CDM – Executive Board

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:

Korea East-West Power Dangjin small hydro power plant project (5MW)
Version: 13
Date: 5 June 2009

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

- The purpose of the project activity
The main purpose of the project activity is to generate electricity from the potential energy in the circulating cooling water discharged from Dangjin thermal power plant and export the net electricity to the grid.

- Project description
The Dangjin thermal power plant is operated and maintained by Korea East-West Power Co., Ltd. (EWP). The proposed project of generating capacity is 4.998 MW (each turbine capacity, 1,666 kW x 3 unit). The annual net generation electricity will be about 27,898.81MWh, electricity generated will be delivered to Daesan substation via power transmission line.

- Contribution of the project activity to sustainable development in view of project participant
Contribution to sustainable development is generally measured through following attributes:

- Reducing greenhouse gases emission and other pollutants emissions.
- Saving energy by using renewable energy, in substitution for fossil fuel.
- Being consistent with Korea National policies.

During the crediting period, the project activity will reduce around 150,960 tCO_2e emissions.

A.3. Project participants:

<Table A-1> The project partispants of Korea East-West Power Dangjin small hydro power plant project

Name of Party involved	Private entity	Kindly indicate if the Party involved wishes to be considered as project participant
Republic of Korea (host)	Private entity : Korea East-West Power Co., Ltd	No

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

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

CDM – Executive Board

A.4.1.1.	Host Party(ies):

Republic of Korea

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

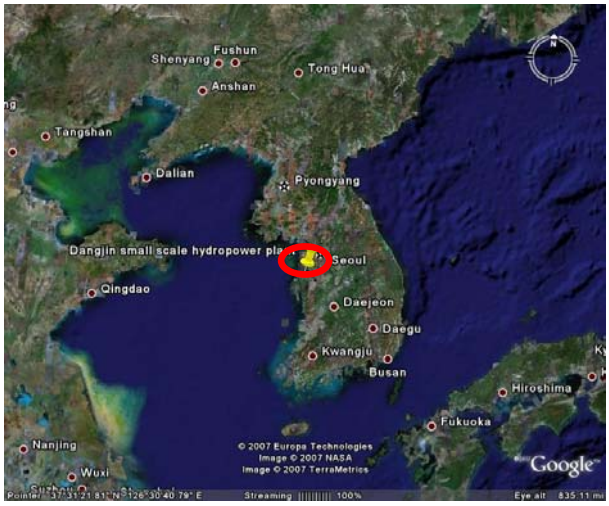
ChungcheoungNam-Do

A.4.1.3.	City/Town/Community etc:

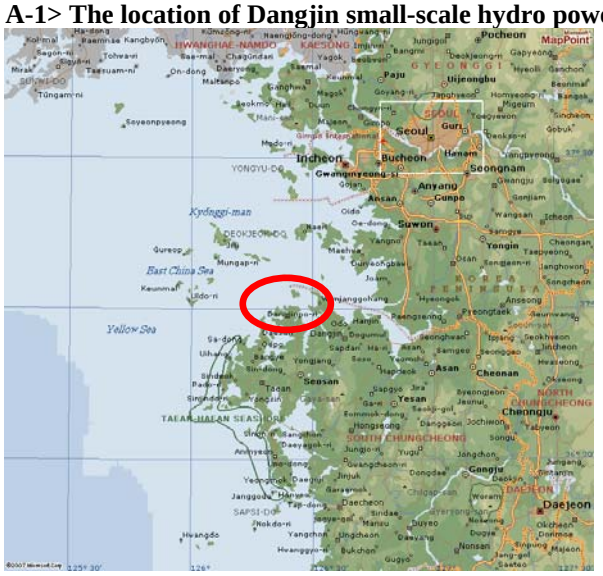
Dangjin-Gun/ Seckmun-Moen / Gyoro-Ri

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

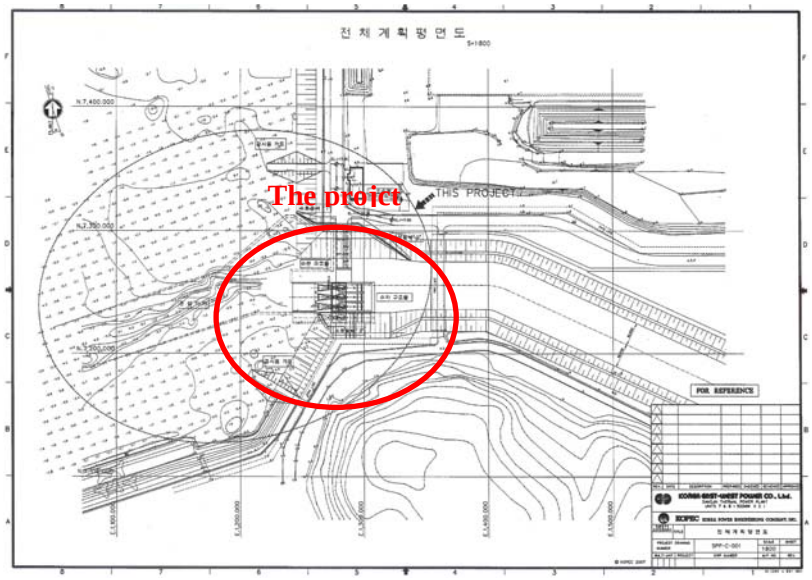
The project site is located in the inside of the Dangjin thermal power plant in Gyoro-Ri, Seckmun-Moen, Dangjin-Gun, Chungcheonnam-Do which is at a longitude of 126° 30'East and a latitude of 37° 03'North.



<Figure A-1> The location of Dangjin small-scale hydro power plant



<Figure A-2> The detail location of Dangjin small-scale hydro power plant



<Figure A-3> The sectioned drawing of small-scale hydro power plant

<Figure A-4> The concept drawing of small-scale hydro power plant

<Figure A-5> The detail concept drawing of small -scale hydro power plant

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

Using the categorization of Appendix B to the *simplified modalities and procedures for small-scale CDM project Activities,* the Project type and category are defined as follows:

Type: Ⅰ. Renewable Energy Project
Category: I.D renewable electricity for the grid.

The Project will use the potential power in the circulating cooling water discharged from Dangjin thermal power plant. The proposed hydro power station will be 4.988MW capacity, rated flow 35m^3/s · unit (Based on Rated flows of 1-8 units). The station will provide net 27,898.81MWh in every year. The total construction period is approximately 24 months.

Classification		
Wheel	Type	Pit, Horizontal, Bulb type
	Rated Output power	1,736 kw
	Rotation	138.4
	Flow rate(unit)	35m^3/sec
	Unit	3
	Manufacturing company	TianJin TianFa Hydro Co,.LTD
Generator	Type	3-phase, Synchronous
	Rated Output power	1,666 kw
	Rotation	138.4
	Unit	3
	Manufacturing company	TianJin TianFa Hydro Co,.LTD
Transformer	Type	Mold
	Capacity	8,000 kVa
	Voltage	3,300/22,900 kv
	Connection type	Y-D(Ynd1)
	Unit	1
	Manufacturing company	Hyosung

The participant is operating five thermal power plants and one pumped storage power plant. This proposed project will be the first small hydro power plant. The participant will obtain installing and operating skills about small hydro power plant.

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

This project of emission reductions will be estimated 150,960 tCO_2e for the project activities during the crediting period.

<Table A-2> Estimated CO_2 emission reductions

Years	Annual estimation of emission reductions (tonnes of CO_2 e)
Year 1	15,096
Year 2	15,096
Year 3	15,096
Year 4	15,096
Year 5	15,096
Year 6	15,096
Year 7	15,096
Year 8	15,096
Year 9	15,096
Year 10	15,096
Total estimated reductions (tonnes of CO2e)	150,960
Total number of crediting years	10 years
Annual average over the crediting period of estimated reductions (tonnes of CO2 e)	15,096

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

Any public funding is not provided for this project activity

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

According to the '*Appendix C of the simplified Modalities and Procedures for Small-Scale CDM project*', the project proponents confirm that the proposed activity is not a debundled component of a large project activity. The project is an independent hydroelectric power plant generating electricity and supplying to the grid. And this proposed project is performed by Korea East-West Power Co., Ltd as small-scale hydroelectric power plant at the first time.

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:

Project category is '*Grid connected Renewable electricity generation*' (Version 13 of AMS-I.D)
Refer to small-scale project category of Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

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

AMS I.D "*Grid connected renewable electricity generation*" Version13, 14 Dec 2007, is applicable. The capacity of the proposed project activity is 5MW that is not exceeding the limits (15MW) of small-scale project activity. And the electricity generated is supplied to a grid.

B.3. Description of the project boundary:

According to AMS I.D. and as referred to in Appendix B for small-scale project activities, the project boundary for a small-scale hydropower project that provides electricity to a grid encompassed the physical, geographical site of the renewable generation source.

The spatial extent of the project boundary includes the project site and all power plants connected physically to the electricity system of Korea Electricity Power Corporation (KEPCO).

