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:

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Daegu & SinanJeungdo PV(photovoltaic) Power Plant Project
Version : 05
Date : 30/09/2008

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

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Description of the project activity

Daegu & SinanJeungdo PV Power Plant is located at Daegu branch, Korea District Heating Corporation(KDHC) and Jeungdo, Sinangun, JeollaNamdo.
The project is a bundled project which consists of Daegu 0.1MW PV Power Plant and SinanJeungdo 0.8MW PV Power Plant. The expected annual electricity exported to the grid by this project is 1,302MWh and the expected annual emission reduction is 827 tCO_2e.
The purpose of this project is to abate greenhouse gas(GHG) emissions by electricity generation of two PV Power Plants instead of using fossil fuel .
The project is developed, financed and implemented by KDHC.
KDHC has been serving customers for 18 years since it was established in November 1985 by the Korea Government, promoting energy conservation and improving living standards, through the efficient use of district heating.

The purpose of the project activity

The PV Power Plant generates electricity utilizing photovoltaic which emits zero GHG into the atmosphere or water system without any natural resources depletion. The purpose of this project is to abate GHG emissions through generating electricity by PV Power without using fossil fuel. The project supports the government policy which promotes development of renewable energy technology in Republic of Korea and also contributes to the decreased dependence on electricity generated by thermal power plants using fossil fuel which takes more than 50% of electricity generation in Korea.

Contribution of the project activity to sustainable development

The project contributes to sustainable development in the following ways:
- Generation by photovoltaic Power Plant decreases fossil use and will make nation-wide benefit.
- As one of renewable energy sources, photovoltaic power does not emit any GHG and pollutant into the air and contribute to improve local air quality
- Photovoltaic power can be utilized as an energy source for future generations, because it alternates fossil fuel and does not impact in resource exhaustion.
- As a good practice for renewable energy use and environmental improvement, the project activity could be replicated across other district heating companies or heat suppliers in Korea.

A.3. Project participants:

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<Table 1> Project participants

Name of Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants	Kindly indicates if the party involves wish to be considered a project participant (yes/no)
Republic of Korea (host Party)	Private entity : Korea District Heating Corporation	No

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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1) Daegu PV Power Plant : Daegu City 2) SinanJeungdo PV Power Plant : JeollaNamdo

A.4.1.3. City/Town/Community etc:

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1) Daegu PV Power Plant : 895 Daecheondong Dalseogu Daegu city

2) SinanJeungdo PV Power Plant : 4-1 Daechori Jeungdomyeon Sinangun JeollaNamdo

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

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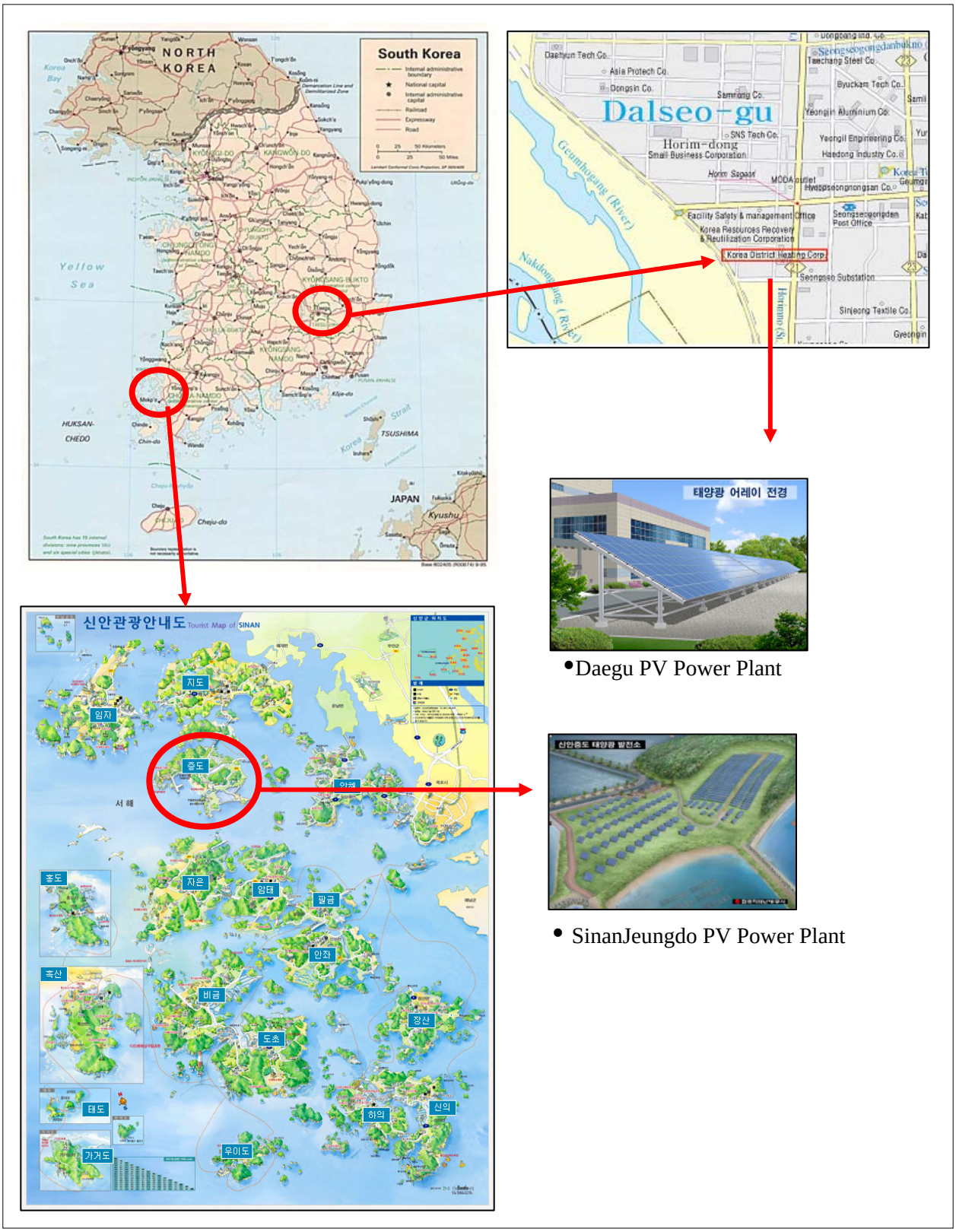
The Daegu project site is located in the KDHC Daegu branch, which is located in the Seongseo industrial area at Daecheondong Dalseogu Daegu city.(2,442 ㎡) There are 'Keimyung University' and 'Keimyung University Subway station' around the Daegu project site.

The SinanJeungdo project site is located in Jeungdo area Sinangun JeollaNamdo.(56,298 ㎡) The Sinan Jeungdo project site is the next to 'Taepyeong Saltern'.



•Daegu PV Power Plant

• SinanJeungdo PV Power Plant

<Figure 1> The location of Daegu & SinanJeungdo PV Power Plant

<Figure 2> Daegu PV Power Plant

<Figure 3> SinanJeungdo PV Power Plant

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

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According to the categories' list of CDM project's activities of the Appendix B of the simplified modalities and procedure for small-scale CDM project activities, the Daegu & SinanJeungdo PV Power project relates to the Type Ⅰ, category D.

The photovoltaic generating Plant consists of a PV array, a power conditioning system, a boosting transformer and an electricity grid connecting system.

The PV array inverts a photovoltaic power to a direct current electricity power. The power conditioning system inverts a direct current to an alternating current. The step-up transformer sends a generated voltage to a power-transmission line.

Unlike the Daegu Project with only fixed type, the SinanJeungdo Project use both solar tracking type and fixed type. The PV generation efficiency of Solar tracking type is 20~30% higher than that of Fixed type according to the recent research report(2006.3.31), 'Improvement of Alternative Energy Development Promotion Act and scheme connected with RPS system' published by Korean Government, Ministry of Commerce, Industry and Energy.

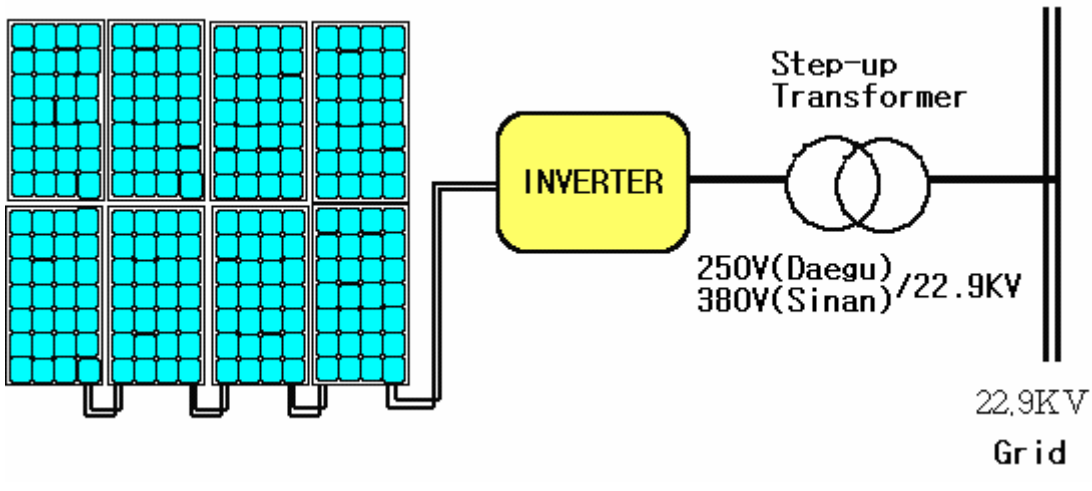
The remote operating and monitoring system of the PV Power Plant makes possible to audit and measure the data by sending electric characteristics such as power generation, voltage, electric current and frequency of photovoltaic generation of electric power to the main computer. It is also possible to audit and measure the data at a distant place by a LAN or a modem and so a part which breaks down will be captured and managed quickly at a distant place, in case that there is something wrong with the equipment.

The project is the electricity generation system using Solar Cells which generate a photoelectric effect in the presence of sunlight. Kyungdong Solar (Daegu Projcet) and Unison (SinanJeungdo Project) supply Solar Cells which are manufactured by Solar World in Germany.

This project used an innovative new module, SW 165(Daegu)/175(SinanJeungdo) mono from SolarWorld.

The operating team was trained for operating, monitoring and managing PV generation system by Manufacturing Company, Solar World. Solar World made KDHC operate by itself through technology transfer. KDHC furnished training materials to operation workers of central control room and operation workers will always be able to study in order.

<Figure 4> The organization of the PV generation



PV Array	Inverter(PCS)	Step-up Transformer	grid connecting system

<Table 2> Technology description

Item			Daegu Project	SinanJeungdo Project
Solar Cell	Type		Si Solar Cells	Si Solar Cells
	Model		SW 165 mono, SolarWorld	SW 175 mono, SolarWorld
	Capacity		100kWp	800kWp 450kWp (Fixed), 50kWp (1axis), 300kWp(2 axis)
	Module Maximum Output Power		165 Wp (±5%)	175 Wp (±10%)
	Cell efficiency		15%	15%
	The number of module		612 pieces	4,608 pieces
Inverter	Type	Fixed Type	Indoor, vertical-pount	Indoor, vertical-pount
		Tracking Type	-	Outdoor
	Capacity	Fixed Type	30kW×2 / 40kW×1	150kW×3
		Tracking Type	-	3.3kW×96 (both axis type)/ 6kW×12 (one axis type)
	Efficiency		93%	93%
	Output Voltage	Fixed Type	250V	380V
		Tracking Type	-	220V
	Control Method		PWM	PWM
	Node form	Fixed Type	3-Phase 3-Wire	3-Phase 3-Wire
		Tracking Type	-	1-Phase 2-Wire
Tracker	Tracking Type		-	Program type(both axis type) / Sensor type(one axis type)
Transformer	Efficiency		97%	97%

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

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Total emission reductions from the electricity exported to grid by the project is estimated as 8,270 tCO2e Over years (crediting period), which means an average annual emission reduction of 827 tCO2e.

