CLEAN DEVELOPMENT MECHANISM
SIMPLIFIED PROJECT DESIGN DOCUMENT
FOR SMALL-SCALE PROJECT ACTIVITIES (SSC-CDM-PDD)
Version 02

CONTENTS

Annexes

Revision history of this document

Version Number	Date	Description and reason of revision
01	21 June 2006	Initial adoption

SECTION A. General description of the small-scale project activity

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

Korea South-East Power Co. (KOSEP) small-scale hydroelectric power plants project (the Samchonpo Thermal Power Plant and Younghung Thermal Power Plant small-scale hydroelectric power plants construction project)

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

- Purpose of the project
The sea-water is used as cooling water in the thermal power plant. The used cooling water makes net head being drained to the sea and it is possible to generate the electric power by the net head. KOSEP is constructing small-scale hydroelectric power plants in the Samchonpo thermal power plant and Younghung thermal power plant. This project activity generates the electric power as well as produce socio-economical benefits in the local and national level. This project also devotes abating global warming and it will cover the increasing demand for the electric power and reduce the import of fossil fuels in Korea.

- Concept of the project
KOSEP small-scale hydroelectric power plants project (the Samchonpo Thermal Power Plant, Younghung Thermal Power Plant small-scale hydroelectric power plants construction project) consists in 5,965 kW of facility capacity, and power generation of 38,155 MWh per year. Major project participant is KOSEP.

- Contribution to sustainable development
The project activity contributes to sustainable development as follows:

- Power generation from small-scale hydroelectric power plants reduces consumption of fossil fuels, decreases imports of fossil fuel, and hence brings in national profits.
- As alternative energy sources, small-scale hydroelectric power does not emit air pollutants or wastes.
- As a renewable energy source, hydroelectric power does not deplete natural resources and therefore it will be used as alternative energy sustainably by future generations.
- There are no Green House Gas (GHG) emissions.
- Construction of the project and operation brings in reduction in below pollutants as much as the following:

  - CO_2 : 21,189 tons/yr
  - SOx : 44.3 tons/yr
  - NOx : 33.5 tons/yr
  - Dust : 2.3 tons/yr

Above mentioned emission reduction contributes to abatement of global warming as well as prevention of acidification and photochemical reaction.

A.3. Project participants:

<Table 1> Project participants of KOSEP small-scale hydroelectric power plants project (the Samchonpo Thermal Power Plant and Younghung Thermal Power Plant small-scale hydroelectric power plants construction project)

Name of Party involved (*) ((host) indicates a host Party)	Private and/or public entity(ies) project participants (*) (as applicable)	Kindly indicate if the Party involved wishes to be considered as project participant (Yes/No)
KOREA (host)	• Public entity: Korea South-East Power Co. (KOSEP) – major project participant	No

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

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

A.4.1.1. Host Party(ies) :

Republic of Korea

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

The Samchonpo thermal power plant small-scale hydroelectric power plant: Gyeongsangnam-do
The Younghung thermal power plant small-scale hydroelectric power plant: Incheon metropolitan City

A.4.1.3. City/Town/Community etc:

The Samchonpo thermal power plant small-scale hydroelectric power plant: Goseong Gun
The Younghung thermal power plant small-scale hydroelectric power plant: Ongjin Gun

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

⦿ Younghung SSC hydroelectric power plant

The whole view of Younghung thermal power plant
- The water turbine will be installed where the used cooling water is drained.

⦿ Samchonpo SSC hydroelectric power plant

The whole view of Samchonpo thermal power plant
- The water turbine will be installed where the used cooling water discharges.

<Figure 1> Location of small-scale power plant and brief description

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

Type : type (I) – Renewable energy projects
Category : D – Grid connected renewable electricity generation

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' in that KOSEP small-scale hydroelectric power plants project utilizes renewable energy source. Additionally, the project falls into 'Electricity generation of a grid' of category D, because electricity generated by renewable energy source is grid-connected.