B.4. Description of baseline and its development:

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

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

OR

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

Therefore the baseline for this project was calculated according to "Tool to calculate the emission factor for an electricity system (version 01.1)", on the authority of (a) as mentioned above. The baseline emission factor (EF_y) was calculated as a combined margin (CM), consisting of the combination of operating margin(OM) and build margin(BM) factors according to the following six steps. Intend to calculating this combined margin(CM), it were applied that the data originated from existing power plants that provide electricity to the current grid-connected electricity generation. Here, these data were collected from the "Statistics of Electric Power in 2004, 2005, 2006(KEPCO 2005, 2006, 2007)", and should be proper because the host country of this project, Republic of Korea, does not import/export electricity from/to other countries.

CDM – Executive Board

STEP 1. Identify the relevant electric power system

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

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

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

- In case of electricity systems with spot markets for electricity: there are differences in electricity prices (without transmission and distribution costs) of more than 5 percent between the systems during 60 percent or more of the hours of the year.
- The transmission line is operated at 90% or more of its rated capacity during 90% percent or more of the hours of the year.

In this sense, it is clear that the project electricity system to be applied is the whole Korean national grid system since all power plants, including Dae gi wind power plant, are physically connected to each other through transmission and distribution lines constituting the grid. Therefore the Koran national grid has been chosen as relevant electricity power system for purpose of determining the electricity emission factors.

<Figure B-1> Electric Power Grid Nationwide in Republic of Korea
(Source: 2008 Annual Report (KEPCO 2007))

STEP 2. Select an operating margin (OM) method

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

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

If low-cost/must-run resources constitute less than 50% of total grid generation in average of the five

most recent years, simple OM can be chosen.

Referring to the gross electricity generation rate by energy sources of the host country (Republic of Korea), the rate of low cost/must run power generation does not exceed 50% of the total grid. Actually, the most recent 5-year (2002~2006) average data shows that the rate of low cost/must run is 42.77%. (Source: KEPCO)

Therefore, for this project case, "Option (a) Simple OM" is available. <Table B-1> is shown the yearly proportion of the generation of electricity based on the source of energy (KEPCO 2007).

<Table B-1> The yearly proportion of the electricity generation based on the source of energy in Korea (Unit : million kWh)

Item \ Year		2002	2003	2004	2005	2006
Hydro*		5,311	6,887	5,861	5,189	5,219
Thermal	Domestic	5,144	5,398	4,603	4,484	4,312
	Bituminous	112,877	114,878	122,556	129,174	134,894
	Heavy	23,940	23,656	21,591	20,079	18,596
	Diesel	1,155	2,870	474	412	599
	Gas	38,943	39,091	55,999	58,118	68,302
Nuclear*		119,103	129,672	130,715	146,779	148,749
Alternative*		-	-	350	404	511
Total		5,311	6,887	5,861	5,189	5,219
The rate of low cost/must run power generation (%)		42.27	44.02	41.36	43.01	41.65

(Source: Summary of Electricity statistics in 2006 (KEPCO 2007))
(* : low-operating cost and must-run power plants)

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

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

• Ex post option: The year in which the project activity displaces grid electricity, requiring the emissions factor to be updated annually during monitoring. If the data required to calculate the emission factor for year y is usually only available later than six months after the end of year y, alternatively the emission factor of the previous year (y-1) may be used. If the data is usually only available 18 months after the end of year y, the emission factor of the year proceeding the previous year (y-2) may be used. The same data vintage (y, y-1 or y-2) should be used throughout all crediting periods.
On this PDD, *ex-ante* data were applied. The Simple OM emission factor is calculated as followed step 3.

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

The simple OM emission factor is calculated as the generation-weighed emissions per electricity unit of all generating units serving the system, excluding low-operating cost and must-run power plants. Low-operating cost and must run power plants include hydro, nuclear, low cost biomass, geothermal and

domestic coal. And it is calculated based on data on fuel consumption and net electricity generation of each power plant /unit (Option A) as follows:

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

Where:

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

In case of this project, the applied parameters are presented for estimation of Operating Margin emission factor ($EF_{grid,OM,y}$) at <Table 10, 11, 12> in Annex 3. As a result, the OM emission factor ($EF_{grid,OM,y}$) is 0.7075 (tCO_2/MWh).

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

The sample group of power units m used to calculate the build margin consists of either:

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

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

As a general guidance, a power unit is considered to have been built at the date when it started to supply electricity to the grid.
Power plant registered as CDM project activities should be excluded from the sample group m. However, If group of power units, not registered as CDM project activity, identified for estimating the build margin emission factor includes power unit(s) that is(are) built more than 10 years ago then:

(i) exclude power unit(s) that is (are) built more than 10 years ago from the group; and

(ii) include grid connected power projects registered as CDM project activities, which are dispatched by dispatching authority to the electricity system.

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

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

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

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

For this project case, *Option* 1 is taken to calculate the Build Margin emission factor, $EF_{grid,BM,y}$ *ex-ante*, and it is estimated as <Table B-2> according with each regulation to compose proper sample group(*m*) that the electricity quantity of candidate sample groups and it ratio to total generation in Korea.

<Table B-2> Sample Plant group(*m*) for determining Build margin Emission factor

Sample group(m) Classification	**Regulation 1**	**Regulation 2**	**Comments**
	"The five power plants that have been built most recently"	**"The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently."**	
Electricity quantity	22.5 GWh	**74,278.8 GWh**	Total generation is 365,004.9 GWh in Korea. (Statistics of Electric Power in 2006(KEPCO 2007))
Proportion (ratio to total generation in Korea)	0.01%	**20.35%**	

The annual generation of "the five power plants that have been built most recently" was 22.5 GWh (0.01% of total generation of the grid system), and the annual generation of "the power plants capacity additions in the electricity system that comprise 20.35% of the system generation and that have been built most recently" was 74,278.8 GWh. Therefore, the latter was chosen for this project as a lager figure than the other one. It is presented at <Table 13> in Annex 3 that the sample group of plants used in the Build Margin emission factor ($EF_{grid,BM,y}$).

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

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

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

Where:

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

According to the BM calculation formula and variables of above tables, $EF_{BM,y}$ is 0.3747 (tCO_2/MWh).

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

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

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

Where:

$EF_{grid,BM,y}$	=	Build margin CO_2 emission factor in year y (tCO_2/MWh)
$EF_{grid,OM,y}$	=	Operating margin CO_2 emission factor in year y (tCO_2/MWh)
w_{OM}	=	Weighting of operating margin emissions factor (%)
w_{BM}	=	Weighting of build margin emissions factor (%)

• Wind and solar power generation project activities: w_{OM} = 0.75 and w_{BM} = 0.25 (owing to their intermittent and non-dispatchable nature) for the first crediting period and for subsequent crediting periods.
• All other projects: w_{OM} = 0.5 and w_{BM} = 0.5 for the first crediting period, and w_{OM} = 0.25 and w_{BM} = 0.75 for the second and third crediting period, unless otherwise specified in the approved methodology which refers to this tool.

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

Therefore baseline emission factor ($EF_{grid,CM,y}$) for this project is = 0.5411(tCO_2/MWh.)as follows :

$$EF_{grid,CM,y} = w_{OM} \cdot EF_{grid,OM\,y} + w_{BM} \cdot EF_{grid,BM,y}$$
$$= 0.5 \cdot 0.7075(tCO_2/MWh) + 0.5 \cdot 0.3747(tCO_2/MWh)$$
$$= 0.5411(tCO_2/MWh)$$

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

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

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

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

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

The electricity supplied by the project activity to the grid (EG_y) is expected to be 27,898.81MWh/yr as described at section A.

As a result, the baseline emission (BE_y) is 15,096 (tCO_2 /yr).

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

<Table B-3> Key information and data used to determine the baseline scenario

Parameter	Value	Source
$FC_{i,m,y}$ is the amount of fossil fuel type *i* consumed by power plant / unit *m* in year *y* (in a mass or volume unit)	Refer to <Table 10 >	Statistics of Electric Power in 2004 (KEPCO 2005) Statistics of Electric Power in 2005 (KEPCO 2006) Statistics of Electric Power in 2006 (KEPCO 2007)
$NCV_{i,y}$ is Net Calorific Values(energy content) of fossil fuel type *i* in year *y* (GJ/mass or volume unit)	Refer to <Table 11>	Statistics of Electric Power in 2004 (KEPCO 2005) Statistics of Electric Power in 2005 (KEPCO 2006) Statistics of Electric Power in 2006 (KEPCO 2007)
$EG_{m,y}$ **(MWh)** is net electricity generated and delivered to the grid by power plant / unit *m* in year *y*.	Refer to <Table 12>	Statistics of Electric Power in 2004 (KEPCO 2005) Statistics of Electric Power in 2005 (KEPCO 2006) Statistics of Electric Power in 2006

		(KEPCO 2007)
$EF_{CO2,i,y}$ (tCO_2/TJ) is CO_2 emission factor of fossil fuel type *i* in year *y*	Refer to <Table 14>	2006 IPCC Guidelines
$EF_{grid,OM\,y}$ Operating Margin Emissions Factor (in ton CO_2/MWh)	0.7075	Calculated
$EF_{grid,BM,y}$ Build Margin Emissions Factor (in ton CO_2/MWh)	0.3747	Calculated
$EF_{grid,CM,y}$ Baseline Emissions Factor (in ton CO_2/MWh)	0.5411	Calculated

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

According to Attachment A to Appendix B of the simplified modalities and procedures for CDM small-scale project activities evidence to why the project is additional is offered under following categories of barriers.