<Table 3> Annual estimation of emission reduction

Years	Annual estimation of emission reductions in tonnes of CO_2 e
August 2008 – July 2009	827
August 2009 – July 2010	827
August 2010 – July 2011	827
August 2011 – July 2012	827
August 2012 – July 2013	827
August 2013 – July 2014	827
August 2014 – July 2015	827
August 2015 – July 2016	827
August 2016 – July 2017	827
August 2017 – July 2018	827
Total estimated reductions (tonnes of CO_2 e)	8,270

Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (tonnes of tCO_2 e)	827

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

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This project has been invested by KDHC. Therefore, this project is not funded by official development assistance or other sources as the financial obligations of Parties included in Annex I.

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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Based on the information provided in Appendix C of SSC, a proposed small-scale 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 an application to register another small-scale CDM project activity:

- 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.

In accordance with above the information, this Project is not a debundled component of a larger project activity since the project participant has not registered or operated another project in the region surrounding the project boundary.

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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Project category : Ⅰ.D Grid connected renewable electricity generation

Methodology : AMS Ⅰ.D/Version 12 : Grid connected renewable electricity generation

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 project activity category of AMS Ⅰ.D is “Grid connected renewable electricity generation”
Because the Daegu & SinanJeungdo PV Power Plant Project utilizes renewable energy source and electricity generated by renewable energy source is grid-connected, the project falls into ‘Renewable energy project’ of Type Ⅰ of ‘Appendix B of the simplified modalities and procedures for small-scale CDM project activities’ and ‘Electricity generation for a system’ of category D.

The category applicable to the methodology AMS I.D comprises the below.
1. This category comprises renewable energy generation units, such as photovoltaics, hydro, tidal/wave, wind, geothermal and renewable biomass.

2. If the unit added has both renewable and non-renewable components (e.g. a wind/diesel unit), the eligibility limit of 15MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15MW.
3. Combined heat and power (co-generation) systems are eligible.
4. In the case of project activities that involve the addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15MW and should be physically distinct from the existing units.
5. Project activities that seek to retrofit or modify an existing facility for renewable energy generation are included in this category. To qualify as a small scale project, the total output of the modified or retrofitted unit shall not exceed the limit of 15MW.

This project is satisfied with the above condition like the below.
1. This project is generating electricity by photovoltaic Power Plant.
2. All capacity, 0.9MW including Daegu project and SinanJeungdo project are less than the applicable condition to small scale, 15MW. This project doesn't comprise any other fossil fuel.
3. This project is not Combined heat and power (co-generation) systems, but electricity generation facility.
4. This project is not the addition of renewable energy generation units, but the construction of new renewable energy generation.
5. This Project is not to retrofit or modify an existing facility for renewable energy generation.
This project is applicable to the methodology AMS I.D like the above.

B.3. Description of the project boundary:

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This project is a new PV power generation project. The boundary of this project comprises the new PV power generation facilities in Daegu branch of KDHC and in SinanJeungdo area. The boundary of the project is able to apply to both Baseline and Project.

B.4. Description of baseline and its development:

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According to AMS-I.D version12, the baseline of this project is the kWh produced by the PV power plant multiplied by an emission coefficient (measured in kg CO_2e/kwh) calculated in a transparent and conservative manner, Combined margin(OM+BM) manner.
A grid connected emission coefficient (measured in kg CO_2e/kwh) is calculated conservatively in methodology ACM0002.
The emission factor of this project baseline is calculated by the weighted average of the Operating margin emission factor and Build margin emission factor multiplied together. The details of baseline will be explained at Annex 3.
This project baseline emissions are calculated like the below.

$BE_y = EG_y * EF_y$

Parameter	Value	Source
EF_y	Baseline emission factor	Calculated by the values of Statistics of Electric Power published by KEPCO.
EG_y	The amount of electricity exported to grid by this project activity	Directly measured.

Baseline Estimation

1. Calculating Simple OM method

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 combined margin (CM), consisting of the combination of operating margin (OM) and build margin (BM) factors according to the procedures prescribed in the approved methodology ACM0002. Any of the four procedures to calculate the operating margin can be chosen, but the restrictions to use the Simple OM and the Average OM calculations must be considered.
According to ACM0002, dispatch data analysis should be the first methodological choice for OM emission factor. But, in Korea, dispatch data of the grid is not available. Thus this dispatch data analysis is not selected as an emission factor. Here, Simple OM method is selected for calculating emission factor. As indicated in ACM0002, the Simple OM method can only be used where low-cost/must run resources that are a data for 5 years constitute less than 50% of total grid generation. The simple OM has to be calculated by except for must run/low cost generate resource.

<Table 4> The ratio must run/low cost resources constitute of total grid (%)

	2002	2003	2004	2005	2006
Total net generation(MWh)	292,746,000	308,225,887	326,879,672	348,187,780	365,368,969
must run/low cost (MWh)	124,379,580	136,622,857	135,253,646	149,934,596	152,932,777
Anthracite generation(MWh)	5,991,495	6,236,623	5,130,890	5,117,963	5,183,980
Hydro generation(MWh)	5,266,907	6,830,016	5,802,167	5,135,032	5,144,992
Nuclear generation(MWh)	113,070,088	123,280,502	123,970,409	139,286,513	142,114,439
Renewable energy generation (MWh)	51,090	275,716	350,180	395,088	489,366
must run/low cost generation of Total net generation (%)	42.49	44.32	41.38	43.06	41.94

As above, the average of the five most recent years(2002-2006), low-cost/must run resources constitute less than 50% of total grid generation in Korea. Thus Simple OM is appropriate method for OM emission factor.

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, not including hydro, geothermal, wind, low-cost biomass, nuclear and solar power plants,
$COEF_{i,j,y}$ ($COEF_i = NCV_i \cdot EF_{CO_2 i} \cdot OXID_i$) 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.

According to the calculation formula and variables of the operating margin emission factor above, $EF_{OM,y}$ is 0.7195 tCO2/MWh. The detailed baseline information used in the calculation will be explained at Annex 3.

2. Calculating build margin(BM)

According to ACM0002, Build Margin emission factor can be calculated ex-ante based on the most recent information available on plants already built for sample group m at the time of PDD submission:

① The sample group m consists of either the five power plants that have been built most recent or the power plant capacity additions in the electricity system that comprise 20% of the system generation (in MWh)
② The 5 power plants have been built most recently. Project participants should use from these two options that sample group that comprises the larger annual generation.

<Table 5> Sample plant group (m) for determining Build margin Emission factor

	The power plant capacity additions in the electricity system that comprise 20% of the system generation	Capacity of five power plants that have been built most recently
Net generation(MWh)	74,056,853	22,522
Selected Group	O	

In calculating the BM, emission factor of the power plant capacity additions in the electricity system that comprise 20% of the system generation is selected because the power plant capacity additions in the electricity system that comprise 20% of the system generation is larger than plant capacity five power plants that have been built most recently.

The calculation of BM_y is as follows;

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

According to the calculation formula and variables of the Build margin emission factor above, $EF_{BM,y}$ is 0.3810 tCO2/MWh. The detailed baseline information used in the calculation will be explained at Annex 3.

3. Calculating Combined Margin(CM)

The baseline emission factor is calculated as the weighted average of operating margin emission factor and the build margin emission factor. Generally, for weighting these two factors, the default value comes 50%(W_{OM}=W_{BM}=0.5) for both the operating margin factor and the build margin emission factor.

But in the photovoltaic and wind power project, due to the weather conditions that may bring shut down of the generation system, the weighted default is:
Operating margin, W_{OM}=0.75, and Build margin, W_{BM} =0.25

Based on the results derived from Step 1 and Step 2, $EF_{CM,y}$ is calculated using the following formula:

$$EF_{CM,y} = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \ , \quad W_{OM}=0.75, \ W_{BM}=0.25$$

<Table 6> Calculation of the baseline emission factor ($EF_{CM,y}$)

	Year	Emission factor (tCO2/MWh)
OM	2004-2006	0.7195
BM	2006	0.3810
CM	2006	**0.6349**

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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:

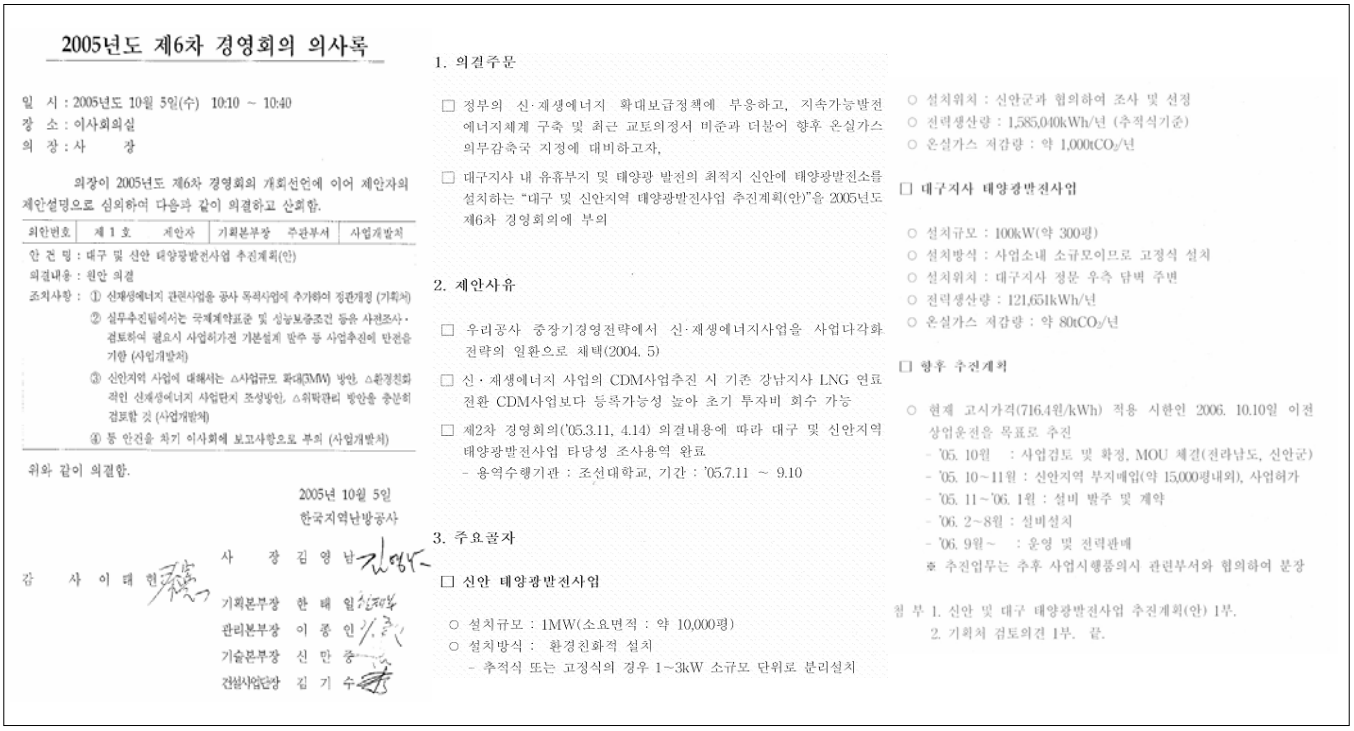
>

Daegu & SinanJeungdo PV(photovoltaic) Power Plant Project was discussed at the KDHC's 6th management session of 2005 for the first time. Although the large amount for investment including purchasing real estates for instalment of PV Power Plant and the maintenance cost had been expected, the executive of KDHC decided to proceed this project for diversifying fuel sources for producing the electricity, serving as a responsible public enterprise and abating the GHG at 6th management meeting on 5 October 2005 and got permission about the electric enterprise from the governor of JeollaNamdo province(13 December 2005) and a mayor of Daegu(22 February 2006). But most of all the possibility of investment's recoupment through selling CERs was considered seriously for development of this project. It can be confirmed through documents of management session and business plans of KDHC.

In case of SinanJeungdo Project the capacity and site for facility had been changed in the middle of proceeding. Thus KDHC received the second permission about site change from the governor of Jeollanamdo province(5 December 2006) and received the final permission about capacity change from the governor of Jeollanamdo province(17 April 2008). As the result of that the construction of PV Power Plant was started late compared with the initial plan and the start of CDM propulsion was also delayed. Expected emission reductions from Daegu PV Power Plant were less than 100tCO_2, it was not reasonable to register the project by itself on economic point of view. Thus KDHC decided to bundle Daegu PV Power Plant project and SinanJeungdo PV Power Plant Project.