<Table1> Description of technology of the small-scale hydroelectric power plants

Classification		The Samchonpo small-scale hydroelectric power plant	The Younghung small-scale hydroelectric power plant
Wheel	Type	Vertical/Horizontal Kaplan	Pit/Horizontal/Kaplan
	Output power	494.2 kW	1,000 kW
	Rotation	160 RPM	187.5 RPM
	Unit	6	3
Generator	Type	Three-phase induction (horizontal axis)	Synchronous (horizontal axis)
	Output power	1,000 kW	1,000 kW
	Unit	6	3
Transformer	Type	Mold type	Mold type
	capacity	7,000 kVA	4,000 kVA
	Volatage	3.3 kV / 22.9 kV	3.3 kV / 22.9 kV
	Connect-ion type	△-Y	△-Y
	Unit	1	1

As the project activity generates electricity with cooling water of thermal power plants, there are no severe environmental impacts. Accordingly, technology adopted to this project is environmentally safe and sound.
The main equipment in this project is water turbine of which technology details are in the following;

⦿ Technology details

- Water turbine applied to Samchonpo SSC hydroelectric power plant

Water turbine is designed and manufactured by **Ossberger Gmbh + Co** in Germany. The type of the water turbine is Kaplan Tube Turbine which has high efficiency with low net head in the small amount of water quantity. The adopted technology to water turbine generator is optimistically designed based on various operational conditions and operation & maintenance is easy. It has low probability of serious problem on the equipment.

- Water turbine applied to Younghung SSC hydroelectric power plant

Kaplan turbine is designed and manufactured by **KÖSSLER Ges.m.b.H.**, which is Austrian company. The sort of the water turbine is Kaplan Tube Turbine and it is primarily used in the low head range with large volumes of water, but the adjustability of the guide wheel and runner blades allows optimal use of varying water flow. In addition, **KÖSSLER Ges.m.b.H.** is certified in accordance with the quality management system ISO 9001:2000 and is committed to adhering to its own quality standard, which is also aligned with current IEC standard. Therefore products are inspected along with strict inspection guidelines which are adapted to customer requirements as well as the best technologies worldwide.

⦿ Transfer of the adopted SSC-hydroelectric technology to KOSEP

This project is electricity generating business which uses seawater, so existed facilities cannot be used. Therefore, technology for anti-corrosion should be used at the step of design and manufacturing. As well, there is no experience about construction and management of ocean small hydro power plant, so it is necessary to be transferred related technologies from a person who experienced. At the technology standard document between KOSEP and supplying company, followed condition is described;

A. Technology Standard Document (summary)

a. In order to prohibit corrosion of facilities, anti-corrosion facilities should be provided at the contact surface of seawater such as 'Current Cathoic protection'.
b. Every material and component which is directly contacted with seawater should use as STS216L or above, corrosion must be prohibited using by the best quality of material.
c. The material for water turbine runner and guide vane is Nickel Aluminum Bronxe(CuA110FeNi-C) and above, also it is necessary to be available for the characteristics of ocean such as water quality and salinity.
d. Casing and draft tubes is necessary to be design, made and pained for resistance of outside seawater and inside salinity. Especially, draft tubes is permanently installed facility, so it needs to be designed considering intensity maintenance and least abrasion by corrosion.

B. Contract document (summary)

a. Supplying company has to provide installing technology for generation equipment to be set up most suitably for the construction-site situations by supporting qualified supervisors.

b. Supplying company has to provide operation technology for the plants to be handled most suitably by supporting qualified supervisiors.

A.4.3. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gas (GHGs) by sources are to be reduced by the proposed small-scale project activity, including why the emission reductions would not occur in the absence of the proposed small-scale project activity, taking into account national and/or sectoral policies and circumstances:

The sea water is used as the cooling water of Samchonpo and Younghung thermal power plants and the used cooling water makes net head when it is returned to the sea. This project is the activity that the participant of this project installs the generation facilities such as water turbine, generator and translator at the point where the used cooling water is drained and produced electricity by operating this generation facility. Small-scale hydroelectric power plants project will reduce GHGs emissions by generating electricity with using hydroelectric power sources and replacing some portion of conventional energy sources.

This project activity will substitute the fossil fuel fired plants by generating 38,155 MWh, so it will bring in 21,189 tons of CO_2 emission reduction annually.

The Korean government has constructed power plants in order to meet the increased demand for electricity, however due to the financial and technological barriers, the Korean government chose to build fossil fuel fired power plants. These fossil fuel fired plants have been emitting GHGs when to generate electricity. 58.8% of the total electricity generated in Korea comes from fossil fuel fired power plants (Source: KEPCO 2005). Less than 5% of the electricity is coming out of the alternative energy sources such as hydroelectric power, wind power and photovoltaic power. Therefore this project is the result of voluntary efforts by KOSEP to reduce GHGs.