Investment Barrier

The purpose of this part is to determine whether the proposed project is economically attractive or not through appropriate analysis method.

If the NPV(Net Present Value) of the project is lower than 0, the project is not an economically attractive course of action and fulfils the requirement of additionality.

Total construction costs of proposed project are 24,280 million won and operation costs are 559 million won per year. To analyze economic feasibility of this project, 79.728 won based on *Electric power statistics information system (http://www.kpx.or.kr/epsis/)* is used as the cost of purchase. The applied Average unit price on settlement(small hydro), 79.728 won, in this project is the average value from January of 2006 to December of 2007.

The detail contents of the laws related to prices are as follows:
● Feed-in tariff: mandatory purchase by Korea Power Exchange at the SMP based on the Electric Utility Act (amended in February 1999)

● Public subsidy: compensation of the difference between the SMP and the standard price based on the Act on the Promotion of the Development and Use and Dissemination of New and Renewable Energy (amended in March 2002)

In this project, economic feasibility is analyzed without subsidy by the results of the 22nd EB meeting. According to the meeting report of the 22nd EB which was held on 23-25 November 2005, the subsidy

adopted after 11 November 2001 do not need to be included in the economic analysis for the project.. The detail explanations are followed.

'Clarifications on the consideration of national and/or sectoral policies and circumstances in baseline scenarios (version 02)' 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. Therefore, there are no problems at all about the economic analysis without subsidy in this project.

<Table B-4> Basic parameters for the calculation of financial indicators of the project.

	Total cost of Construction (million won)	Operation cost (million won/year)	Insurance fee (million won/year)	Average unit price on settlement (small hydro) (won/kWh)	Electricity sale (million won/year)	NPV (million won)
Dangjin small hydroelectric power plant	24,280	559	49	79.728	2,224	-3,760

As a result of economical analysis, NPV of the project is -3,760 million won which is lower than '0'. Therefore, the project is not financially feasible and fulfils the requirement of additionality.

Sensitivity Analysis

The objective of sensitivity analysis is to show whether the conclusion regarding the financial attractiveness is robust to reasonable variations in the critical assumptions.

<Table B-5> Result of sensitivity analysis

Scenario	NPV (million won)	IRR(%)
Standard	-3,760	4.79%
+ 5%: Growth of benefit (Increasing unit cost of electricity sale)	-2,357	5.33%
+ 10%: Growth of benefit (Increasing unit cost of electricity sale)	- 954	5.85%
- 5%: Decrease total cost of construction	- 2,168	5.36%
- 10%: Decrease total cost of construction	- 577	5.97%
- 5%: Decrease Operation cost	- 3,382	4.94%
- 10%: Decrease Operation cost	- 3,005	5.08%

As a result of analysis, the result is lower than '0'. Therefore, this project is not available for commercial purpose. The purpose of this project is only for CDM which prevent global warming.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

Calculation of Baseline Emission

Depending on ACM0002 (Version06), baseline emissions should be obtained by the below equation (5)

$$BE_y = (EG_y - EG_{baseline}) \cdot EF_y \quad \textbf{(5)}$$

Where,

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

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

$$BE_y = EG_y \cdot EF_y \quad \textbf{(6)}$$

The baseline emission factor (EF_y) calculations will be based on the Tool to calculate the emission factor for an electricity system (version 01.1).

$$EF_y = w_{OM} \cdot EF_{OM,y} + w_{BM} \cdot EF_{BM,y} \quad \textbf{(4)}$$

Where,

EF_y : Baseline emission factor (tCO_2/ MWh)
w_{OM} : Operation Margin weight, which is 0.5 by default
w_{BM} : Build Margin weight, which is 0.5 by default
$EF_{OM,y}$: Operational Margin emission factor (tCO_2 / MWh)
$EF_{BM,y}$: Build Margin emission factor (tCO_2 / MWh)
y : Refers to a given year

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

The OM emission factors is calculated as follows,

$$EF_{OM,Simple,y} = \frac{\sum_{i,j} F_{i,j,y} \cdot COEF_{i,j}}{\sum_{j} GEN_{j,y}} \quad \textbf{(1)}$$

Where,

$F_{i,j,y}$: The amount of fuel i (in GJ) consumed by power source j in year y
$COEF_{i,j,y}$: The carbon coefficient of fuel i (tCO_2/GJ)
$GEN_{j,y}$: Electricity (MWh) delivered to the grid by source j
j The set of plants delivering electricity to the grid, not including low-cost or must-run plants and carbon financed plants

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y : Refers to a given year

The emission factor ($EF_{BM,y}$) of Build margin is calculated using the following equation:

$$EF_{BM,y} = \frac{\sum_{i,m} F_{i,m,y} \cdot COEF_{i,m}}{\sum_{m} GEN_{m,y}} \quad \textbf{(3)}$$

Where,

$F_{i,m,y}$: The amount of fuel *i* (in GJ) consumed by sample power plant *m* in year *y*
$COEF_{i,m,}$: The carbon coefficient of fuel *i* (t CO_2/GJ);
$GEN_{m,y}$: Electricity (MWh) delivered to the grid by source *m*.
m : The sample power plant that comprise 20% of the system generation and that have been built most recently

As a result, the baseline emission (BE_y) is 15,096 (tCO_2 /yr)

<Table B-6>Annual electricity generation and baseline emission of small-scale hydroelectricity power plant

Category	Annual electricity generation
Operational Margin emission factor ($EF_{OM,y}$)	0.7075 (tCO_2/MWh)
Build Margin emission factor ($EF_{BM,y}$)	0.3747 (tCO_2/MWh)
Baseline emission factor(EF_y)	0.5411 (tCO_2/MWh)
Project electricity generation(EG_y)	27,898.81 (MWh/yr)
Baseline emission(BE_y)	15,096 (tCO_2 /yr)

Project emission

The project activity generates electricity by utilizing potential hydro power and it means that no greenhouse gas is emitted by performing this project activity. Therefore, the project emission is zero.

Leakage

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

Estimation of Emission reduction

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

$$\boldsymbol{ER_y = BE_y - PE_y - L_y} \quad \textbf{(7)}$$

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

Here, both of the project emission and the leakage in this project activity are zero.

$$PE_y + L_y = 0 \quad (8)$$

Therefore the emission reduction by the project activity are equal to baseline emissions, that is 15,096 (tCO_2 /yr).

$$ER_y = BE_y - (PE_y + L_y) \quad (9)$$
$$= 15{,}096\ (tCO_2\ /yr)$$

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

Data / Parameter:	**EF_y**
Data unit:	$tonCO_2/MWh$
Description:	CO2e emissions intensity of the electricity displaced
Source of data used:	Calculated
Value applied:	0.5411
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value of data was calculated according to Tool to calculate the emission factor for an electricity system (version 01.1). Applied value was calculated by referring Statistics of Electric Power in 2004(KEPCO 2005), Statistics of Electric Power in 2005(KEPCO 2006), Statistics of Electric Power in 2006(KEPCO 2007), and Status of Generation facility in 2006(KPX 2007)
Any comment:	The same value of data will be applied during the first crediting period without updating.

Data / Parameter:	**$EF_{om,y}$**
Data unit:	tCO_2/MWh
Description:	Operating Margin emission factor
Source of data used:	Calculated
Value applied:	0.7075 tCO_2/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	This value of data was calculated according to Tool to calculate the emission factor for an electricity system (version 01.1). Applied value was calculated by referring Statistics of Electric Power in 2004(KEPCO 2005), Statistics of Electric Power in 2005(KEPCO 2006), Statistics of Electric Power in 2006(KEPCO 2007), and Status of Generation facility in 2006(KPX 2007)
Any comment:	The same value of data will be applied during the first crediting period without updating.

Data / Parameter:	**$EF_{BM,y}$**
Data unit:	tCO2/MWh
Description:	Operating Margin emission factor
Source of data used:	Calculated
Value applied:	0.3747 tCO2/MWh
Justification of the choice of data or description of measurement methods and procedures actually	This value of data was calculated according to Tool to calculate the emission factor for an electricity system (version 01.1). Applied value was calculated by referring Statistics of Electric Power in 2004(KEPCO 2005), Statistics of Electric Power in 2005(KEPCO 2006), Statistics of Electric Power in 2006(KEPCO 2007), and Status of Generation facility in 2006(KPX 2007)

applied :	
Any comment:	The same value of data will be applied during the first crediting period without updating.

B.6.3 Ex-ante calculation of emission reductions:

Baseline emission

The capacity of the project (hydroelectric power plant) is 5MW and coefficient of utilization is about 100%. Therefore, expected electricity produced by the project is 27,898.81MWh per year.
Emission factor (EF_y) is 0.5411(tCO_2/MWh) and for detail calculation method, refer to Annex 3.