After the government's admission, KDHC started construction of Daegu(4 May 2006) & SinanJeungdo (28 February 2007) PV Power Plant and completed construction of Daegu(30 September 2006) & SinanJeungdo(30 November 2007) PV Power Plant. Daegu Plant has been operated since its operation was officially started on 22 September 2006 and SinanJeungdo Plant has been operated since its operation was officially started on 8 November 2007.

<figure 5> the document of 6th management session (2005)



2005년도 제6차 경영회의 의사록

일 시 : 2005년도 10월 5일(수) 10:10 ~ 10:40
장 소 : 이사회의실
의 장 : 사 장

의장이 2005년도 제6차 경영회의 개회선언에 이어 제안자의 제안설명으로 심의하여 다음과 같이 의결하고 산회함.

회안번호	제 1 호	제안자	기획본부장	주관부서	사업개발처

안 건 명 : 대구 및 신안 태양광발전사업 추진계획(안)
의결내용 : 원안 의결
조치사항 : ① 신재생에너지 관련사업을 공사 독점사업에 추가하여 정관개정 (기획처)
② 실무추진팀에서는 국제계약표준 및 심능보증조건 등을 사전조사·검토하여 필요시 사업타당성 기본설계 발주 등 사업추진에 반영을 기할 (사업개발처)
③ 신안지역 사업에 대해서는 △사업규모 확대(3MW) 방안, △환경친화적인 신재생에너지 사업단지 조성방안, △취락관리 방안을 충분히 검토할 것 (사업개발처)
④ 동 안건을 차기 이사회에 보고사항으로 부의 (사업개발처)

위와 같이 의결함.

2005년 10월 5일
한국지역난방공사

감 사 이 태 현
사 장 김 영 남
기획본부장 한 태 일
관리본부장 이 종 인
기술본부장 신 만 중
건설사업단장 김 기 수

1. 의결주문

□ 정부의 신·재생에너지 확대보급정책에 부응하고, 지속가능발전 에너지체계 구축 및 최근 교토의정서 비준과 더불어 향후 온실가스 의무감축국 지정에 대비하고자,

□ 대구지사 내 유휴부지 및 태양광 발전의 최적지 신안에 태양광발전소를 설치하는 "대구 및 신안지역 태양광발전사업 추진계획(안)"을 2005년도 제6차 경영회의에 부의

2. 제안사유

□ 우리공사 중장기경영전략에서 신·재생에너지사업을 사업다각화 전략의 일환으로 채택('2004. 5)

□ 신·재생에너지 사업의 CDM사업추진 시 기존 강남지사 LNG 연료 전환 CDM사업보다 등록가능성 높아 초기 투자비 회수 가능

□ 제2차 경영회의('05.3.11, 4.14) 의결내용에 따라 대구 및 신안지역 태양광발전사업 타당성 조사용역 완료
- 용역수행기관 : 조선대학교, 기간 : '05.7.11 ~ 9.10

3. 주요골자

□ 신안 태양광발전사업

○ 설치규모 : 1MW(소요면적 : 약 10,000평)
○ 설치방식 : 환경친화적 설치
- 추적식 또는 고정식의 경우 1~3kW 소규모 단위로 분리설치
○ 설치위치 : 신안군과 협의하여 조사 및 선정
○ 전력생산량 : 1,585,040kWh/년 (추적식기준)
○ 온실가스 저감량 : 약 1,000tCO2/년

□ 대구지사 태양광발전사업

○ 설치규모 : 100kW(약 300평)
○ 설치방식 : 사업소내 소규모이므로 고정식 설치
○ 설치위치 : 대구지사 정문 우측 담벽 주변
○ 전력생산량 : 121,651kWh/년
○ 온실가스 저감량 : 약 80tCO2/년

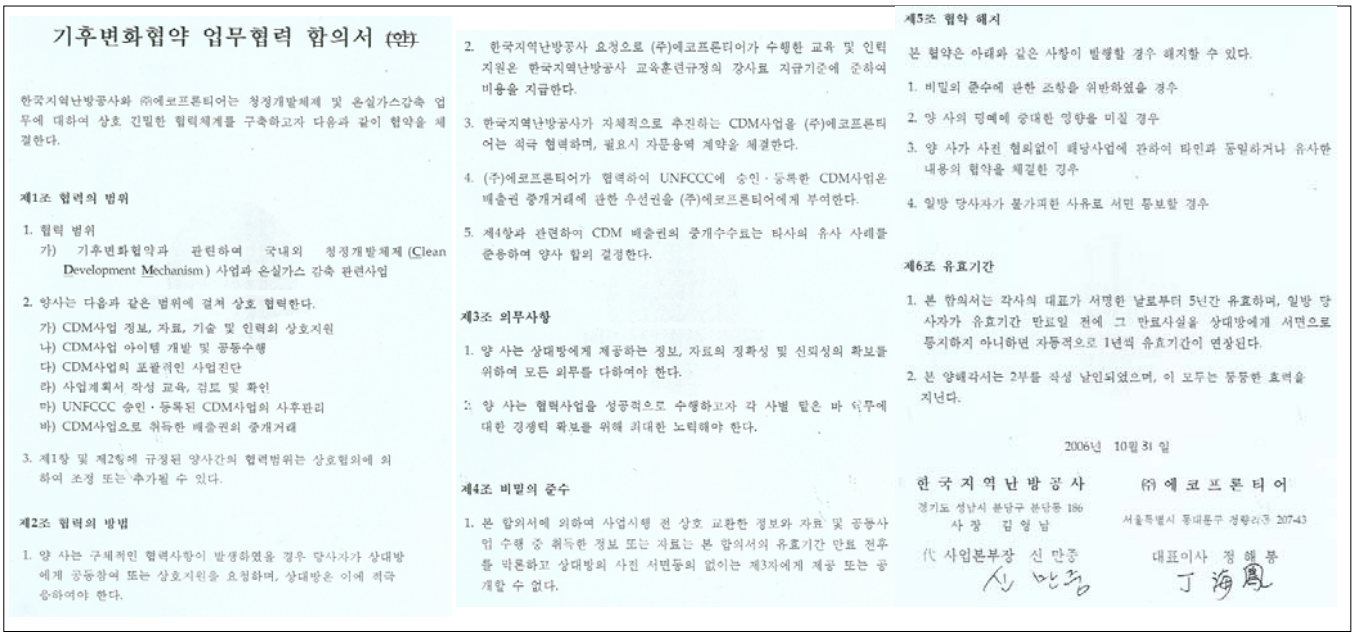
□ 향후 추진계획

○ 현재 고시가격(716.4원/kWh) 적용 시한인 '2006. 10.10일 이전 상업운전을 목표로 추진
- '05. 10월 : 사업검토 및 확정, MOU 체결(전라남도, 신안군)
- '05. 10~11월 : 신안지역 부지매입(약 15,000평내외), 사업허가
- '05. 11~'06. 1월 : 설비 발주 및 계약
- '06. 2~8월 : 설비설치
- '06. 9월~ : 운영 및 전력판매
※ 추진업무는 추후 사업시행품의시 관련부서와 협의하여 분장

첨 부 1. 신안 및 대구 태양광발전사업 추진계획(안) 1부.
2. 기획처 검토의견 1부. 끝.

When KDHC decided to proceed this project, there was an economic barrier to promote the project as CDM. Daegu and SinanJeung PV Power Plants each had very small capacity, so KDHC had to bundle those projects for saving the cost. Even though those projects would be registered as bundling CDM, the CERs would be still very small. Thus KDHC tried to register this project by themselves for saving the cost and raising their ability for dealing CDM. KDHC has focused on the training of employees and KDHC employees working at CDM has been educated steadily. They have attended various educations, conferences and seminars. Especially the educations conducted by DOE and consulting company have been helpful for raising their ability related with CDM and Green House Gas. At the same time, KDHC was trying to register fuel switching project as CDM under a contract with a consultant company and they anticipated obtaining the know-how for other CDM project through the project's registration as CDM. When the fuel switching CDM was registered as CDM, KDHC published the news including the fact PV Power Plant and LFG boiler projects were also proceeding as CDM through the newspapers like financial news(5 April 2007) and Gyeonginilbo(6 April 2007) and KDHC's homepage. Those news can be still confirmed by these web sites (www.kdhc.co.kr , www.kyeongin.com, www.fnnews.com). Furthermore KDHC signed MOU(memorandum of understanding) with the consultant company, Eco-Frontier on 31 October 2006. They agreed that they would cooperate each other for all of the work related with UNFCCC. KDHC employees working at CDM Team has been educated by a consultant company according to the document. Through the education they could learn sufficiently how they write PDD and calculate the emission reductions, which method had to be adopted and the procedure of CDM registration. After the plan of the SinanJeungdo cleared through the final permission from the governor of Jeollanamdo and the SinanJeungdo PV plant was completed, KDHC put their right hand to the work for CDM. Finally they started writing the PDD on September 2007 and signed a contract for validation with KFQ on 29 October 2007. After that KDHC received approval form DNA on 20 June 2008 and requested registration on 25 June 2008.

<figure 6> the memorandum of understanding between KDHC and Eco-Frontier(2006)



기후변화협약 업무협력 합의서 (안)

한국지역난방공사와 ㈜에코프론티어는 청정개발체제 및 온실가스감축 업무에 대하여 상호 긴밀한 협력체계를 구축하고자 다음과 같이 협약을 체결한다.

제1조 협력의 범위

1. 협력 범위
   가) 기후변화협약과 관련하여 국내외 청정개발체제 (Clean Development Mechanism) 사업과 온실가스 감축 관련사업
2. 양사는 다음과 같은 범위에 걸쳐 상호 협력한다.
   가) CDM사업 정보, 자료, 기술 및 인력의 상호지원
   나) CDM사업 아이템 개발 및 공동수행
   다) CDM사업의 포괄적인 사업진단
   라) 사업계획서 작성 교육, 검토 및 확인
   마) UNFCCC 승인·등록된 CDM사업의 사후관리
   바) CDM사업으로 취득한 배출권의 중개거래
3. 제1항 및 제2항에 규정된 양사간의 협력범위는 상호협의에 의하여 조정 또는 추가될 수 있다.

제2조 협력의 방법

1. 양 사는 구체적인 협력사항이 발생하였을 경우 당사자가 상대방에게 공동참여 또는 상호지원을 요청하며, 상대방은 이에 적극 응하여야 한다.
2. 한국지역난방공사 요청으로 (주)에코프론티어가 수행한 교육 및 인력지원은 한국지역난방공사 교육훈련규정의 강사료 지급기준에 준하여 비용을 지급한다.
3. 한국지역난방공사가 지체적으로 추진하는 CDM사업을 (주)에코프론티어는 적극 협력하며, 필요시 자문용역 계약을 체결한다.
4. (주)에코프론티어가 협력하여 UNFCCC에 승인·등록한 CDM사업은 배출권 중개거래에 관한 우선권을 (주)에코프론티어에게 부여한다.
5. 제4항과 관련하여 CDM 배출권의 중개수수료는 타사의 유사 사례를 준용하여 양사 합의 결정한다.

제3조 의무사항

1. 양 사는 상대방에게 제공하는 정보, 자료의 정확성 및 신뢰성의 확보를 위하여 모든 의무를 다하여야 한다.
2. 양 사는 협력사업을 성공적으로 수행하고자 각 사별 맡은 바 의무에 대한 경쟁력 확보를 위해 최대한 노력해야 한다.

제4조 비밀의 준수

1. 본 합의서에 의하여 사업시행 전 상호 교환한 정보와 자료 및 공동사업 수행 중 취득한 정보 또는 자료는 본 합의서의 유효기간 만료 전후를 막론하고 상대방의 사전 서면등의 없이는 제3자에게 제공 또는 공개할 수 없다.

제5조 협약 해지

본 협약은 아래와 같은 사항이 발생할 경우 해지할 수 있다.

