	4,091,406	3,744,413	0.8378	0.8361	0.8386
	#5	3,637,652	4,056,835	3,999,847	0.8356	0.8347	0.8348
Hadong	#1	3,995,331	3,688,313	3,997,914	0.8377	0.8382	0.8382
	#2	3,739,800	4,028,529	3,732,583	0.8346	0.8356	0.8357
	#3	3,694,945	3,997,064	3,769,077	0.8357	0.8374	0.8346
	#4	4,029,035	3,724,757	3,989,315	0.8340	0.8437	0.8380
	#5	3,733,243	4,013,845	3,553,901	0.8352	0.8251	0.8372
	#6	4,013,010	3,685,698	4,037,763	0.8315	0.8193	0.8325
Dangjin	#1	3,677,169	3,986,406	3,797,307	0.8383	0.8356	0.8331
	#2	3,685,913	4,038,457	3,798,078	0.8336	0.8346	0.8323
	#3	4,034,969	3,711,787	4,081,017	0.8338	0.8339	0.8305
	#4	4,096,642	3,801,495	4,079,557	0.8269	0.8304	0.8290
	#5	-	-	1,318,670	-	-	0.8654
	#6	-	-	96,365	-	-	0.9800
Ulsan	#1	430,067	271,544	262,393	0.7928	0.8156	0.8140
	#2	404,834	244,246	255,812	0.7835	0.8073	0.7995
	#3	414,630	268,231	200,518	0.7930	0.8066	0.8077
	#4	1,507,363	1,759,376	1,549,091	0.7271	0.7282	0.7415
	#5	2,025,171	2,141,162	1,500,935	0.7250	0.7288	0.7410
	#6	1,363,879	2,196,344	1,454,644	0.7274	0.7298	0.7402
Youngnam	#1	890,011	973,872	1,022,470	0.7906	0.8089	0.8043
	#2	753,536	665,973	531,006	0.8170	0.8722	0.8455
Yosu	#1	703,557	723,968	430,310	0.7523	0.7673	0.7563
	#2	328,981	1,304,109	904,597	0.7946	0.7407	0.7320
Pyongtaek	#1	1,465,460	850,533	1,258,662	0.7032	0.7316	0.7109
	#2	1,393,188	880,646	1,376,342	0.7062	0.7251	0.7097
	#3	1,400,056	751,633	1,321,167	0.7110	0.7372	0.7077
	#4	1,539,552	800,854	1,338,204	0.7081	0.7365	0.7065
Namjeju	#1	38,080	50,294	44,602	0.9879	0.9901	0.9876

	#2	36,860	48,714	44,654	0.9962	0.9936	1.0135
Jeju	#1	30,288	44,659	36,266	1.0450	1.0335	1.0488
	#2	439,474	486,401	532,700	0.7437	0.7357	0.7352
	#3	513,880	509,330	502,189	0.7363	0.7366	0.7398
Seoul	#4	132,599	90,322	207,498	0.7116	0.7165	0.6835
	#5	503,383	480,919	444,324	0.7236	0.7082	0.7067
Incheon	#1	225,023	47,491	16,450	0.6308	0.6412	0.7675
	#2	242,806	49,144	37,727	0.6200	0.6533	0.6517
	#3	267,999	19,018	-	0.6483	0.6649	-
	#4	214,153	594	29,202	0.6594	3.3103	0.6912
Namjeju	D/P	265,063	274,089	268,073	0.6393	0.6367	0.6369
Jeju	G/T	-	3,016	5,069	-	1.9307	4.2227
Jeju	D/P	-	-	268,074	-	-	0.3596
Pyongtaek	C/C	863,292	596,001	659,932	0.5440	0.4798	0.4862
Ilsan	C/C	3,097,425	3,281,407	2,873,958	0.5291	0.5226	0.5358
Bundang	C/C	3,344,852	3,650,122	3,742,073	0.5174	0.5179	0.5191
Ulsan	C/C	1,557,954	2,329,524	3,131,075	0.4593	0.4272	0.4249
Seoincheon	C/C	7,012,289	8,353,619	7,001,031	0.4337	0.4182	0.4083
Shinincheon	C/C	10,459,986	11,596,955	10,543,280	0.4000	0.3955	0.3996
Boryeong	C/C	4,436,234	6,979,928	8,221,926	0.4306	0.4094	0.4086
Incheon	C/C	-	-	2,055,016	-	-	0.3960
Busan	C/C	1,574,883	9,884,075	9,076,327	0.4317	0.3791	0.3850
Hallim	C/C	55,044	96,435	100,346	0.7733	0.7811	0.7739
Anyang	C/C	1,793,725	1,506,070	1,433,978	0.5244	0.5194	0.5266
Bucheon	C/C	1,454,854	1,425,073	1,404,160	0.5296	0.5241	0.5379
K I E Co.	C/C	2,683,591	2,809,983	2,571,095	0.5126	0.4810	0.5006
L G Bugog	C/C	1,221,992	1,894,996	2,189,808	0.4312	0.3977	0.4155
Yulchon	C/C	-	36,366	1,300,627	-	0.6429	0.4327
Total(inland)		**166,911,025**	**187,514,442**	**195,161,380**	**0.7424**	**0.7161**	**0.7179**
Total(Jeju)		**1,378,689**	**1,512,938**	**1,801,973**	**0.7422**	**0.7489**	**0.6974**

Source: Statistics of Electric Power in KOREA (2004, 2005, 2006) (KEPCO)

<Table -6>Fuel Carbon Emission Factor

Fuel	Carbon Emission Factor (tC/TJ)	Fuel	Carbon Emission Factor (tC/TJ)
Liquid Fossil		**Solid Fossil**	
Primary fuels		*Primary Fuels*	
Crude oil	20	Anthracite	26.8
Orimulsion	22	Coking coal	25.8
Natural gas liquids	17.2	Other bituminous coal	25.8
Secondary fuels/products		sub-bituminous coal	26.2
Gasoline	18.9	Lignite	27.6
Jet kerosene	19.5	Oil shale	29.1
Other Kerosene	19.6	Peat	28.9
Shale oil	20	*Secondary fuels/products*	
Gas/Diesel oil	20.2	BKB & Patent Fuel	25.8
Residual fuel oil	21.1	Coke Oven/Gas Coke	29.5
LPG	17.2	Coke gas oven	13
Ethane	16.8	Blast Furnace gas	66
Naphtha	20	**Gaseous Fossil**	
Bitumen	22	Natural gas (dry)	15.3
Lubricants	20	**Biomass**	
Petroleum coke	27.5	Solid Biomass	29.9
Refinery Feedstocks	20	Liquid Biomass	20
Refinery gas	18.2	Gas Biomass	30.6
Other oil	20		

Source: IPCC Guidelines, 1996a

<Table 7.> Sample group plants used in Build Margin calculation

Plant name		Technology	Year operation	Fuel	MWh In 2005	% of total output	CO2 Emission (tCO2)
Hankyung wind power		wind	2004.03	wind	18,265	1.70%	-
Hoicheon ENC		steam	2003.05	LFG	3,650	0.34%	-
Jeju	#3	steam	2000.12	Heavy oil	502,189	46.63%	371,508
Jeju	#2	steam	2000.03	Heavy oil	532,700	49.46%	391,642
Haengwon-wind power	15EA	wind	1998.02	wind	20,126	1.87%	-
Total					1,076,930	100%	763,150
Build Margin Emission Factor						0.7086	
Total generation in Jeju island					3,008,502		

Annex 4

MONITORING INFORMATION

Please refer to section B.7.