Baseline emission = electricity produced by the project × emission factor (EF_y)
= 27,898.81 MWh/yr × 0.5411 tCO_2/MWh
= 15,096 $tonCO_2$/yr

Project emission

Project emission is zero

Leakage

Emission due to leakage is zero

Ex-ante emission reduction

Emission reduction = Baseline emission - Project emission - Leakage
= 15,096 $tonCO_2$/yr

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

Years	Estimation 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 (tCO2 e)
Year1: 2010.1.1 - 2010.12.31	0	15,096	0	15,096
Year2: 2011.1.1 – 2011.12.31	0	15,096	0	15,096
Year3: 2012.1.1 – 2012.12.31	0	15,096	0	15,096
Year4: 2013.1.1 – 2013.12.31	0	15,096	0	15,096
Year5: 2014.1.1 – 2014.12.31	0	15,096	0	15,096

Year6: 2015.1.1 – 2015.12.31	0	15,096	0	15,096
Year7: 2016.1.1 – 2016.12.31	0	15,096	0	15,096
Year8: 2017.1.1 – 2017.12.31	0	15,096	0	15,096
Year9: 2018.1.1 – 2018.12.31	0	15,096	0	15,096
Year10: 2019.1.1 – 2019.12.31	0	15,096	0	15,096
Total (tonnes of CO_2 e)	**0**	150,960	**0**	150,960

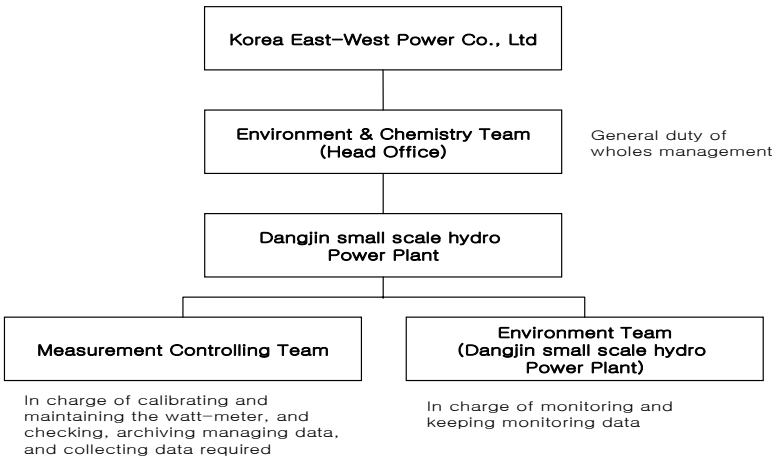
B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

Data / Parameter:	**EG_y**
Data unit:	MWh
Description:	Net Electricity supplied to the grid by the project in year y.
Source of data to be used:	Electrical meters
Value of data	27,898.81 MWh
Description of measurement methods and procedures to be applied:	Directly measured by metering systems installed. The recording frequency will be and monthly recorded. The data will be archived electronically and kept during the crediting period and 2 years after. Double check by receipt of sales.
QA/QC procedures to be applied:	Uncertainty of data is low. Data measured by meters will be cross checked by electricity sales receipt. If the data are different, project participant shall be followed "Act on operation of electricity market". In case meters are improperly operated equipments, internal audit and correction procedure shall be followed and be certified by the final decision- maker and Korea Power Exchange.
Any comment:	

B.7.2 Description of the monitoring plan:

The project operator assigns the person in charge of CDM project with assistance of the Management controlling team and Environment & Chemistry team. The structure shows as the following Figure.B-2



<Figure B-2> Management structure of Monitoring Plan

1. **Installation of Monitoring equipment**
   Electricity measuring meters shall be set up transparently in accordance with "Law regarding measurement" and "Act on operation of electricity market" and shall be sealed after affirmation of Korea Power Exchange. The meters shall be authorized through the due formal certifying process (the valid period for the authorized certification: 7 years). The meters shall be calibrated them they are installed, and re-calibrated within 3 years 6 months ± 6months after installation.

2. **Monitoring data**
   Electricity supplied to the grid will be monitored by metering devices installed. The electricity sale receipt will be provided by Korea Power Exchange for the project owner's double check of the amount of electricity supplied and accepted by Korea Power Exchange. And the participant will monitor the imported electricity by metering device.

3. **Manager of monitoring**
   The person who is in charge of monitoring and electricity safety shall attend the following courses.
   - Course on 'Act on operation of electricity market'
   - Course on Electricity safety

   If the responsible for monitoring and electricity safety is transferred to another person, it is needed to be approved by final decision-maker.

ISO 14000 system has already existed in the object site and ISO 14000 system will be connected with monitoring system of this project.

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

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: *05/25/2007*

Responsible monitoring department
: Environment & Chemistry Team (head office)

Baseline emission factor calculating person:
: Dr. Jung, Jae-Soo / Ecoeye Co., Ltd.

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

25/01/2008(Contract date on equipment purchase)

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

The expected operational life time is 30 years.

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

C.2.1. Renewable crediting period

Not applicable

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

Not applicable

C.2.1.2. Length of the first crediting period:

Not applicable

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

01/01/2010

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:

Dangjin small scale hydro power plant is planned to be installed in discharge-watercourse in Dangjin thermal power station. Environmental impact assessment of Dangjin thermal power station was finished on March 5, 1990.

According to article 24, clause 1, "modification of business plan which is not the object of renegotiation", of "assessment law about environment, transportation, disasters", domestic law, in case of business, which is not the object of renegotiation, it is enforcing to reflect in business plan with the devise of a impact-minimizing-scheme due to the modification of business plan.

Consequently environmental impact assessment due to installing of Dangjin small scale hydro power plant and modified business plan which reflects impact-minimizing-scheme-devise and impact-analysis accompanied by business alteration were submitted to Ministry of Commerce, Industry and Energy (currently Ministry of Knowledge Economy) on Dec. 28, 2005. The contents of submitted summary documents are as following:

- **EIA contents - negotiations**
  - The reason of modification: Dangjin thermal small hydro plant construction

<Table D-1> The contents - negotiations

	Before negotiation	After negotiation	
Generating capacity	500,000kw X 8 unit	500,000kw X 8 unit	To change existing watercourse gradient after floodgate
Discharging warm water method	Open watercourse	Open watercourse and passing small hydro plant facility	

- **Environmental assessment examination about Warm Water discharging**
  - Additional effects did not occur on Warm water discharging flux and diffusion area by constructing small hydro plant.
    - Result of Environmental impact research (July 1994 – December 2005)
      - ✓ Warm water discharging flux (130m^3/s), Diffusion area (0-2.0km)
  - Less occurring foam for the reason that warm water discharging will be passing through small hydro plan and be discharge under water.

- **Environmental assessment reduce plan about small hydro plant construction**

Tailrace construction for discharge water would be occur turbidity. Therefore, Participant is going to minimize the impact of turbidity with install floating turbidity curtain.

The project participant received the official document from Ministry of Commerce, Industry and Energy on Jan 11, 2006.

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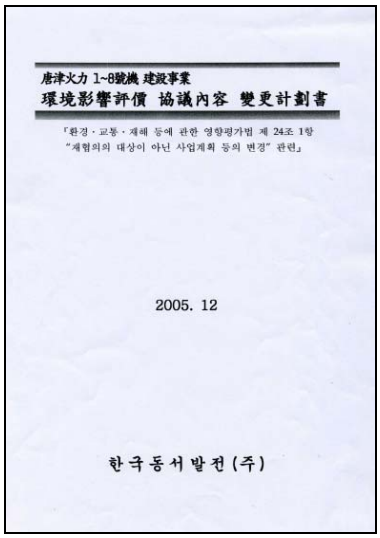
The contents of the official document: Please be ensured in thorough execution of discussed contents in order to minimize the environmental impact in discharging of warm drainage due to the small-scale hydro power plant.

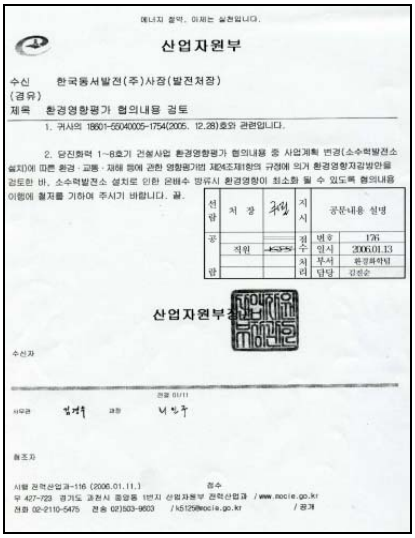
The project participant is going to minimize the impact of sewage and muddy water by thorough execution of environmental-impact-minimizing-plan in installing small-scale hydro power plant.

<Figure D-1> The picture I with floating turbidity curtain at the project site

<Figure D-2> The picture II with floating turbidity curtain at the project site


唐津火力 1~8號機 建設事業
環境影響評價 協議內容 變更計劃書
「환경·교통·재해 등에 관한 영향평가법 제 24조 1항
"재협의의 대상이 아닌 사업계획 등의 변경" 관련」
2005. 12
한국동서발전(주)

<Figure D-3> The document submitted to Ministry of Commerce, Industry and Energy



산업자원부

수신 한국동서발전(주)사장(발전처장)
(경유)
제목 환경영향평가 협의내용 검토

1. 귀사의 18601-E6040005-1754(2005. 12.28)호와 관련입니다.