1. 비밀의 준수에 관한 조항을 위반하였을 경우
2. 양 사의 명예에 중대한 영향을 미칠 경우
3. 양 사가 사전 협의없이 해당사업에 관하여 타인과 동일하거나 유사한 내용의 협약을 체결한 경우
4. 일방 당사자가 불가피한 사유로 서면 통보할 경우

제6조 유효기간

1. 본 합의서는 각사의 대표가 서명한 날로부터 5년간 유효하며, 일방 당사자가 유효기간 만료일 전에 그 만료사실을 상대방에게 서면으로 통지하지 아니하면 자동적으로 1년씩 유효기간이 연장된다.
2. 본 양해각서는 2부를 작성 날인되었으며, 이 모두는 동등한 효력을 지닌다.

2006년 10월 31 일

한국지역난방공사 — ㈜에코프론티어

According to Attachment A to Annex B of the simplified modalities and procedures for CDM small-scale project activities, to prove additionality, of the project, the evidence to why the proposed project is additional should be offered under at least one of the following barrier categories
(a) Investment barrier (b) Technological barrier (c) Prevailing practice (d) other barriers
This project will prove additionality with (a) Investment barrier.

Investment barrier

The PV generation project require high capital investments but expectation of return is very low. Due to these reasons, the PV generation project is not a very attractive option for power generation. The main reason that the PV generation project is unprofitable is because the average price of the system marginal price(SMP) for the PV generation is very low, 82.116KRW/kWh(2006).

In case of this project, we calculate Net Present Value for this category considering the amount of expected annual generation and the average price of the system marginal price 82.12 KRW/kWh (2006) for PV generation. In calculating the amount of expected annual generation, we used 13.8%(Daegu project), 15.0%(SinanJeungdo project's Fixed type), 17.6%(SinanJeungdo project's Tracking one axis type), 19.5%(SinanJeungdo project's Tracking both axis type) as PV generation utilization rate

<Table 7> The projects' Net Present Value

	Daegu project		SinanJeungdo project	
	Without CERs benefit	With CERs benefit	Without CERs benefit	With CERs benefit
The projects' Net Present Value	-818	-802	-6,517	-6,363

(Unit : million won)

We calculated NPV with using expected benefits from electricity and CERs sales and costs from construction and operation for PV power facility. As the above, NPV of this project is very poor regardless of CERs benefit.

· Sensitivity analysis :

In order to check how this project's NPV is affected by changing discount rate, PV generation utilization rate and the average price of the system marginal price(SMP), Sensitivity analysis was performed using discount rate, PV generation utilization rate and the average price of the system marginal price(SMP) as a parameter.

<Table 8> NPV's Sensitivity analysis by changing PV generation discount rate

Discount rate changing (in current discount rate 7%)	Daegu project		SinanJeungdo project	
	Without CERs benefit	With CERs benefit	Without CERs benefit	With CERs benefit
Discount rate is **3%**.	-812	-789	-6,386	-6,169
Discount rate is **10%**.	-822	-809	-6,581	-6,457

(Unit : million won)

<Table 9> NPV's Sensitivity analysis by changing PV generation utilization rate

PV generation utilization rate Changing	Daegu project		SinanJeungdo project	
	Without CERs benefit	With CERs benefit	Without CERs benefit	With CERs benefit
10% lower than expected.	-829	-815	-6,620	-6,481
30% higher than expected.	-787	-766	-6,209	-6,008

(Unit : million won)

<Table 10> NPV's Sensitivity analysis by changing the average price of SMP

SMP changing	Daegu project		SinanJeungdo project	
	Without CERs benefit	With CERs benefit	Without CERs benefit	With CERs benefit
10% lower than expected.	-829	-813	-6,620	-6,465
10% higher than expected.	-808	-792	-6,414	-6,260

(Unit : million won)

<Table 11> Data and parameters that are available at NPV and NPV's Sensitivity analysis

Cost	Daegu	SinanJeungdo	Remark
Construction (million won)	835	6,637	-
Design (million won)	-	204	-

Maintenance	1.00%	1.00%	- 1% of construction expense
Electricity Generation	120,888	1,180,629	- Calculated
SMP	82.116	82.116	- System Marginal Price(2006, Korea Power Exchange) - In 2002, subsidy for renewable energy facility was established first with Alternative Energy Development Promotion Act(No. 6672) and in 2004 the law was revised with Alternative Energy Development Promotion Act(No. 7284)
Discount rate	7.00%	7.00%	- 2nd basic plan of long term electric supply & demand(2004, Ministry of Commerce, industry and Energy, now Ministry of Knowledge Economy)

As a result of sensitivity analysis, NPV of this project is also very poor . Therefore, sensitivity analysis didn't make difference of additionality of the project.

Impact of CDM registration

Although the expected NPV for this project is too low to justify implementation on a business-as usual basis, this project will be used as a stepping stone toward future renewable projects of KDHC and the expected additional financial benefit from CERs sales can lead KDHC to future progress with the planning and development of the proposed project. This can be confirmed through the final report of "business feasibility analysis" by Chosun University.

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) 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 AMS I.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 = 1,302MWh*0.6349 ton CO_2/MWh − 0 − 0 = 827 ton CO_2

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

(Copy this table for each data and parameter)

Data / Parameter:	Utilization rate
Data unit:	%
Description:	Annual proportion of solar power plant operation
Source of data used:	Calculated
Value applied:	Daegu - 13.8% SinanJeungdo's Fixed type - 15.0% SinanJeungdo's Tracking one axis type – 17.6% SinanJeungdo's Tracking both axis type – 19.5%
Justification of the choice of data or description of measurement methods and procedures actually applied :	Daegu project' data[13.8% (Fixed type)] is a actual result in 2007. and the Data of SinanJeungdo's Tracking type is able to be confirmed by the recent research report(2006.3.31), 'Improvement of Alternative Energy Development Promotion Act and scheme connected with RPS system' published by Korean Government, Ministry of Commerce, Industry and Energy.
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:	0.6349
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

Data / Parameter:	**$EF_{OM,y}$**
Data unit:	ton CO_2/MWh
Description:	Operating Margin emission factor
Source of data used:	Calculated
Value applied:	0.7195
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:	0.3810
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:

>>

This project is generating electricity by PV Power Plant and connecting to grid instead of using fossil fuel for abating greenhouse gas(GHG) emissions. The amount of GHG emissions are calculated according to the methodology AMS I.D

Project emissions

This is the electricity generation by PV Power Plant. Project activity emission is 0.

Baseline emissions

Baseline emissions of this project are calculated by multiplying the amount of this project electricity exported to grid by the electricity CO_2 Emission Factor which is calculated through the methodology

$$BE_{electricity,y} = EG_y \times EF_{electricity,y}$$

where;

$BE_{electricity,y}$: the amount of Baseline emissions in year y (tCO_2)

EG_y : the amount of total electricity exported to grid by this project activity in year y (MWh)

$EF_{electricity,y}$: the Baseline Electricity CO_2 Emissions Factor in year y (tCO2/MWh)

The Electricity Emissions Factor is calculated by KEPCO, Statistics of Electric Power in 2004, 2005, 2006. The detail about Baseline Electricity CO_2 Emissions Factor will be described in Annex 3.

• The amount of total net electricity exported to grid by this project activity by PV Power Plant

- Daegu Project : Generation Capacity × Generation utilization rate × 8,760hr
  = 0.1MW × 13.8% × 8,760hr = 121 MWh

- SinanJeungdo Project : Generation Capacity × Generation utilization rate × 8,760hr
  = 0.45MW × 15.0% × 8,760hr (Fixed type)

+ 0.05MW × 17.6% × 8,760hr (Tracking one axis type)
+ 0.3 MW × 19.5% × 8,760hr (Tracking both axis type) = 1,181 MWh

<PV generation efficiency rate>
- Daegu project : 13.8% (Fixed type) ⇒ This is a actual result.
- SinanJeungdo project : 15.0% (Fixed type), 17.6%(Tracking one axis type), 19.5%(Tracking both axis type)

⇒ This is able to be confirmed by the recent research report(2006.3.31), 'Improvement of Alternative Energy Development Promotion Act and scheme connected with RPS system' published by Korean Government, Ministry of Commerce, Industry and Energy.

• **Baseline emissions**

Annual electricity generation × Emission Factor = 1,302MWh × 0.6349tCO_2/MWh = 827 tCO_2

Leakage

The amount of Leakage is 0.

Emission Reductions

Baseline emissions – Project emissions – Leakage emissions = 827-0-0 =827 tCO_2

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

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<Table 12> Annual estimation of emission reduction

Years	Estimation of Project activity emissions (t CO_2 e)	Estimation of Baseline emissions (t CO_2 e)	Estimation of leakage (t CO_2 e)	Estimation of overall emission reductions (t CO_2 e)
August '08 – July '09	0	827	0	827
August '09 – July '10	0	827	0	827
August '10 – July '11	0	827	0	827
August '11 – July '12	0	827	0	827
August '12 – July '13	0	827	0	827
August '13 – July '14	0	827	0	827
August '14 – July '15	0	827	0	827
August '15 – July '16	0	827	0	827
August '16 – July '17	0	827	0	827
August '17 – July '18	0	827	0	827
Total (t CO_2 e)	0	8,270	0	8,270

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

B.7.1 Data and parameters monitored:

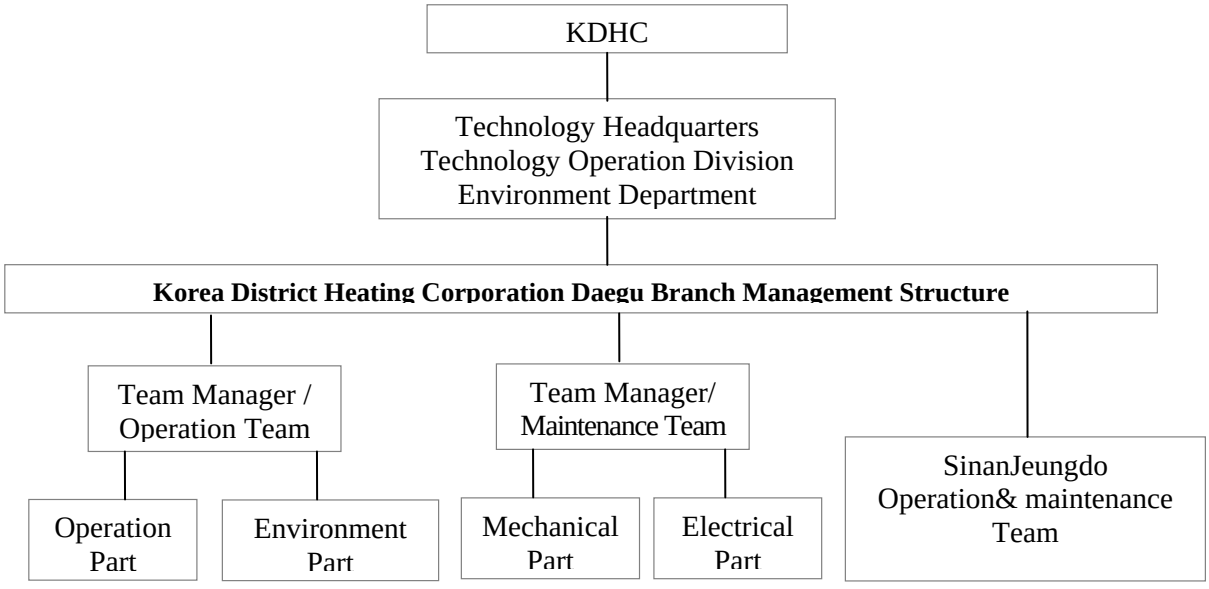
(Copy this table for each data and parameter)	
Data / Parameter:	Total electricity exported to grid by this project activity
Data unit:	MWh
Description:	Electricity exported to grid by PV Power Plant
Source of data to be used:	KDHC
Value of data	Measured value
Description of measurement methods and procedures to be applied:	Electricity exported to grid by KDHC Daegu & SinanJeungdo PV Power Plant is measured automatically by established meter hourly and sent to KEPCO.
QA/QC procedures to be applied:	Electricity meter belongs to KEPCO. The meter was set up transparently in accordance with 'Law regarding measurement' and 'Act on operation of electricity market' and sealed after affirmation of KEPCO. Additionally, The meter will be calibrated one time per 2 years according to KEPCO's procedure. The allowed error of data must be within $\pm 0.5\%$
Any comment:	

B.7.2 Description of the monitoring plan:

>>

The operational and management structure for monitoring

The remote operating and monitoring system of the PV Power Plant makes possible to audit and measure the data by sending electric characteristics such as power generation, voltage, electric current and frequency of photovoltaic generation of electric power to the main computer. It is also possible to audit and measure the data at a distant place by a LAN or a modem.
Daegu & SinanJeungdo PV Plant will be operated and monitored by KDHC Daegu branch's operation teams through the remote operating and monitoring system. Daegu branch's operation teams are as follows.