This project will not only reduce GHGs emission but also work as effective driving forces to promote the electricity generation industries by means of renewable energy sources.

A.4.3.1 Estimated amount of emission reductions over the chosen crediting period:

211,898 tons of CO_2 emission reduction is estimated for the 10-year period.

Years	Annual estimation of emission reductions in tonnes of CO_2 e
Year 1 (2007.11.1 ~ 2008.10.31)	21,189
Year 2 (2008.11.1 ~ 2009.10.31)	21,189
Year 3 (2009.11.1 ~ 2010.10.31)	21,189
Year 4 (2010.11.1 ~ 2011.10.31)	21,189
Year 5 (2011.11.1 ~ 2012.10.31)	21,189
Year 6 (2012.11.1 ~ 2013.10.31)	21,189
Year 7 (2013.11.1 ~ 2014.10.31)	21,189
Year 8 (2014.11.1 ~ 2015.10.31)	21,189
Year 9 (2015.11.1 ~ 2016.10.31)	21,189
Year 10 (2016.11.1 ~ 2017.10.31)	21,189
Total estimated reductions (tonnes of CO_2 e)	211,898
Total number of crediting years	10
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	21,189

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

No public funding is provided for this project activity.

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

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

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.

Bundled two small-scale hydroelectric power plants have 5.965 MW capacity. None of these two plants are part of a large project. Therefore this project is not a debundled project.

SECTION B. Application of a baseline methodology:

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

Project activity I.D "Grid connected renewable electricity generation."

Referred to small-scale project category of Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

B.2 Project category applicable to the small-scale project activity:

Project category is Type I.D-"Grid connected renewable electricity generation."

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' in that Kwater small-scale hydroelectric power plants project utilizes renewable energy source. Additionally, the project falls into 'Electricity generation of a grid' of category D, because electricity generated by renewable energy source is grid-connected.

Facts for baseline to estimate emission reduction of the project is shown at 9th clause of Appendix B – Type I.D. of 'the simplified modalities and procedures for small-scale CDM project activities'. The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (measured in kg CO_2 eq/kWh) and calculation should be transparent and conservative.

Baseline shown at 9th clause of Appendix B – Type I.D. of 'the simplified modalities and procedures for small-scale CDM project activities' is:

(a) A combined margin(CM), consisting of the combination of operating margin(OM) and build margin(BM) according to the procedures prescribed in the approved methodology ACM0002. 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;

(b) The weighted average emissions (in kg CO2 equ/kWh) of the current generation mix. The data of the year in which project generation occurs must be used.

Calculations must be based on data from an official source (where available) and made publicly available.

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

Parameter	Value	Source
the electricity delivered to the grid by source Coals, Heavy oil, Light Oil, LNG	Refer to <Table 14>	Statistics of Electric Power in KOREA (2004, 2005, 2006) (KEPCO)
the amount of Coal, Heavy oil, Light Oil, LNG (in a mass or volume unit) consumed by relevant power)	Refer to <Table 10.>	Statistics of Electric Power in KOREA (2004, 2005, 2006) (KEPCO)
Net Calorific Values at each power plant	Refer to <Table 11>, <Table 12>, <Table 13>	Statistics of Electric Power in KOREA (2004, 2005, 2006) (KEPCO)
Fuels Carbon Emission Factor (tC/TJ)	Coal : 25.8 heavy Oil : 21.1 Light Oil: 20.2 LNG : 15.3	IPCC 1996 Revised Guidelines
Fraction of Carbon Oxidised (OXID)	Coal : 0.98 Petroleum products : 0.99 LNG : 0.995	IPCC 1996 Revised Guidelines
Operating Margin Emissions Factor (in kg CO_2/kWh)	0.7187	Calculated
Build Margin Emissions Factor (in kg CO_2/kWh)	0.3920	Calculated
Baseline Emissions Factor (in kg CO_2/kWh)	0.5554	Calculated

B.3. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

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

The hugest barrier is investment barrier. As for the small hydro power resources, development of small hydro power resources haven’t be activated because they are not economical. Korea Government has carried out the various policies to support the small scale hydrogen power generation economically in order to activate the small hydro power generation plant. That is, a unit cost of fuel of oil heating power generation plant was adopted to small hydro power electricity from 1984 to 1994. Since 1995, small hydro electricity cost was estimated excluding the electric supply cost, electric purchase cost, and electric supply loss cost of previous year’s average price from Korea Electric Power Corporation. Since 2002, the policy to raise economical efficiency of small hydro power generation plant comes into effect, then the official price of small hydro power electricity is 73.69 Won/KWh. It is demonstrated from this government policy that small hydro power plant doesn’t have economical efficiency without government support.
The result of NPV analysis of individual plant has been performed to show the difficulty of investment in this project. As for the economical analysis, EB 22 Meeting Report, based on Annex 3 “CLARIFICATIONS ON THE CONSIDERATION OF NATIONAL AND/OR SECTORAL POLICIES

AND CIRCUMSTANCES IN BASELINE SCENARIOS", SMP is adopted from small hydro power unit cost prior to the notice of official price.