2. 당진화력 1~8호기 건설사업 환경영향평가 협의내용 중 사업계획 변경(소수력발전소 설치)에 따른 환경·교통·재해 등에 관한 영향평가법 제16조제1항의 규정에 의거 환경영향자문받은 바, 소수력발전소 설치로 인한 문제수 발생시 환경영향이 최소화 될 수 있도록 협의내용 이행에 철저를 기하여 주시기 바랍니다. 끝.

산업자원부장관

<Figure D-4> The official document received from Ministry of Commerce, Industry and Energy

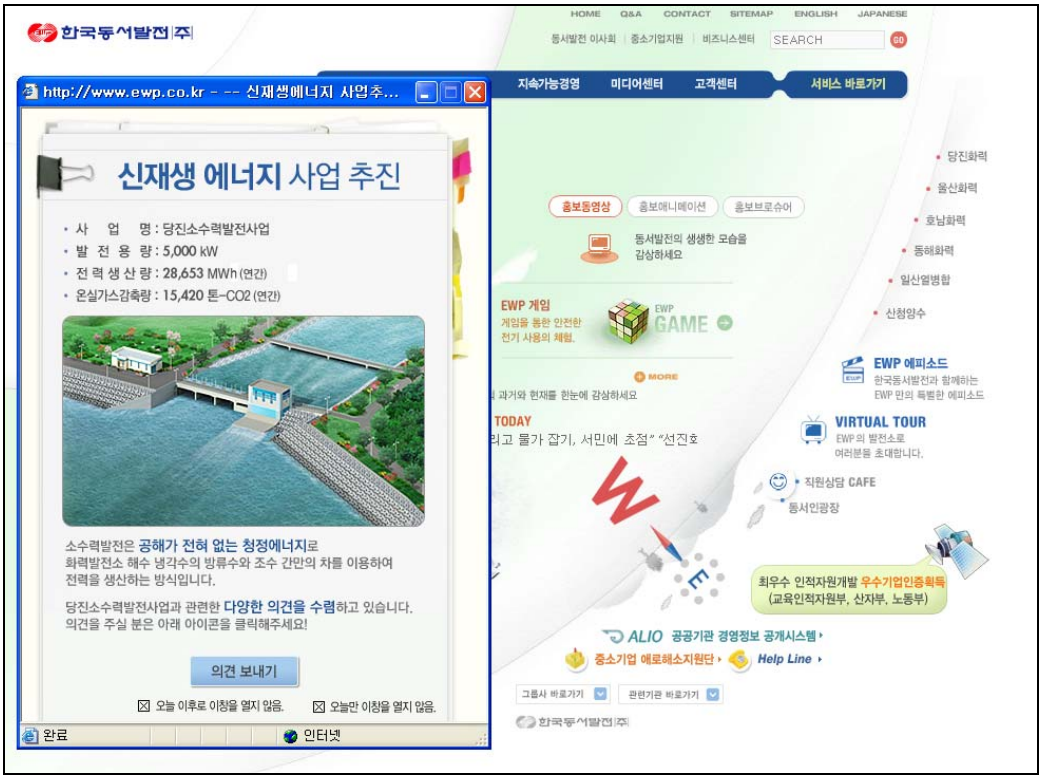
D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

>> Not applicable.

SECTION E. Stakeholders' comments

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

Korea's public service broadcaster, KBS announced the construction plan of Dangjin small hydroelectric power plant through KBS internet news on 03 February 2004.



<Figure E-1> Popup window for Stakeholders comments on EWP homepage. (Source: http://www.ewp.co.kr)

Stakeholders who related to this project, while visiting EWP homepage, Information of small hydro power plant is shown and comments can be collected to Q&A bulletin on website. Some Comments were collected about proposed project. It was started in 28 January 2008 until 10 March 2008.

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<Figure E-2> A comment on Q/A bulletin webpage

E.2. Summary of the comments received:

The participant had received five stakeholders' comments from 28 January 2008 to 10 March 2008 on the EWP homepage. Four comments had positive opinion about constructing small hydro plant. One of the positive opinions was that government has to invest and support for parts of renewable energy technology (photovoltaic, wind power, and fuel cell, etc) as policies.

Negative comment had that hydro power plant is environmental friendly technology but it has to put in too much investment costs. So, it will necessary for more practical and more profitable power generation system.

EWP will reflect stakeholders' comments positively

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

During the compilation of stakeholders' comments, significant adverse comment was not received.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Korea East-West Power Co., Ltd.
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FAX:	+82-2-3456-8499
E-Mail:	jonghan@ ewp.co.kr
URL:	http://www.ewp.co.kr
Represented by:	Jung, Jonghan
Title:	Deputy General Manager
Salutation:	Mr.
Last Name:	Jung
Middle Name:	
First Name:	Jonghan
Department:	Environment & Chemistry Team Power Generation Department
Mobile:	+82-18-362-1997
Direct FAX:	+82-2-3456-8499
Direct tel:	+82-2-3456-8533
Personal E-Mail:	jonghan@ewp.co.kr

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no public funding invested for this project.

Annex 3

BASELINE INFORMATION

<Table 10> Data on fuel consumption for plants in the Operating Margin

Year	Plant name		Coal (t)	Heavy oil(kl)	Diesel oil(kl)	LNG(t)
2004	Honam	#1	885,758	606	300	-
		#2	783,300	1,714	335	-
	Samchonpo	#1	1,624,500	-	1,674	-
		#2	1,564,986	-	744	-
		#3	1,467,177	-	814	-
		#4	1,538,768	-	785	-
		#5	1,707,777	-	230	-
		#6	1,734,977	-	652	-
	Yonghung	#1	1,114,254	-	27,916	-
		#2	459,217	-	18,314	-
	Boryeong	#1	1,599,557	-	311	-
		#2	1,555,055	-	616	-
		#3	1,427,263	-	574	-
		#4	1,560,014	-	179	-
		#5	1,397,343	-	422	-
		#6	1,559,785	-	350	-
	Taean	#1	1,438,094	-	999	-
		#2	1,509,379	-	310	-
		#3	1,415,585	-	390	-
		#4	1,539,502	-	254	-
		#5	1,547,217	-	329	-
		#6	1,531,751	-	230	-
	Hadong	#1	1,389,739	-	533	-
		#2	1,515,681	-	145	-
		#3	1,501,027	-	670	-
		#4	1,397,482	-	737	-
		#5	1,501,672	-	318	-
		#6	1,379,396	-	689	-
	Dangjin	#1	1,502,885	-	294	-
		#2	1,523,605	-	211	-
		#3	1,404,465	-	605	-
		#4	1,434,844	-	528	-
	Ulsan	#1	-	73,408	114	-
		#2	-	65,316	82	-
		#3	-	71,305	554	-
		#4	-	420,739	1,238	-
		#5	-	513,497	931	-
		#6	-	527,083	1,603	-
	Youngnam	#1	-	347,107	837	-
		#2	-	248,049	274	-
	Yosu	#1	-	181,712	571	-
		#2	-	316,523	436	-
	Pyongtaek	#1	-	204,664	247	2,095
		#2	-	209,664	232	2,515
		#3	-	179,921	240	3,791
		#4	-	192,294	225	3,217
	Namjeju	#1	-	16,510	6	-
		#2	-	16,040	13	-
	Jeju	#1	-	15,306	7	-
		#2	-	118,473	73	-
		#3	-	124,160	41	-
	Seoul	#4	-	-	1.46	22,409
		#5	-	-	3	117,908
	Incheon	#1	-	-	-	10,523
		#2	-	-	-	11,094
		#3	-	-	149	4,235

	Pyongtaek	C/C	-	-	21	98,846
	Ilsan	C/C	-	-	-	593,548
	Bundang	C/C	-	-	-	653,880
	Ulsan	C/C	-	-	-	347,076
	Seoincheon	C/C	-	-	88	1,209,806
2004	Shinincheon	C/C	-	-	-	1,587,638
	Boryeong	C/C	-	-	-	988,548
	Busan	C/C	-	-	2,687	1,298,418
	Hallim	C/C	-	-	28,796	-
	Anyang	C/C	-	-	-	270,559
	Bucheon	C/C	-	-	-	258,596
	K I E Co.	C/C	-	-	-	467,583
	L G Bugog	C/C	-	-	-	260,653
	Yulchon	C/C	-	-	596	7,388
	Namjeju	D/P	-	57,808	80	-

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

<Table 10> Data on fuel consumption for plants in the Operating Margin (continued)