Name of person for monitoring is as follow.

Person in charge	Team	Work
Lim Jong-Weon	Technology Headquarters Environment Department	Monitoring overall
Lim Sung-Mook	Technology Headquarters Environment Department	Monitoring overall
Kim Yeong-Min	KDHC Daegu branch operation management team	Data collection and storage
Choi Woo-young	KDHC Daegu branch operation management team	Data collection and storage
Kim Kyung-Joong	KDHC Daegu branch Maintenance team	Maintenance and management
Bak Jo-Hum	KDHC Daegu branch Maintenance team	Maintenance and management
Joo Jae-Kyu	KDHC SinanJeungdo Operation & Maintenance team	Operation and Maintenance
Jung Kyun-woo	KDHC SinanJeungdo Operation & Maintenance team	Operation and Maintenance

Data collection and storage

• Data collection and storage method

Daegu Project
The amount of electricity supplied to the grid is measured by the meter. The measured electricity amount is collected and stored hourly, also these are managed as reports. The data is saved on PV management system PC. All electricity generated is supplied to the grid directly and is sold to KEPCO. The supplied amount is crosschecked monthly by the invoice sent to KEPCO.

SinanJeungdo Project
The amount of electricity supplied to the grid is measured by the meter. The measured electricity amount is collected and stored hourly, also these are managed as reports. The data measured by the meter is transferred remotely to Korea Power Exchange which purchase all electricity generated and KDHC input the data measured by the meter to KDHC Electric Power Trading System. The amount of electricity supplied to the grid is crosschecked both of them.

• Data modification method

The collected data is compared with those of KEPCO and KPX. If the data collected is different from them, the operation condition of electricity meters and other equipments will be followed and be certified by the final decision-maker and KEPCO.

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Training

Daegu PV Power Plant operation team was trained for PV Power Plant operation and management from manufacturing company through the remote monitoring system simulation and pilot manufacturing program of the PV Power Plant in September 2006 and also will be trained for operation management education once per every quarter by KDHC Daegu branch.
SinanJeungdo PV Power Plant operation team will be trained for PV Power Plant operation and management from manufacturing company in November 2007 and also will be trained for operation management education once per every quarter by KDHC Daegu branch.

Quality Assurance and Quality Control

Korea District Heating Corporation Daegu branch office obtained ISO14001 certification in December 2002 and is operating continuous and systematic Environment management system.
Korea District Heating Corporation Daegu branch obtained monitoring and QA/QC process for all parameters related to proposed project activity monitoring through ISO 14001 certification.
Monitoring plan of this project activity will be managed in integration and continuation with Environment management system through ISO 14001.

Monitoring equipment and facility management procedures

The remote operating and monitoring system of the PV Power Plant makes possible to audit and measure the data at a distant place by a LAN or a modem and so a part which breaks down will be captured and managed quickly at a distant place, in case that there is something wrong with the equipment.
In case that there is something wrong with the equipment like these, KDHC Daegu branch will resolve the problem by the procedure connected with ISO 14001.

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 application of methodology : 12/10/2007
The name of the responsible person/entity :
Ms. Miyeon Kim (kmy97@kdhc.co.kr) / KDHC, Department of Technology Operation
752 KDHC Suseo-Dong Gangnam-Gu, Seoul Republic of KOREA
Tel : +82-2-2040-2255 Fax : +82-2-3412-1050 URL : www.Kdhc.co.kr

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

>>
13/12/2005

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

>>
20 years

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

C.2.1. Renewable crediting period

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

>>
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:

>>
01/11/2008 or Registration date whatever is later

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:

>>
This project obtained permission from the Ministry of Commerce, Industry and Energy . According to the Act on Assessment of Impacts of Works on Environment, Traffic, Disasters, etc., Korea government does not require an EIA (Environmental Impact Assessment) for the project activity as regard District heating . Although the government does not require an EIA, KDHC considered environmental impacts from this project activity – Air quality, water quality and noise etc. in the designing stage.
The Daegu project is located within KDHC Daegu branch and the SinanJeungdo project is located in Sinan which was chosen as the optimum area for PV Power Plant in 'Previous Environmental Impact Business handbook' published by the Ministry of environment, there is no significant environmental impact.
Sinangun administration authorities investigated environmental impact on 27th Sept 2006. They decided that there is no any special environmental impact.
Additionally, because this project does not emit any air pollutant or GHG unlike other fossil fuel power generations, this project can be seen as an environment friendly project.

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 significant negative environmental impact is expected from this project activites.

SECTION E. Stakeholders' comments

>>

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

>>

Daegu Project
Stakeholder comments of the project activity were carried out by newspaper etc. KDHC announced this project through newspapers like Dongailbo(28 February 2006), Korea Energy(3 March 2006), and Gas Industry newspaper(27 February 2006) and took stakeholders' comments

SinanJeungdo Project

The local stakeholders of the SinanJeungdo project activity are local people of Jeungdomyeon, Sinangun and village administration authorities. KDHC held a public hearing for the local stakeholders. The public hearing was arranged on 22 February 2007 at Jeungdomyeon office. About thirty people including the local community leaders and the village administration authorities attended in this public hearing.

E.2. Summary of the comments received:

>>

Daegu Project

KDHC announced on newspaper that " There have been minimal application for PV plant admission in major cities such as Daegu due to high capital investment and unfavourable location. In spite of these obstacles, KDHC participated in the Daegu city's Solar City which is being promoted by KDHC. Additionally, this PV Power Plant will be used as a educational place for local residents and students."

<Figure 7> 27 February 2006 –Gas Industry Newspaper

대구에 100kW 태양광발전설비 구축

대구시, 지역난방公 발전사업 허가

한국지역난방공사가 대구시에 신청한 '태양광 발전사업' 허가가 지난 22일자로 수리됨에 따라 100kW규모의 태양광발전설비가 설치된다.

대구시가 허가한 한국지역난방공사(사장 김영남)의 태양광발전사업은 달서구 대천동에 위치한 지역난방공사 대구지사 부지내에 총사업비 7억원을 투자해 100kW규모의 태양광 발전 설비를 구축하는 것이다.

지역난방공사는 발전사업이 허가됨에 따라 5월 1일부터 9월 30일까지 약 5개월간 건설에 들어갈 예정이다.

구축사업이 완료되면 연간 122MWh 전력을 생산할 뿐 아니라 지역 시민과 학생들의 견학장소로도 활용될 수 있을 것으로 기대된다.

그동안 경북, 전남, 제주도 등 일조량이 많고 풍력을 이용할 수 있는 입지여건을 갖춘 지역에서는 발전사업허가 신청이 수시로 있어 왔으나 대도시의 경우 많은 초기 투자비용의 부담과 불리한 입지여건 등으로 발전사업허가 신청이 없었다. 그러나 이번 한국지역난방공사의 허가를 계기로 앞으로도 발전사업 허가 신청이 이어질 것으로 예상된다.

대구시는 2000년도부터 국제에너지기구(International Energy Agency)가 추진하는 솔라시티로 참여하고 있기도 하다.

서민규 기자 mkseo@enn.co.kr

<Figure 8> 28 February 2006 - Dongailbo

東亞日報

2006년 02월 28일
14C면 (지역)

대구시가 10억 원을 들여 지난달 완공한 두류정수장에 있는 태양광 발전시설. 이 시설은 하루 80KW의 전기를 생산할 수 있다. 대구시는 솔라시티를 지향하고 있다. 사진제공 대구시

대구 '태양도시' 주도권 잡나

최근 에너지판 핵심부품 생산시설 유치
6월 그린엑스포 개최… 민간투자 유도

태양빛을 이용해 전기를 생산하는 신(新)재생에너지 사업의 주도권 경쟁이 전국적으로 치열한 상황에서 대구 성서공단 옛 삼성상용차 터에 태양광 에너지판 핵심부품 생산시설이 다음달 착공될 예정이어서 귀추가 주목된다.

대구시는 독일 측과 합작으로 공장 부지를 물색하고 있는 ㈜미리넷솔라를 최근 유치했다고 27일 밝혔다.

이 공장이 완공되면 수입에 의존하는 태양에너지판(태양빛을 전기에너지로 바꾸는 장치)의 핵심부품이 연말부터 생산되게 된다. 이 공장은 대구시가 전략산업으로 추진하고 있는 '솔라시티' 브랜드에도 상당한 도움이 될 것으로 기대된다.

그동안 대구시와 광주시는 서로 '태양도시'를 슬로건으로 내세우며 경쟁을 벌여 왔다.

2000년부터 국제에너지기구가 추진하는 솔라시티에 참여하고 있는 대구시는 태양주택 1만 가구 등을 비롯해 2050년까지 태양에너지를 비롯한 신재생에너지 공급을 총에너지 수요의 30%까지 끌어올린다는 계획을 수립했다.

광주시도 지난해 솔라시티센터를 설립한 것을 비롯해 2011년까지 1900억 원을 투입해 '태양에너지도시'를 만들 방침이다.

하지만 이 같은 태양에너지 사업이 대부분 지자체 주도로 이뤄지고 있어 한계가 있다는 지적이다. 민간기업의 적극적인 참여가 시급하다는 것이다.

대구시는 2001년부터 복지시설을 중심으로 태양열 급탕시설 29곳, 태양광 발전시설 16곳, 태양전지 가로등 등을 모두 자체 예산으로 설치했다.

하지만 최근 한국지역난방공사 대구지사는 7억 원을 투입해 자체 태양광발전 시설을 마련하기로 했다.

난방공사 측은 9월 이 시설을 완공하면 30가구의 1일 전기소비량에 해당하는 100KW를 생산할 예정이다.

대구시 이시룡(李時龍) 산업지원기계금속과장은 "6월 대구에서 10개국 90개 관련 업체가 참가하는 '그린엑스포'를 통해 태양에너지 등에 대한 민간투자를 적극 유도할 방침"이라고 밝혔다. 이권효 기자 boriam@donga.com

(17.5*19.0)cm

<Figure 9> 3 March 2006- Koea Energy

대구 태양광발전 사업 가속화

한난, 100kW 태양광발전설비 허가

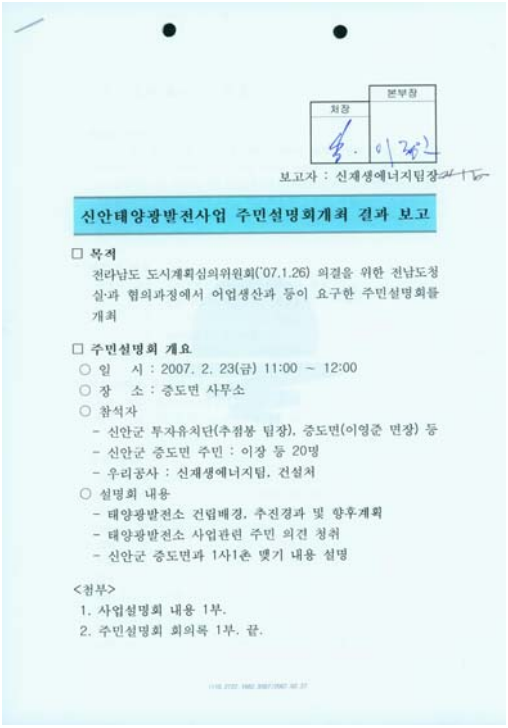
쏠라시티를 표방하고 있는 대구광역시의 태양광 발전사업이 더욱 진일보할 것으로 보인다.