Plant Name	Total Expenses (unit: one million won)	Operation & Maintenance Cost including tax (unit: one million won /year)	Unit Cost of Purchase (unit: won/KWh)	Purchased Electricity (unit :MWh)	NPV (unit : one million won)
The Samchonpo small scale hydroelectric power plant	15,230	539	55.79	22,728	-5,097
The Younghung small scale hydroelectric power plant	11,880	192	55.79	15,426	-3,492
* Crediting period is for 10 years except construction period. * The dicount rate of Samchonpo project is 6.00 and the discount rate of Younghung is 7.00 * Discount rate and other variables are adopted from the execution design report of individual plant. * Raw data (Excel sheet) for economical analysis is submitted to DOE (KEMCO).					

As a result of economical analysis, NPV is lower than 0. It means, it doesn't have economical attraction. In addition, there are risks of difficulty in retrieving the investment. Investment retrieval depends on when power plants operate and how much power is generated. Power generation depends on operation time of power plants. However, real operating time can change by virtue of below mentioned risk factors.

- Change of real outflow drained
- Stop of generating by the problem on the thermal power plants
- Repair of SSC hydroelectric equipment

The above mentioned risk factors act as obstacles against investment in small-scale hydroelectric projects. This investment barrier can be resolved after registration as the CDM project of governmental support.

B.4. Description of how the definition of the project boundary related to the baseline methodology selected is applied to the small-scale project activity:

For the baseline determination, project boundary is related to CO2 emissions from power generation in a fossil fuel power plant replaced by this project activity. The spatial extent of the project boundary includes the project sites and all the power plants connected physically to the electricity system of Korea Electric Power Corporation (KEPCO).
For calculation of baseline GHG emissions from the project boundary does not include emissions during plant construction, leakage from electricity transfer, and emission from transportation, mining, and pumping.

B.5. Details of the baseline and its development:

B.5.1. Specify the baseline for the proposed project activity using a methodology specified in the applicable project category for small-scale CDM project activities contained in appendix B of the simplified M&P for small-scale CDM project activities:

Step 1. Calculation of the Operating Margin emission factor (OM)

Referring to the ACM0002, the rate of low cost/must run power generation does not exceed 50% of the total grid (The recent 5 years' low cost/must run power generation from total generation rate was 42.65), and an hourly dispatched data is not available in that region at this point of time.
Therefore, option (a) (Simple OM) from the ACM0002 has been chosen.

(Unit : million kWh)

Item \ Year		2001	2002	2003	2004	2005
Hydro*		4,151	5,311	6,887	5,861	5,189
Thermal	Coal(Domestic)*	5,235	5,144	5,398	4,603	4,484
	Coal(Bituminous)	105,098	112,877	114,878	122,556	129,174
	Oil(Heavy)	27,770	23,940	23,656	21,591	20,079
	Oil(Diesel)	386	1,155	2,870	474	412
	Gas	30,451	38,943	39,091	55,999	58,118
Nuclear*		112,133	119,103	129,672	130,715	146,779
Alternative*		-	-	-	350	404
Total		285,224	306,474	322,452	342,148	364,683
the rate of low cost/must run power generation(%)		42.60	42.27	44.02	41.36	43.01
Yearly proportion of the Generation of Electricity based on the Source of Energy (Source: Electricity statistics on Electricity quantity from Korea Electric Power Corporation, 2005) (* : low-operating cost and must-run power plants)						

The OM is calculated as follows, using a 3 year average:

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

$F_{i,j,y}$ 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,
$COEF_{i,j,y}$ ($COEF\ i = NCV\ i \cdot EFco_2 i \cdot OXID\ i$) 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.