Year	Plant name		Coal (t)	Heavy oil(kl)	Diesel oil(kl)	LNG(t)
2005	Honam	#1	870,214	961	278	-
		#2	912,497	338	185	-
	Samchonpo	#1	1,534,223	-	1,220	-
		#2	1,731,265	-	626	-
		#3	1,723,152	-	377	-
		#4	1,632,334	-	1,029	-
		#5	1,516,654	-	1,415	-
		#6	1,546,663	-	1,001	-
	Yonghung	#1	2,081,972	-	4,541	-
		#2	1,761,395	-	2,903	-
	Boryeong	#1	1,440,343	-	761	-
		#2	1,388,532	-	551	-
		#3	1,589,150	-	90	-
		#4	1,421,343	-	603	-
		#5	1,587,999	-	156	-
		#6	1,260,305	-	627	-
	Taean	#1	1,508,570	-	621	-
		#2	1,323,078	-	395	-
		#3	1,494,175	-	650	-
		#4	1,383,297	-	365	-
		#5	1,411,398	-	742	-
		#5	1,504,962	-	417	-
	Hadong	#1	1,513,930	-	284	-
		#2	1,410,099	-	792	-
		#3	1,422,196	-	472	-
		#4	1,511,054	-	567	-
		#5	1,345,648	-	614	-
		#6	1,520,774	-	331	-
	Dangjin	#1	1,438,702	-	637	-
		#2	1,437,473	-	632	-
		#3	1,549,041	-	141	-
		#4	1,544,010	-	134	-
		#5	499,714	-	5,701	-
		#6	38,671	-	1,779	-
	Ulsan	#1	-	70,183	750	-
		#2	-	67,296	585	-
		#3	-	53,085	662	-
		#4	-	375,417	1,971	-
		#5	-	363,992	1,676	-
		#6	-	352,776	1,708	-
	Youngnam	#1	-	359,910	844	-
		#2	-	190,085	584	-
	Yosu	#1	-	106,919	434	-

		#2	-	218,356	346	-
	Pyongtaek	#1	-	293,214	118	3,553
		#2	-	321,188	140	2,641
		#3	-	308,042	132	1,784
		#4	-	311,245	138	2,047
	Namjeju	#1	-	14,628	15	-
		#2	-	15,031	12	-
	Jeju	#1	-	12,564	12	-
		#2	-	129,516	-	-
		#3	-	122,866	48	-
	Seoul	#4	-	-	-	49,143
		#5	-	-	1	108,761
2005	Incheon	#2	-	-	-	8,505
	Pyongtaek	C/C	-	-	1	110,953
	Ilsan	C/C	-	-	-	533,188
	Bundang	C/C	-	-	-	671,944
	Ulsan	C/C	-	-	-	470,131
	Seoincheon	C/C	-	-	335	989,645
	Shinincheon	C/C	-	-	-	1,458,763
	Boryeong	C/C	-	-	-	1,161,510
	Incheon	C/C	-	-	-	281,813
	Busan	C/C	-	-	-	1,211,144
	Hallim	C/C	-	-	29,686	-
	Anyang	C/C	-	-	-	261,202
	Bucheon	C/C	-	-	-	261,705
	POSCO POWER	C/C	-	-	-	445,253
	G S Bugog	C/C	-	-	-	297,976
	Yulchon	C/C	-	-	159	194,534
	Namjeju	D/P	-	56,727	37	-
	Jeju	D/P	-	31,808	72	-

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

<Table 10> Data on fuel consumption for plants in the Operating Margin (continued)

Year	Plant name		Coal (t)	Heavy oil(kl)	Diesel oil(kl)	LNG(t)
2006	Honam	#1	781,139	1,113	279	-
		#2	859,736	1,251	359	-
	Samchonpo	#1	1,696,271	-	860	-
		#2	1,508,082	-	1,362	-
		#3	1,519,385	-	457	-
		#4	1,521,263	-	1,818	-
		#5	1,665,339	-	977	-
		#6	1,770,348	-	428	-
	Yonghung	#1	2,004,193	-	2,548	-
		#2	2,129,118	-	2,545	-
	Boryeong	#1	1,638,140	-	306	-
		#2	1,389,425	-	1,137	-
		#3	1,323,779	-	514	-
		#4	1,610,928	-	82	-
		#5	1,296,455	-	541	-
		#6	1,553,273	-	518	-
	Taean	#1	1,354,832	-	514	-
		#2	1,532,209	-	162	-
		#3	1,338,967	-	575	-
		#4	1,548,909	-	133	-
		#5	1,542,775	-	544	-
		#6	1,294,577	-	1,113	-
		#7	61,910		4,799	
	Hadong	#1	1,373,049	-	515	-
		#2	1,543,074	-	293	-
		#3	1,549,094	-	153	-
		#4	1,376,612	-	796	-
		#5	1,554,524	-	242	-

		#6	1,371,801	-	690	-
	Dangjin	#1	1,380,527	-	966	-
		#2	1,570,077	-	161	-
		#3	1,402,916	-	433	-
		#4	1,386,317	-	1,549	-
		#5	1,456,458	-	745	-
		#6	1,216,582	-	3,051	-
		#7	1,008	-	505	
	Ulsan	#1	-	72,243	605	-
		#2	-	80,187	469	-
		#3	-	96,459	518	-
		#4	-	360,919	3,729	-
		#5	-	375,985	3,678	-
		#6	-	378,331	3,694	-
	Youngnam	#1	-	107,090	1,016	-
		#2	-	95,127	1,494	-
	Yosu	#1	-	99,129	281	-
		#2	-	215,957	291	-
	Pyongtaek	#1	-	261,458	141	3,997
		#2	-	277,025	166	5,687
		#3	-	303,858	134	3,891
		#4	-	245,602	103	3,473
	Namjeju	#1	-	11,406	17	-
		#2	-	9,772	14	-
		#3	-	46,504	2,509	-
2006	Jeju	#1	-	8,603	23	-
		#2	-	113,679	64	-
		#3	-	117,464	67	-
	Seoul	#4	-	-	1	69,383
		#5	-	-	1	152,891
	Incheon	#1	-	-	-	6,945
		#2	-	-	-	5,223
		#3	-	-	311	15,426
		#4	-	-	311	12,454
	Pyongtaek	C/C	-	-	45	84,054
	Ilsan	C/C	-	-	1,384	556,504
	Bundang	C/C	-	-		720,381
	Ulsan	C/C	-	-		536,196
	Seoincheon	C/C	-	-	1,066	1,199,196
	Shinincheon	C/C	-	-		1,641,038
	Boryeong	C/C	-	-		998,683
	Incheon	C/C	-	-		484,606
	Busan	C/C	-	-		1,396,417
	Hallim	C/C	-	-	48,475	
	Anyang	C/C	-	-	-	230,969
	Bucheon	C/C	-	-	215	225,713
	POSCO POWER	C/C	-	-	-	408,018
	G S Bugog	C/C	-	-	-	389,811
	Yulchon	C/C	-	-	-	315,132
	Namjeju	D/P	-	51,347	111	-
	Jeju	G/T	-	-	8,264	-
	Jeju	D/P	-	52,907		-

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

<Table 11> Gross caloric value

Year	Plant name		Coal (kcal/kg)	Heavy oil(kcal/l)	Diesel oil(kcal/l)	LNG(kcal/kg)
2004	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	-
	Seoul	#4	-	-	9,070	13,011
		#5	-	-	9,070	13,014
	Incheon	#1	-	-	-	13,038
		#2	-	-	-	13,039
		#3	-	-	8,951	13,038
	Pyongtaek	C/C	-	-	8,758	13,033
	Ilsan	C/C	-	-	-	13,017

Year	Plant name		Coal (kcal/kg)	Heavy oil(kcal/l)	Diesel oil(kcal/l)	LNG(kcal/kg)
	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
2004	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	-	9,901	8,867	-

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

<Table 11> Gross caloric value (Continued)

Year	Plant name		Coal (kcal/kg)	Heavy oil(kcal/l)	Diesel oil(kcal/l)	LNG(kcal/kg)
2005	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	-
		#5	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	-

Year	Plant name		Coal (kcal/kg)	Heavy oil(kcal/l)	Diesel oil(kcal/l)	LNG(kcal/kg)
		#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	#2	-	-	-	13,025
	Pyongtaek	C/C	-	-	8,950	13,030
	Ilsan	C/C	-	-	-	13,011
2005	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
	Namjeju	D/P	-	9,877	8,975	-
	Jeju	D/P	-	9,932	8,954	-
2005	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
	Namjeju	D/P	-	9,877	8,975	-
	Jeju	D/P	-	9,932	8,954	-

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

<Table 11> Gross caloric value (Continued)

Year	Plant name		Coal (kcal/kg)	Heavy oil(kcal/l)	Diesel oil(kcal/l)	LNG(kcal/kg)
2006	Honam	#1	5,436	9,809	8,917	-
		#2	5,407	9,823	8,870	-
	Samchonpo	#1	5,937	-	8,814	-
		#2	5,942	-	8,814	-
		#3	5,858	-	8,814	-
		#4	5,861	-	8,803	-
		#5	5,236	-	9,000	-