대구시는 지난달 22일 한국지역난방공사(이하 한난)가 대구시에 신청한 태양광 발전사업을 허가하고 100kW 규모 태양광발전설비 구축에 본격적으로 나섰다. 이번에 대구시가 허가한 한난의 사업계획에 따르면 현 지역난방공사 대구지사(달서구 대천동 895번지) 부지 7만6365.4㎡ 내에 총사업비 7억원을 투자해 설비용량 100kW 규모의 태양광발전 설비를 구축하고 발전사업을 시행하는 것이다.

이 공사는 오는 5월 1일부터 9월 30일까지 약 5개월 간 소요될 예정으로 구축사업이 완료되면 전력생산량은 연간 122MWh정도가 가능할 것으로 예상된다. oyk@

SinanJeungdo Project

KDHC explained the purpose, background, present condition and construction schedule of this project and KDHC also obtained the attendances' optimistic comment.
KDHC explained environmental and social benefit through this project. Also, KDHC explained that this project will contribute to stable electricity supplies for the salt farm which is located on the next to the Plant. The public hearing attendances were deeply interested in this project. The local resident asked the possibility of affecting the fishing farm on the construction.
KDHC established sisterly relationship with Sinangun through the public hearing attendances. As one of events, KDHC members bought special products in early 2007. KDHC is going to make events like this every year.



보고자 : 신재생에너지팀장

신안태양광발전사업 주민설명회개최 결과 보고

□ 목적

전라남도 도시계획심의위원회('07.1.26) 의결을 위한 전남도청 실·과 협의과정에서 어업생산과 등이 요구한 주민설명회를 개최

□ 주민설명회 개요

○ 일 시 : 2007. 2. 23(금) 11:00 ~ 12:00
○ 장 소 : 증도면 사무소
○ 참석자
- 신안군 투자유치단(추점봉 팀장), 증도면(이영준 면장) 등
- 신안군 증도면 주민 : 이장 등 20명
- 우리공사 : 신재생에너지팀, 건설처

○ 설명회 내용
- 태양광발전소 건립배경, 추진경과 및 향후계획
- 태양광발전소 사업관련 주민 의견 청취
- 신안군 증도면과 1사1촌 맺기 내용 설명

<첨부>
1. 사업설명회 내용 1부.
2. 주민설명회 회의록 1부. 끝.

<Figure 10> The public hearing of SinanJeungdo project and the result report

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

>>

Daegu Project

KDHC announced that PV Power Plant of KDHC Daegu branch supports Daegu administration authority's Solar city policy and this PV Power Plant would be used as an educational place for local residents and students.
KDHC pushed the button for other companies to build PV Power Plant.

SinanJeungdo Project

The Stakeholders have a very positive attitude toward this plant. KDHC ensured that this project won't affect fish farms on the construction. KDHC compensated the local resident for the possibility of affecting the fishing farm before construction of this project.
KDHC is going to obtain various Stakeholders' comments from public hearings, homepage (www.kdhc.co.kr) and etc.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Korea District Heating Corporation
Street/P.O.Box:	186 Bundang-dong, Bundang-gu
Building:	
City:	Seongnam
State/Region:	Gyeonggi-do
Postfix/ZIP:	463-908
Country:	Republic of Korea
Telephone:	+82-2-2040-2255
FAX:	+82-2-3412-1050
E-Mail:	kmy97@kdhc.co.kr
URL:	http://www.kdhc.co.kr
Represented by:	Seung-Il, Chung
Title:	CEO
Salutation:	Mr.
Last Name:	Chung
Middle Name:	
First Name:	Seung-Il
Department:	
Mobile:	+82-10-3567-7917
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Direct tel:	+82-2-2040-2255
Personal E-Mail:	kmy97@kdhc.co.kr

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding in the Daegu & SinanJeungdo PV Power Plant.

Annex 3

BASELINE INFORMATION

<Table 13> Key Parameter and data sources

No.	Key parameter	Data Source
1	Generation data for all plants for the year 2004-2006	KEPCO 2005, Statistics of Electric Power in 2004 KEPCO 2006, Statistics of Electric Power in 2005 KEPCO 2007, Statistics of Electric Power in 2006
2	fuel consumption data	KEPCO 2005, Statistics of Electric Power in 2004 KEPCO 2006, Statistics of Electric Power in 2005 KEPCO 2007, Statistics of Electric Power in 2006
3	Calorific value of fuel	KEPCO 2005, Statistics of Electric Power in 2004 KEPCO 2006, Statistics of Electric Power in 2005 KEPCO 2007, Statistics of Electric Power in 2006
4	Oxidation Factors	IPCC, Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories

1. Calculating Simple OM method

<Table 14> Operation Margin 2004

item			consumption				Net caloric value of heavy oil				Electricity generation (MWh)		
plant			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)	Coal (kcal/kg)	Heavy oil (kcal/l)	Diesel oil (kcal/l)	L. N. G (kcal/kg)		Total CO2 emission (tCO_2/yr)	EFom, 2004 (tCO_2/MWh)
sub-bituminous coal	Honam	#1	885,758	606	300	-	5,219	9,323	8,406	-	1,855,554	1,833,470	0.9881
		#2	783,300	1,714	335	-	5,158	9,326	8,407	-	1,625,399	1,606,315	0.9883
	Samchonpo	#1	1,624,500	-	1,674	-	5,251	-	8,562	-	3,974,202	3,382,754	0.8512
		#2	1,564,986	-	744	-	5,961	-	8,560	-	3,839,080	3,697,099	0.9630

		#3	1,467,177	-	814	-	6,203	-	8,556	-	3,652,769	3,606,963	0.9875
		#4	1,538,768	-	785	-	6,182	-	8,554	-	3,811,371	3,769,648	0.9891
		#5	1,707,777	-	230	-	4,587	-	8,550	-	4,147,957	3,103,360	0.7482
		#6	1,734,977	-	652	-	4,534	-	8,550	-	4,185,213	3,117,605	0.7449
	Yonghung	#1	1,114,254	-	27,916	-	5,597	-	8,481	-	2,986,382	2,543,503	0.8517
		#2	459,217	-	18,314	-	5,559	-	8,284	-	1,172,450	1,058,197	0.9026
	Boryeong	#1	1,599,557	-	311	-	5,628	-	8,332	-	4,014,109	3,566,236	0.8884
		#2	1,555,055	-	616	-	5,626	-	8,464	-	3,915,285	3,466,743	0.8854
		#3	1,427,263	-	574	-	5,646	-	8,312	-	3,746,265	3,193,141	0.8524
		#4	1,560,014	-	179	-	5,648	-	8,312	-	4,097,489	3,490,269	0.8518
		#5	1,397,343	-	422	-	5,635	-	8,312	-	3,660,240	3,119,656	0.8523
		#6	1,559,785	-	350	-	5,641	-	8,312	-	4,093,207	3,485,588	0.8516
	Taean	#1	1,438,094	-	999	-	5,681	-	8,326	-	3,780,097	3,238,538	0.8567
		#2	1,509,379	-	310	-	5,678	-	8,264	-	3,975,123	3,395,101	0.8541
		#3	1,415,585	-	390	-	5,676	-	8,554	-	3,732,363	3,183,400	0.8529
		#4	1,539,502	-	254	-	5,669	-	8,285	-	4,048,258	3,457,376	0.8540
		#5	1,547,217	-	329	-	5,696	-	8,467	-	4,091,406	3,491,623	0.8534
		#6	1,531,751	-	230	-	5,696	-	8,364	-	4,056,835	3,456,448	0.8520
	Hadong	#1	1,389,739	-	533	-	5,730	-	8,552	-	3,688,313	3,155,610	0.8556
		#2	1,515,681	-	145	-	5,723	-	8,526	-	4,028,529	3,436,204	0.8530
		#3	1,501,027	-	670	-	5,744	-	8,534	-	3,997,064	3,416,524	0.8548
		#4	1,397,482	-	737	-	5,792	-	8,543	-	3,724,757	3,207,779	0.8612
		#5	1,501,672	-	318	-	5,683	-	8,534	-	4,013,845	3,380,641	0.8422
		#6	1,379,396	-	689	-	5,639	-	8,534	-	3,685,698	3,082,416	0.8363
	Dangjin	#1	1,502,885	-	294	-	5,711	-	8,436	-	3,986,406	3,399,990	0.8529
		#2	1,523,605	-	211	-	5,700	-	8,444	-	4,038,457	3,440,433	0.8519
		#3	1,404,465	-	605	-	5,677	-	8,452	-	3,711,787	3,159,520	0.8512
		#4	1,434,844	-	528	-	5,668	-	8,454	-	3,801,495	3,222,254	0.8476
heavy oil	Ulsan	#1	-	73,408	114	-	-	9,399	8,560	-	271,544	223,788	0.8241
		#2	-	65,316	82	-	-	9,406	8,560	-	244,246	199,222	0.8157
		#3	-	71,305	554	-	-	9,401	8,560	-	268,231	218,600	0.8150
		#4	-	420,739	1,238	-	-	9,474	8,664	-	1,759,376	1,294,471	0.7358

		#5	-	513,497	931	-	-	9,465	8,664	-	2,141,162	1,576,803	0.7364
		#6	-	527,083	1,603	-	-	9,461	8,664	-	2,196,344	1,619,648	0.7374
	Youngnam	#1	-	347,107	837	-	-	7,060	8,422	-	973,872	795,969	0.8173
		#2	-	248,049	274	-	-	7,295	8,432	-	665,973	586,879	0.8812
	Yosu	#1	-	181,712	571	-	-	9,511	8,478	-	723,968	561,289	0.7753
		#2	-	316,523	436	-	-	9,508	8,508	-	1,304,109	976,014	0.7484
	Pyongtaek	#1	-	204,664	247	2,095	-	9,383	8,472	11,628	850,533	628,421	0.7389
		#2	-	209,664	232	2,515	-	9,385	8,494	11,616	880,646	644,819	0.7322
		#3	-	179,921	240	3,791	-	9,407	8,461	11,619	751,633	559,231	0.7440
		#4	-	192,294	225	3,217	-	9,408	8,470	11,660	800,854	595,402	0.7435
	Namjeju	#1	-	16,510	6	-	-	9,405	8,867	-	50,294	50,313	1.0004
		#2	-	16,040	13	-	-	9,406	8,404	-	48,714	48,906	1.0039
	Jeju	#1	-	15,306	7	-	-	9,403	8,513	-	44,659	46,636	1.0443
		#2	-	118,473	73	-	-	9,417	8,489	-	486,401	361,558	0.7433
		#3	-	124,160	41	-	-	9,423	8,482	-	509,330	379,079	0.7443
L.N.G	Seoul	#4	-	-	1	22,409	-	-	8,617	11,710	90,322	61,638	0.6824
		#5	-	-	3	117,908	-	-	8,617	11,712	480,919	324,370	0.6745
	Incheon	#1	-	-	-	10,523	-	-	-	11,734	47,491	29,001	0.6107
		#2	-	-	-	11,094	-	-	-	11,735	49,144	30,580	0.6223
		#3	-	-	149	4,235	-	-	8,504	11,734	19,018	12,065	0.6344
		#4	-	-	171	526	-	-	8,501	11,719	594	1,899	3.1947
Combined Cycle	Pyongtaek C/C		-	-	21	98,846	-	-	8,320	11,730	596,001	272,382	0.4570
	Ilsan	C/C	-	-	-	593,548	-	-	-	11,715	3,281,407	1,633,218	0.4977
	Bundang	C/C	-	-	-	653,880	-	-	-	11,723	3,650,122	1,800,497	0.4933
	Ulsan	C/C	-	-	-	347,076	-	-	-	11,628	2,329,524	947,892	0.4069
	Seoincheon	C/C	-	-	88	1,209,806	-	-	8,750	11,709	8,353,619	3,327,474	0.3983
	Shinincheon	C/C	-	-	-	1,587,638	-	-	-	11,716	11,596,955	4,368,787	0.3767
	Boryeong	C/C	-	-	-	988,548	-	-	-	11,723	6,979,928	2,721,937	0.3900
	Busan	C/C	-	-	2,687	1,298,418	-	-	8,788	11,703	9,884,075	3,576,546	0.3618
	Hallim	C/C	-	-	28,796	-	-	-	8,524	-	96,435	76,113	0.7893
	Anyang	C/C	-	-	-	270,559	-	-	-	11,723	1,506,070	744,968	0.4946