Year	Plant name		Coal (kcal/kg)	Heavy oil(kcal/l)	Diesel oil(kcal/l)	LNG(kcal/kg)
		#6	5,255	-	9,000	-
	Yonghung	#1	6,072	-	8,891	-
		#2	6,086	-	8,899	-
	Boryeong	#1	5,768	-	8,855	-
		#2	5,766	-	8,943	-
		#3	5,845	-	8,943	-
		#4	5,824	-	8,943	-
		#5	5,845	-	8,749	-
		#6	5,834	-	8,749	-
	Taean	#1	5,982	-	8,749	-
		#2	5,978	-	8,371	-
		#3	5,983	-	8,649	-
		#4	5,979	-	8,665	-
		#5	5,934	-	8,665	-
		#6	5,960	-	8,665	-
		#7	5,965		8,558	
	Hadong	#1	5,969	-	8,838	-
		#2	5,959	-	8,928	-
		#3	5,958	-	8,928	-
		#4	5,969	-	8,825	-
		#5	5,963	-	8,911	-
		#6	5,967	-	8,901	-
	Dangjin	#1	5,882	-	8,975	-
		#2	5,906	-	8,978	-
		#3	5,886	-	9,007	-
		#4	5,875	-	9,015	-
		#5	6,046	-	8,955	-
		#6	6,120	-	8,895	-
		#7	5,818	-	8,984	
	Ulsan	#1	-	9,915	9,120	-
		#2	-	9,923	9,120	-
		#3	-	9,919	9,120	-
		#4	-	10,030	9,120	-
		#5	-	10,033	9,120	-
		#6	-	10,035	9,120	-
	Youngnam	#1	-	10,138	8,845	-
		#2	-	10,110	8,862	-
	Yosu	#1	-	9,963	8,798	-
		#2	-	9,954	8,796	-
	Pyongtaek	#1	-	9,707	8,943	12,941
		#2	-	9,719	8,943	12,941
		#3	-	9,747	8,949	12,859
		#4	-	9,693	8,949	12,963
2006	Namjeju	#1	-	9,908	8,974	-
		#2	-	9,908	8,952	-
		#3	-	9,898	8,938	-
	Jeju	#1	-	9,870	8,873	-
		#2	-	9,952	8,973	-
		#3	-	9,953	8,973	-
	Seoul	#4	-	-	9,070	13,018
		#5	-	-	9,070	12,882
	Incheon	#1	-	-	-	13,036
		#2	-	-	-	13,028
		#3	-	-	8,982	13,018
		#4	-	-	8,981	13,024
	Pyongtaek	C/C	-	-	8,950	13,030
	Ilsan	C/C	-	-	8,989	13,017
	Bundang	C/C	-	-	-	13,025
	Ulsan	C/C	-	-	-	12,646
	Seoincheon	C/C	-	-	9,200	13,025
	Shinincheon	C/C	-	-	-	13,025
	Boryeong	C/C	-	-	-	13,034

Year	Plant name		Coal (kcal/kg)	Heavy oil(kcal/l)	Diesel oil(kcal/l)	LNG(kcal/kg)
	Incheon	C/C	-	-	-	12,998
	Busan	C/C	-	-		13,017
	Hallim	C/C	-	-	8,954	-
	Anyang	C/C	-	-	-	13,028
	Bucheon	C/C	-	-	10,927	13,013
	POSCO POWER	C/C	-	-	-	13,031
	G S Bugog	C/C	-	-	-	13,030
	Yulchon	C/C	-	-	-	13,376
	Namjeju	D/P	-	10,246	8,907	0
	Jeju	G/T	-	0	8,792	72,650
	Jeju	D/P	-	9,617	-	-

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

<Table 12> Electricity delivered to the grid by power plants (*GEN*) and *COEF*

Year	Plant name		Electricity generation (MWh)	*COEF* (tonCO_2/MWh)
2004	Honam	#1	1,855,554	0.9682
		#2	1,625,399	0.9683
	Samchonpo	#1	3,974,202	0.8340
		#2	3,839,080	0.9436
		#3	3,652,769	0.9675
		#4	3,811,371	0.9691
		#5	4,147,957	0.7331
		#6	4,185,213	0.7299
	Yonghung	#1	2,986,382	0.8348
		#2	1,172,450	0.8847
	Boryeong	#1	4,014,109	0.8705
		#2	3,915,285	0.8676
		#3	3,746,265	0.8352
		#4	4,097,489	0.8346
		#5	3,660,240	0.8351
		#6	4,093,207	0.8344
	Taean	#1	3,780,097	0.8394
		#2	3,975,123	0.8368
		#3	3,732,363	0.8357
		#4	4,048,258	0.8368
		#5	4,091,406	0.8362
		#6	4,056,835	0.8348
	Hadong	#1	3,688,313	0.8383
		#2	4,028,529	0.8357
		#3	3,997,064	0.8375
		#4	3,724,757	0.8438
		#5	4,013,845	0.8252
		#6	3,685,698	0.8194
	Dangjin	#1	3,986,406	0.8357
		#2	4,038,457	0.8347
		#3	3,711,787	0.8340
		#4	3,801,495	0.8305
	Ulsan	#1	271,544	0.8157
		#2	244,246	0.8073
		#3	268,231	0.8067
		#4	1,759,376	0.7283
		#5	2,141,162	0.7289
		#6	2,196,344	0.7299
	Youngnam	#1	973,872	0.8090
		#2	665,973	0.8723
	Yosu	#1	723,968	0.7674
		#2	1,304,109	0.7408
	Pyongtaek	#1	850,533	0.7314
		#2	880,646	0.7248
		#3	751,633	0.7365

Year	Plant name		Electricity generation (MWh)	*COEF* (tonCO_2/MWh)
		#4	800,854	0.7359
	Namjeju	#1	50,294	0.9902
		#2	48,714	0.9937
	Jeju	#1	44,659	1.0336
		#2	486,401	0.7358
		#3	509,330	0.7367
	Seoul	#4	90,322	0.6789
		#5	480,919	0.6710
	Incheon	#1	47,491	0.6075
		#2	49,144	0.6190
		#3	19,018	0.6310
	Pyongtaek	C/C	596,001	0.4546
	Ilsan	C/C	3,281,407	0.4951
	Bundang	C/C	3,650,122	0.4907
	Ulsan	C/C	2,329,524	0.4048
	Seoincheon	C/C	8,353,619	0.3963
	Shinincheon	C/C	11,596,955	0.3748
	Boryeong	C/C	6,979,928	0.3879
2004	Busan	C/C	9,884,075	0.3592
	Hallim	C/C	96,435	0.7812
	Anyang	C/C	1,506,070	0.4921
	Bucheon	C/C	1,425,073	0.4966
	K I E Co.	C/C	2,809,983	0.4557
	L G Bugog	C/C	1,894,996	0.3768
	Yulchon	C/C	36,366	0.6120
	Namjeju	D/P	274,089	0.6368

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

<Table 12> Electricity delivered to the grid by power plants (*GEN*) and *COEF* (continued)

Year	Plant name		Electricity generation (MWh)	*COEF* (tonCO_2/MWh)
2005	Honam	#1	1,787,715	0.969775
		#2	1,875,790	0.965165
	Samchonpo	#1	3,810,079	0.878838
		#2	4,323,618	0.875081
		#3	4,343,666	0.862831
		#4	4,112,297	0.863929
		#5	3,542,728	0.845002
		#6	3,643,969	0.842121
	Yonghung	#1	5,623,299	0.839107
		#2	4,658,862	0.845492
	Boryeong	#1	3,547,140	0.873489
		#2	3,433,608	0.867685
		#3	4,124,745	0.835689
		#4	3,698,705	0.835034
		#5	4,121,314	0.83582
		#6	3,283,477	0.835687
	Taean	#1	3,992,112	0.836401
		#2	3,484,251	0.841676
		#3	3,957,054	0.836831
		#4	3,653,534	0.837804
		#5	3,744,413	0.838885
		#5	3,999,847	0.835105
	Hadong	#1	3,997,914	0.838439
		#2	3,732,583	0.835946
		#3	3,769,077	0.834854
		#4	3,989,315	0.838238
		#5	3,553,901	0.837489
		#6	4,037,763	0.832791
	Dangjin	#1	3,797,307	0.833337

Year	Plant name		Electricity generation (MWh)	*COEF* (tonCO$_2$/MWh)
		#2	3,798,078	0.832519
		#3	4,081,017	0.83078
		#4	4,079,557	0.829236
		#5	1,318,670	0.865703
		#6	96,365	0.980255
	Ulsan	#1	262,393	0.814259
		#2	255,812	0.799711
		#3	200,518	0.807912
		#4	1,549,091	0.741722
		#5	1,500,935	0.741278
		#6	1,454,644	0.740409
	Youngnam	#1	1,022,470	0.804523
		#2	531,006	0.845724
	Yosu	#1	430,310	0.756566
		#2	904,597	0.732255
	Pyongtaek	#1	1,258,662	0.710687
		#2	1,376,342	0.709618
		#3	1,321,167	0.707667
		#4	1,338,204	0.706521
	Namjeju	#1	44,602	0.987901
		#2	44,654	1.013819
	Jeju	#1	36,266	1.049095
		#2	532,700	0.73543
		#3	502,189	0.740008
	Seoul	#4	207,498	0.647692
		#5	444,324	0.669728
2005	Incheon	#2	37,727	0.617604
	Pyongtaek	C/C	659,932	0.460786
	Ilsan	C/C	2,873,958	0.507729
	Bundang	C/C	3,742,073	0.491941
	Ulsan	C/C	3,131,075	0.402668
	Seoincheon	C/C	7,001,031	0.386929
	Shinincheon	C/C	10,543,280	0.378715
	Boryeong	C/C	8,221,926	0.387172
	Incheon	C/C	2,055,016	0.375319
	Busan	C/C	9,076,327	0.364863
	Hallim	C/C	100,346	0.774174
	Anyang	C/C	1,433,978	0.499029
	Bucheon	C/C	1,404,160	0.509728
	POSCO POWER	C/C	2,571,095	0.474389
	G S Bugog	C/C	2,189,808	0.393716
	Yulchon	C/C	1,300,627	0.410083
	Namjeju	D/P	268,073	0.637104
	Jeju	D/P	151,759	0.635426