	Bucheon	C/C	-	-	-	258,596	-	-	-	11,712	1,425,073	711,369	0.4992
	K I E Co.	C/C	-	-	-	467,583	-	-	-	11,720	2,809,983	1,287,188	0.4581
	L G Bugog	C/C	-	-	-	260,653	-	-	-	11,725	1,894,996	717,820	0.3788
	Yulchon	C/C	-	-	596	7,388	-	-	11,145	11,712	36,366	22,384	0.6155
Internal combustion	Namjeju	D/P	-	57,808	80	-	-	9,406	8,424	-	274,089	176,341	0.6434
	Jeju	D/P	-	-	2,232	-	-	-	8,501	-	3,016	5,884	1.9508
total			45,512,055	3,901,899	104,006	8,220,852					187,514,442	135,381,805	**0.7220**

<Table 15> Operation Margin 2005

item / plant			consumption				Net caloric value of heavy oil				Electricity generation (MWh)		
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)	Coal (kcal/kg)	Heavy oil (kcal/l)	Diesel oil (kcal/l)	L. N. G (kcal/kg)		Total CO2 emission (tCO_2/yr)	EFom, 2005 (tCO_2/MWh)
sub-bituminous coal	Honam	#1	870,214	961	278	-	5,122	9,343	8,368	-	1,787,715	1,769,026	0.9895
		#2	912,497	338	185	-	5,107	9,362	8,364	-	1,875,790	1,847,380	0.9849
	Samchonpo	#1	1,534,223	-	1,220	-	5,618	-	8,399	-	3,810,079	3,416,746	0.8968
		#2	1,731,265	-	626	-	5,628	-	8,439	-	4,323,618	3,860,712	0.8929
		#3	1,723,152	-	377	-	5,602	-	8,550	-	4,343,666	3,824,327	0.8804
		#4	1,632,334	-	1,029	-	5,603	-	8,496	-	4,112,297	3,625,209	0.8816
		#5	1,516,654	-	1,415	-	5,079	-	8,183	-	3,542,728	3,054,669	0.8622
		#6	1,546,663	-	1,001	-	5,107	-	8,550	-	3,643,969	3,131,261	0.8593
	Yonghung	#1	2,081,972	-	4,541	-	5,824	-	8,488	-	5,623,299	4,814,722	0.8562
		#2	1,761,395	-	2,903	-	5,750	-	8,500	-	4,658,862	4,019,342	0.8627
	Boryeong	#1	1,440,343	-	761	-	5,539	-	8,496	-	3,547,140	3,161,600	0.8913
		#2	1,388,532	-	551	-	5,525	-	8,496	-	3,433,608	3,040,078	0.8854
		#3	1,589,150	-	90	-	5,588	-	8,303	-	4,124,745	3,517,349	0.8527
		#4	1,421,343	-	603	-	5,596	-	8,311	-	3,698,705	3,151,558	0.8521
		#5	1,587,999	-	156	-	5,588	-	8,312	-	4,121,314	3,514,972	0.8529
		#6	1,260,305	-	627	-	5,606	-	8,312	-	3,283,477	2,799,942	0.8527
	Taean	#1	1,508,570	-	621	-	5,700	-	8,257	-	3,992,112	3,407,135	0.8535
		#2	1,323,078	-	395	-	5,708	-	8,249	-	3,484,251	2,992,449	0.8588

		#3	1,494,175	-	650	-	5,707	-	8,242	-	3,957,054	3,378,947	0.8539
		#4	1,383,297	-	365	-	5,699	-	8,270	-	3,653,534	3,123,405	0.8549
		#5	1,411,398	-	742	-	5,730	-	8,242	-	3,744,413	3,205,216	0.8560
		#6	1,504,962	-	417	-	5,716	-	8,256	-	3,999,847	3,408,451	0.8521
	Hadong	#1	1,513,930	-	284	-	5,703	-	8,493	-	3,997,914	3,420,409	0.8555
		#2	1,410,099	-	792	-	5,697	-	8,481	-	3,732,583	3,183,894	0.8530
		#3	1,422,196	-	472	-	5,698	-	8,533	-	3,769,077	3,210,832	0.8519
		#4	1,511,054	-	567	-	5,699	-	8,491	-	3,989,315	3,412,226	0.8553
		#5	1,345,648	-	614	-	5,695	-	8,526	-	3,553,901	3,037,079	0.8546
		#6	1,520,774	-	331	-	5,695	-	8,481	-	4,037,763	3,431,229	0.8498
	Dangjin	#1	1,438,702	-	637	-	5,664	-	8,392	-	3,797,307	3,228,999	0.8503
		#2	1,437,473	-	632	-	5,664	-	8,469	-	3,798,078	3,226,487	0.8495
		#3	1,549,041	-	141	-	5,638	-	8,402	-	4,081,017	3,459,616	0.8477
		#4	1,544,010	-	134	-	5,644	-	8,387	-	4,079,557	3,451,952	0.8462
		#5	499,714	-	5,701	-	5,809	-	8,458	-	1,318,670	1,164,722	0.8833
		#6	38,671	-	1,779	-	5,910	-	10,540	-	96,365	96,331	0.9996
heavy oil	Ulsan	#1	-	70,183	750	-	-	9,405	8,660	-	262,393	215,814	0.8225
		#2	-	67,296	585	-	-	9,408	8,657	-	255,812	206,642	0.8078
		#3	-	53,085	662	-	-	9,413	8,663	-	200,518	163,637	0.8161
		#4	-	375,417	1,971	-	-	9,501	8,666	-	1,549,091	1,160,601	0.7492
		#5	-	363,992	1,676	-	-	9,494	8,666	-	1,500,935	1,123,849	0.7488
		#6	-	352,776	1,708	-	-	9,480	8,662	-	1,454,644	1,087,911	0.7479
	Youngnam	#1	-	359,910	844	-	-	7,108	8,495	-	1,022,470	830,910	0.8126
		#2	-	190,085	584	-	-	7,342	8,496	-	531,006	453,621	0.8543
	Yosu	#1	-	106,919	434	-	-	9,462	8,442	-	430,310	328,846	0.7642
		#2	-	218,356	346	-	-	9,447	8,441	-	904,597	669,087	0.7397
	Pyongtaek	#1	-	293,214	118	3,553	-	9,407	8,496	11,608	1,258,662	903,501	0.7178
		#2	-	321,188	140	2,641	-	9,409	8,513	11,585	1,376,342	986,506	0.7168
		#3	-	308,042	132	1,784	-	9,412	8,502	11,647	1,321,167	944,366	0.7148
		#4	-	311,245	138	2,047	-	9,413	8,502	11,604	1,338,204	954,991	0.7136
	Namjeju	#1	-	14,628	15	-	-	9,384	8,853	-	44,602	44,507	0.9979
		#2	-	15,031	12	-	-	9,385	8,842	-	44,654	45,728	1.0241

	Jeju	#1	-	12,564	12	-	-	9,435	8,441	-	36,266	38,431	1.0597
		#2	-	129,516	-	-	-	9,433	-	-	532,700	395,721	0.7429
		#3	-	122,866	48	-	-	9,429	8,491	-	502,189	375,377	0.7475
L.N.G	Seoul	#4	-	-	-	49,143	-	-	-	11,702	207,498	135,070	0.6509
		#5	-	-	1	108,761	-	-	8,617	11,707	444,324	299,072	0.6731
	Incheon	#1	-	-	-	4,365	-	-	-	11,729	16,450	12,025	0.7310
		#2	-	-	-	8,505	-	-	-	11,723	37,727	23,417	0.6207
		#3	-	-	372	746	-	-	8,516	11,727	-	-	-
		#4	-	-	400	6,620	-	-	8,506	11,723	29,202	19,273	0.6600
Combined Cycle	Pyongtaek C/C		-	-	1	110,953	-	-	8,503	11,727	659,932	305,616	0.4631
	Ilsan	C/C	-	-	-	533,188	-	-	-	11,710	2,873,958	1,466,525	0.5103
	Bundang	C/C	-	-	-	671,944	-	-	-	11,723	3,742,073	1,850,131	0.4944
	Ulsan	C/C	-	-	-	470,131	-	-	-	11,475	3,131,075	1,267,120	0.4047
	Seoincheon	C/C	-	-	335	989,645	-	-	8,740	11,709	7,001,031	2,722,520	0.3889
	Shinincheon	C/C	-	-	-	1,458,763	-	-	-	11,712	10,543,280	4,012,964	0.3806
	Boryeong	C/C	-	-	-	1,161,510	-	-	-	11,727	8,221,926	3,199,300	0.3891
	Incheon	C/C	-	-	-	281,813	-	-	-	11,711	2,055,016	775,162	0.3772
	Busan	C/C	-	-	-	1,211,144	-	-	-	11,700	9,076,327	3,328,258	0.3667
	Hallim	C/C	-	-	29,686	-	-	-	8,524	-	100,346	78,470	0.7820
	Anyang	C/C	-	-	-	261,202	-	-	-	11,723	1,433,978	719,193	0.5015
	Bucheon	C/C	-	-	-	261,705	-	-	-	11,702	1,404,160	719,336	0.5123
	POSCO POWER	C/C	-	-	-	445,253	-	-	-	11,721	2,571,095	1,225,829	0.4768
	G S Bugog	C/C	-	-	-	297,976	-	-	-	12,381	2,189,808	866,496	0.3957
	Yulchon	C/C	-	-	159	194,534	-	-	10,384	11,721	1,300,627	536,047	0.4121
Internal combustion	Namjeju	D/P	-	56,727	37	-	-	9,383	8,526	-	268,073	172,515	0.6435
	Jeju	G/T	-	-	2,869	-	-	-	8,473	-	151,759	7,538	1.4871
	Jeju	D/P		31,808	72			9,435	8,506			97,406	0.6418
total			47,854,833	3,776,147	72,875	8,537,927					195,039,996	141,157,601	**0.7237**

<Table 16> Operation Margin 2006

item / plant			consumption				Net caloric value of heavy oil				Electricity generation (MWh)		
			Coal (t)	Heavy oil (kl)	Diesel oil (kl)	L. N. G (t)	Coal (kcal/kg)	Heavy oil (kcal/l)	Diesel oil (kcal/l)	L. N. G (kcal/kg)		Total CO2 emission (tCO_2/yr)	EFom, 2006 (tCO_2/MWh)
sub-bituminous coal	Honam	#1	781,139	1,113	279		5,164	9,318	8,472		1,622,639	1,601,720	0.9871
		#2	859,736	1,251	359		5,137	9,332	8,426		1,782,016	1,753,965	0.9843
	Samchonpo	#1	1,696,271		860		5,640		8,373		4,161,219	3,791,319	0.9111
		#2	1,508,082		1,362		5,645		8,373		3,703,880	3,375,527	0.9113
		#3	1,519,385		457		5,565		8,373		3,779,585	3,350,374	0.8864
		#4	1,521,263		1,818		5,568		8,363		3,816,997	3,359,780	0.8802
		#5	1,665,339		977		4,974		8,550		3,761,205	3,283,488	0.8730
		#6	1,770,348		428		4,993		8,550		4,065,091	3,501,868	0.8614
	Yonghung	#1	2,004,193		2,548		5,768		8,447		5,337,432	4,585,572	0.8591
		#2	2,129,118		2,545		5,782		8,454		5,727,937	4,882,488	0.8524
	Boryeong	#1	1,638,140		306		5,479		8,412		3,988,848	3,555,891	0.8915
		#2	1,389,425		1,137		5,478		8,496		3,423,101	3,017,630	0.8815
		#3	1,323,779		514		5,552		8,496		3,409,486	2,912,493	0.8542
		#4	1,610,928		82		5,533		8,496		4,133,946	3,530,403	0.8540
		#5	1,296,455		541		5,552		8,312		3,364,148	2,852,477	0.8479
		#6	1,553,273		518		5,542		8,312		3,987,488	3,410,748	0.8554
	Taean	#1	1,354,832		514		5,683		8,312		3,556,797	3,051,070	0.8578
		#2	1,532,209		162		5,679		7,952		4,035,753	3,446,979	0.8541
		#3	1,338,967		575		5,684		8,216		3,528,613	3,015,675	0.8546
		#4	1,548,909		133		5,680		8,232		4,069,820	3,484,977	0.8563
		#5	1,542,775		544		5,638		8,232		4,013,235	3,446,314	0.8587
		#6	1,294,577		1,113		5,662		8,232		3,381,867	2,906,215	0.8594
		#7	61,910		4,799		5,667		8,130		159,677	151,053	0.9460
	Hadong	#1	1,373,049		515		5,670		8,396		3,607,063	3,084,992	0.8553
		#2	1,543,074		293		5,662		8,482		4,068,036	3,460,899	0.8508
		#3	1,549,094		153		5,660		8,481		4,079,158	3,473,270	0.8515
		#4	1,376,612		796		5,671		8,384		3,631,374	3,093,935	0.8520
		#5	1,554,524		242		5,665		8,466		4,092,625	3,488,765	0.8525

		#6	1,371,801		690		5,669		8,456		3,610,222	3,081,908	0.8537
	Dangjin	#1	1,380,527		966		5,588		8,526		3,598,820	3,058,145	0.8498
		#2	1,570,077		161		5,611		8,529		4,115,891	3,489,611	0.8478
		#3	1,402,916		433		5,592		8,556		3,666,490	3,108,133	0.8477
		#4	1,386,317		1,549		5,581		8,564		3,610,984	3,068,711	0.8498
		#5	1,456,458		745		5,743		8,507		3,946,931	3,315,155	0.8399
		#6	1,216,582		3,051		5,814		8,450		3,392,395	2,809,291	0.8281
		#7	1,008		505		5,527		8,535		1,474	3,543	2.4045
heavy oil	Ulsan	#1		72,243	605			9,419	8,664		275,016	222,038	0.8074
		#2		80,187	469			9,427	8,664		306,668	246,106	0.8025
		#3		96,459	18			9,423	8,664		376,132	295,815	0.7865
		#4		360,919	3,729			9,529	8,664		1,511,557	1,124,011	0.7436
		#5		375,985	3,678			9,531	8,664		1,583,846	1,170,698	0.7391
		#6		378,331	3,694			9,533	8,664		1,589,838	1,178,176	0.7411
	Youngnam	#1		107,090	1,016			9,631	8,403		359,205	336,736	0.9374
		#2		95,127	1,494			9,605	8,419		323,595	299,847	0.9266
	Yosu	#1		99,129	281			9,465	8,358		403,547	304,642	0.7549
		#2		215,957	291			9,456	8,356		906,849	662,222	0.7302
	Pyongtaek	#1		261,458	141	3,997		9,222	8,496	11,647	1,123,948	792,323	0.7049
		#2		277,025	166	5,687		9,233	8,496	11,647	1,198,620	844,536	0.7046
		#3		303,858	134	3,891		9,260	8,501	11,573	1,304,568	922,318	0.7070
		#4		245,602	103	3,473		9,208	8,501	11,667	1,052,228	742,363	0.7055
	Namjeju	#1		11,406	17			9,413	8,525		34,448	34,819	1.0108
		#2		9,772	14			9,412	8,504		28,686	29,829	1.0399
		#3		46,504	2,509			9,403	8,491		179,033	148,249	0.8281
	Jeju	#1		8,603	23			9,377	8,429		24,748	26,191	1.0583
		#2		113,679	64			9,454	8,524		462,023	348,305	0.7539
		#3		117,464	67			9,455	8,524		479,676	359,928	0.7504
L.N.G	Seoul	#4			1	69,383			8,617	11,716	306,558	190,933	0.6228
		#5			1	152,891			8,617	11,594	685,011	416,360	0.6078
	Incheon	#1				6,945				11,733	32,932	19,138	0.5811
		#2				5,223				11,725	24,366	14,384	0.5903
		#3			311	15,426			8,533	11,716	78,669	43,263	0.5499

		#4			311	12,454			8,532	11,722	62,414	35,101	0.5624
Combined Cycle	Pyongtaek C/C				45	84,054			8,503	11,727	497,441	231,630	0.4656
	Ilsan	C/C			1,384	556,504			8,540	11,715	3,038,165	1,534,955	0.5052
	Bundang	C/C				720,381				11,723	4,059,300	1,983,507	0.4886
	Ulsan	C/C				536,196				11,381	3,608,435	1,433,377	0.3972
	Seoincheon	C/C			1,066	1,199,196			8,740	11,723	8,726,521	3,304,819	0.3787
	Shinincheon	C/C				1,641,038				11,723	11,797,500	4,518,469	0.3830
	Boryeong	C/C				998,683				11,730	7,089,662	2,751,603	0.3881
	Incheon	C/C				484,606				11,698	3,648,288	1,331,550	0.3650
	Busan	C/C				1,396,417				11,716	10,455,401	3,842,621	0.3675
	Hallim	C/C			48,475				8,506		175,356	127,862	0.7292
	Anyang	C/C				230,969				11,726	1,286,480	636,109	0.4945
	Bucheon	C/C			215	225,713			10,381	11,711	1,241,795	621,582	0.5006
	POSCO POWER	C/C				408,018				11,728	2,338,128	1,123,912	0.4807
	G S Bugog	C/C				389,811				11,727	2,911,683	1,073,697	0.3688
	Yulchon	C/C				315,132				12,039	2,276,276	891,071	0.3915
Internal combustion	Namjeju	D/P		51,347	111			9,734	8,462		239,690	162,182	0.6766
	Jeju	G/T			8,264				8,352		15,986	21,402	1.3388
	Jeju	D/P		52,907				9,136			252,764	156,576	0.6195
Total			50,123,092	3,383,417	111,869	9,466,086					206,605,293	147,359,636	**0.7132**

2. Calculating build margin(BM)

<Table 17> Build Margin

Plant name		Technology	year operation	Fuel and source	MWh in 2006	% of total output	CEF	Result
Solar park		solar	2006.12	photovoltaic	106	0.000%	0	0.0000
Cheongsong pumping	**#2**	pumping	2006.12	hydro	21,542	0.029%	0	0.0000
yangyang pump windpower		wind	2006.10	wind	1,788	0.002%	0	0.0000

Top infra Solar		solar	2006.09	photovoltaic	-	0.000%	0	0.0000
HanlaJeunggong Solar		solar	2006.09	photovoltaic	287	0.000%	0	0.0000
Namhae Solar		solar	2006.09	photovoltaic	297	0.000%	0	0.0000
Enepark		solar	2006.09	photovoltaic	85	0.000%	0	0.0000
Bundang fuel cell		fuel cell	2006.09	LNG	290	0.000%	0	0.0000
Yongheng solar		solar	2006.09	photovoltaic	242	0.000%	0	0.0000
Cheongsong pumping	**#1**	pumping	2006.09	hydro	39,965	0.054%	0	0.0000
Namjeju	**#3**	thermal	2006.09	heavy oil	179,033	0.241%	0.8281	0.0020
yangyang(pumping)	**#4**	pumping	2006.08	hydro	62,801	0.084%	0	0.0000
Hadongho		small hydro power	2006.06	hydro	1,294	0.002%	0	0.0000
yangyang (pumping)	**#3**	pumping	2006.06	hydro	93,471	0.126%	0	0.0000
Goheung Solar		solar	2006.06	photovoltaic	619	0.001%	0	0.0000
Jangseong		small hydro power	2006.05	hydro	514	0.001%	0	0.0000
yangyang (pumping)	**#2**	pumping	2006.04	hydro	97,896	0.132%	0	0.0000
Dangjin	**#6**	thermal	2006.04	Bituminous coal	3,392,395	4.564%	0.8281	0.0378
Sinchang-wind power		wind	2006.03	wind	2,969	0.004%	0	0.0000
yangyang (pumping)	**#1**	pumping	2006.02	hydro	129,063	0.174%	0	0.0000
Suncheon Solar		solar	2005.12	Solar	1,247	0.002%	0	0.0000
Samcheonpo solar energy		solar	2005.10	Solar	118	0.000%	0	0.0000
Dangjin	#5	steam power	2005.10	Bituminous coal	3,946,931	5.311%	0.8399	0.0446
yangyang pump small hydro		small hydro power	2005.10	hydro	5,143	0.007%	0	0.0000
Taean solar energy		solar	2005.08	photovoltaic	127	0.000%	0	0.0000
Jeju DP		internal combustion	2005.07	heavy oil	252,764	0.340%	0.6195	0.0021
WunjeongLFG		internal combustion	2005.07	LFG	17,419	0.023%	0	0.0000
Yulchon		combined	2005.07	LNG	2,276,276	3.063%	0.3915	0.0120
Incheon		combined	2005.06	LNG	3,648,288	4.909%	0.3650	0.0179
Daegok		small hydro power	2005.06	hydro	1,740	0.002%	0	0.0000
Donghwa		small hydro power	2005.05	hydro	2,434	0.003%	0	0.0000
Ulchin	#6	nuclear	2005.04	nuclear	7,401,424	9.959%	0	0.0000
Hanryu		LFG	2005.04	LFG	5,045	0.007%	0	0.0000
Busan Bio-gas		internal combustion	2005.01	LFG	7	0.000%	0	0.0000
Maebongsan-wind power		wind	2004.12	wind	8,998	0.012%	0	0.0000
Yongheng	#2	steam power	2004.11	Bituminous coal	5,727,937	7.707%	0.8524	0.0657
new solar energy		solar	2004.09	photovoltaic	216	0.000%	0	0.0000
Daegwanryung-wind power		wind	2003.11/2004.08	wind	3,451	0.005%	0	0.0000
Yongheng	#1	steam power	2004.07	Bituminous coal	5,337,432	7.182%	0.8591	0.0617

Ulchin	#5	nuclear	2004.07	nuclear	7,879,757	10.602%	0	0.0000
Busan	C/C	combined combustion	2003.05/2004.03	LNG	10,455,401	14.068%	0.3675	0.0517
Hankyung-wind power		wind	2004.02	wind	18,371	0.025%	0	0.0000
Chunsang		small hydro power	2004.01	hydro	183	0.000%	0	0.0000
Cheongju LFG		internal combustion	2004.01	LFG	6,906	0.009%	0	0.0000
Daejon Geumgodong		internal combustion	2003.06	LFG	12,768	0.017%	0	0.0000
Hoicheon ENC		internal combustion	2003.05	LFG	4,501	0.006%	0	0.0000
Gunsan-wind power		wind	2002.11/2003.09	wind	6,069	0.008%	0	0.0000
Sangwon ENC		internal combustion	2001.12/2003.03/2003.06	LFG	17,353	0.023%	0	0.0000
Muju		small hydro power	2003.04	hydro	555	0.001%	0	0.0000
Yonggwang	#6	nuclear	2002.12	nuclear	7,969,957	10.724%	0	0.0000
Taean	#6	steam power	2002.05	Bituminous coal	3,381,867	4.550%	0.8594	0.0391
Yonggwang	#5	nuclear	2002.05	nuclear	7,681,293	10.335%	0	0.0000
Sanchong		small hydro power	2001.12	hydro	1,385	0.002%	0	0.0000
Sanchong pumping #2		pumping	2001.11	hydro	204,444	0.275%	0	0.0000
Milyang		small hydro power	2001.10	hydro	5,820	0.008%	0	0.0000
Taean	#5	steam power	2001.10	Bituminous coal	4,013,235	5.400%	0.8587	0.0464
Total					74,321,519	100%	BM Factor	**0.3810**

3. Calculating Combined Margin(CM)

	Year	Combined Margin (tCO2/MWh)
		CM(1)=0.75*OM+0.25*BM
OM	2004	0.7220
	2005	0.7237
	2006	0.7132
	Average(2004-2006)	0.7195
BM	2006	0.3810
CM (tCO2/MWh)	2006	**0.6349**

Annex 4

MONITORING INFORMATION

Monitoring plan was presented in Section B. Please refer that section.