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

<Table 12> Electricity delivered to the grid by power plants (*GEN)* and *COEF* (continued)

Year	Plant name		Electricity generation (MWh)	*COEF* (tonCO$_2$/MWh)
2006	Honam	#1	1,622,639	0.96739
		#2	1,782,016	0.96460
	Samchonpo	#1	4,161,219	0.89289
		#2	3,703,880	0.89313
		#3	3,779,585	0.86871
		#4	3,816,997	0.86262
		#5	3,761,205	0.85554
		#6	4,065,091	0.84422
	Yonghung	#1	5,337,432	0.84196

Year	Plant name		Electricity generation (MWh)	*COEF* (tonCO$_2$/MWh)
		#2	5,727,937	0.83536
	Boryeong	#1	3,988,848	0.87363
		#2	3,423,101	0.86393
		#3	3,409,486	0.83715
		#4	4,133,946	0.83692
		#5	3,364,148	0.83095
		#6	3,987,488	0.83826
	Taean	#1	3,556,797	0.84066
		#2	4,035,753	0.83703
		#3	3,528,613	0.83755
		#4	4,069,820	0.83917
		#5	4,013,235	0.84157
		#6	3,381,867	0.84217
		#7	159,677	0.92783
	Hadong	#1	3,607,063	0.83816
		#2	4,068,036	0.83374
		#3	4,079,158	0.83444
		#4	3,631,374	0.83497
		#5	4,092,625	0.83540
		#6	3,610,222	0.83659
	Dangjin	#1	3,598,820	0.83278
		#2	4,115,891	0.83088
		#3	3,666,490	0.83076
		#4	3,610,984	0.83284
		#5	3,946,931	0.82314
		#6	3,392,395	0.81158
		#7	1,474	2.36545
	Ulsan	#1	275,016	0.79929
		#2	306,668	0.79449
		#3	376,132	0.77860
		#4	1,511,557	0.73617
		#5	1,583,846	0.73176
		#6	1,589,838	0.73366
	Youngnam	#1	359,205	0.92808
		#2	323,595	0.91734
	Yosu	#1	403,547	0.74736
		#2	906,849	0.72294
2006	Pyongtaek	#1	1,123,948	0.69795
		#2	1,198,620	0.69761
		#3	1,304,568	0.69996
		#4	1,052,228	0.69851
	Namjeju	#1	34,448	1.00068
		#2	28,686	1.02947
		#3	179,033	0.81977
	Jeju	#1	24,748	1.04775
		#2	462,023	0.74633
		#3	479,676	0.74285
	Seoul	#4	306,558	0.61971
		#5	685,011	0.60478
	Incheon	#1	32,932	0.57823
		#2	24,366	0.58738
		#3	78,669	0.54724
		#4	62,414	0.55965
	Pyongtaek	C/C	497,441	0.46331
	Ilsan	C/C	3,038,165	0.50269
	Bundang	C/C	4,059,300	0.48619
	Ulsan	C/C	3,608,435	0.39524
	Seoincheon	C/C	8,726,521	0.37681
	Shinincheon	C/C	11,797,500	0.38109
	Boryeong	C/C	7,089,662	0.38617
	Incheon	C/C	3,648,288	0.36315
	Busan	C/C	10,455,401	0.36569

CDM – Executive Board

Year	Plant name		Electricity generation (MWh)	*COEF* (tonCO_2/MWh)
	Hallim	C/C	175,356	0.72186
	Anyang	C/C	1,286,480	0.49198
	Bucheon	C/C	1,241,795	0.49805
	POSCO POWER	C/C	2,338,128	0.47829
	G S Bugog	C/C	2,911,683	0.36691
	Yulchon	C/C	2,276,276	0.38950
	Namjeju	D/P	239,690	0.66987
	Jeju	G/T	15,986	1.32542
	Jeju	D/P	252,764	0.61326

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

CDM – Executive Board

<Table 13> Sample group plants used in the Build Margin calculation and Carbon Emission Factor of the Build Margin

Plant name		Technology	year operation	Fuel and source	MWh in 2006	% of total output	CEF	Result
Cheongsong pumping	**#2**	pumping	2006.12	hydro	21,542	0.029%	0	0.0000
Bundang fuel cell		fuel cell	2006.10	LNG	290	0.000%	0	0.0000
Solar park		solar	2006.10	photovoltaic	106	0.000%	0	0.0000
Namhae Solar		solar	2006.10	photovoltaic	297	0.000%	0	0.0000
HanlaJeunggong Solar		solar	2006.10	photovoltaic	287	0.000%	0	0.0000
Top infra Solar		solar	2006.09	photovoltaic	-	0.000%	0	0.0000
Enepark		solar	2006.09	photovoltaic	85	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%	0.8198	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%	0.8116	0.0370
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	2005.12	Solar	118	0.000%	0	0.0000
Dangjin	#5	steam power	2005.10	Bituminous coal	3,946,931	5.311%	0.8231	0.0437
Taean solar energy		solar	2005.10	photovoltaic	127	0.000%	0	0.0000
Jeju DP		internal combustion	2005.07	heavy oil	252,764	0.340%	0.6133	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%	0.3895	0.0119
Incheon		combined	2005.07	LNG	3,648,288	4.909%	0.3632	0.0178
Daegok		small hydro power	2005.07	hydro	1,740	0.002%	0	0.0000
Donghwa		small hydro power	2005.07	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	2005.03	LFG	7	0.000%	0	0.0000
Yongdam	#3	small hydro power	2004.12	hydro	23,972	0.032%	0	0.0000
Maebongsan-wind power		wind	2004.12	wind	8,998	0.012%	0	0.0000

Plant name		Technology	year operation	Fuel and source	MWh in 2006	% of total output	CEF	Result
Daegwanryung-wind power		wind	2004.12	wind	3,451	0.005%	0	0.0000
Yongheng	#2	steam power	2004.11	Bituminous coal	5,727,937	7.707%	0.8354	0.0644
new solar energy		solar	2004.11	photovoltaic	216	0.000%	0	0.0000
Yongheng	#1	steam power	2004.07	Bituminous coal	5,337,432	7.182%	0.8420	0.0605
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%	0.3657	0.0514
Chunsang		small hydro power	2004.02	hydro	183	0.000%	0	0.0000
Cheongju LFG		internal combustion	2004.02	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
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%	0.8422	0.0383
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%	0.8416	0.0454
Total					74,302,834	100%	BM Factor	**0.3747**

Source from: Statistics of Electric Power in 2006 (KEPCO 2007), Status of Generation facility in 2006 (KPX 2007)

<Table 14> Default Values of Carbon content

Fuel	Default carbon content (kg/GJ)	Fuel	Default carbon content (kg/GJ)
Crude oil	20	Oil shale and Tar sands	29.1
Orimulsion	22	Brown Coal Briquettes	26.6
Natural gas liquids	17.2	Patent Fuel	26.6
Motor Gasoline	18.9	Coke Oven Coke and Lignite Coke	29.2
Aviation Gasoline	19.1	Gas Coke	29.2
Jet Gasoline	19.1	Coal Tar	22.0
Jet kerosene	19.5	Gas Works Gas	12.1
Other Kerosene	19.6	Coke Oven Gas	12.1
Shale oil	20	Blast Furnace Gas	70.8
Gas/Diesel oil	20.2	Oxygen Steel Furnace Gas	49.6
Residual fuel oil	21.1	Natural Gas	15.3
LPG	17.2	Municipal Wastes (non-biomass fraction)	25.0
Ethane	16.8	Industrial Wastes	39.0
Naphtha	20.0	Waste Oils	20.0
Bitumen	22.0	Peat	28.9
Lubricants	20.0	Wood/Wood Waste	30.5
Petroleum coke	26.6	Sulphite lyes (black liquor)	26.0
Refinery Feedstocks	20.0	Other Primary Solid Biomass	27.3
Refinery gas	15.7	Charcoal	30.5
Paraffin Waxes	20.0	BioGasoline	19.3
White Spirit & SBP	20.0	Biodiesels	19.3
Other Petroleum Products	20.0	Other Liquid Biofuels	21.7
Anthracite	26.8	Land fill Gas	14.9
Coking coal	25.8	Sludge Gas	14.9
Other bituminous coal	25.8	Other Biogas	14.9
sub-bituminous coal	26.2	Municipal Wastes (biomass fraction)	27.3
Lignite	27.6		

Source: IPCC Guidelines for national greenhouse gas inventories, 2006

Annex 4

MONITORING INFORMATION

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