Step 2. – Calculation of the Build Margin (BM)

According to ACM0002, there are two options to choose in order to calculate the BM.
Option 1. Calculate the Build Margin emission factor $EF_{BM,y}$ ex ante based on the most recent information available on plants already built for sample group m at the time of PDD submission. The sample group m consists of either

- The five power plants that have been built most recently
- The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently

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

- The five power plants that have been built most recently
- 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

Project participants should use from these two options that sample group that comprises the larger annual generation. For this project, option1 was selected.

The calculation of BM_y is as follows;

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

Step 3. – Calculation of the baseline emission factor (EF_y)

The average of OM and BM factors calculated by step 1 and 2 is EF_y, baseline emission factor.

$$EF_y = (EF_{OM_y} + EF_{BM,y})/2$$

(In order to conservatively calculate emission factor, private power generation and community energy service facility[1] are excluded.)

B.5.2. Date of completing the final draft of this baseline section (DD/MM/YYYY):

03/04/2006.

B.5.3. Name of person/entity determining the baseline:

Dr. Jaesoo Jung(civilenvi@ecoeye.com) / ecoeye co., ltd which is not a project participant.

[1] Community energy Service: Community energy service is a facility that supplies energy from collectivized energy generating facility such as Steam Supply and Power Generation plant, Heat Only Boiler, and facility for resource recovery to multi-users of household, commercial, and industrial zones. All the generated power is not supplied to the grid, but surplus power supplied in community energy services and private power generation plants, for this reason CO_2 emissions per KWh from power supplied to the grid is very high.

SECTION C. Duration of the project activity / Crediting period:

C.1. Duration of the small-scale project activity:

C.1.1. Starting date of the small-scale project activity:

Commercial start of plants are followed;

The Samchonpo small-scale hydroelectric power plant: 31/10/2006
The Younghung small-scale hydroelectric power plant: 31/10/2007

C.1.2. Expected operational lifetime of the small-scale project activity:

Expected lifetime of equipment is 30 years.

C.2. Choice of 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:

10 years

C.2.2.1. Starting date:

01/11/2007

C.2.2.2. Length:

10 years- 0 month

SECTION D. Application of a monitoring methodology and plan:

D.1. Name and reference of approved monitoring methodology applied to the small-scale project activity:

Name: monitoring methodology for Project activity I.D "Grid connected renewable electricity generation"

Reference: Article 9 Type I.D. Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

D.2. Justification of the choice of the methodology and why it is applicable to the small-scale project activity:

The project generates electricity by utilizing small-scale hydroelectric power. The generated electricity is connected to the grid. Therefore the project is included in the category of I.D. The electricity connected to the grid replaces electricity generated by the existing fossil fuel power plants. Accordingly, the reduction of fossil fuel leads to the reduction of CO_2 emission.

To accurately estimate emission reduction by the project, it is necessary to decide which GHGs emit in the boundary and transboundary and how to monitor GHGs emission. Decision on GHGs emission in the boundary and transboundary is done in the following ways:

- Direct emission in the boundary: Small-scale hydroelectric power plant utilizes clean hydro potential energy with the view of generating power, and hence there is no direct emission in the boundary.

- Indirect emission in the boundary: Indirect emission results from electricity used inside the boundary. For the purpose of estimating emission reduction, electricity consumed in the plants is excluded.

- Direct transboundary emission: Fuel transportation in the process of power generation or fuel consumption outside the boundary is not detected in the project activity. There is no direct transboundary emission.

- Indirect transboundary emission: there is zero indirect transboundary emission in the project.

- Leakage: No leakage is associated with the project.

According to the result of defining GHG emission in the project, the amount of emitted GHGs is not important factor for estimating emission reduction. The important factors for estimating emission reduction are emission factor for baseline and electricity generated from the project activity.

The monitoring plan for emission factor for baseline and electricity generated is as fallows:

- Emission factor for baseline: As emission factor is calculated, so all the parameters and data used for calculation shall be transparent and credible. All the data shall be collected and calculated in the same way as D.3.

- Electricity used for the project activity: Electricity is defined as the grid connected electricity and the value of it is measured. Measurement shall be done by both project participant and Korea power exchange. The measured data by both entities shall be equal. Monitoring equipment for measurement shall fulfill step 1 of QA/QC in D.4.

D.3 Data to be monitored:

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ID number	Data type	Data variable	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	For how long Is archived Data kept?	Comment
1. EGy*	Electricity quantity	Electricity supplied to the grid by the project	MWh	Directly measured	hourly measurement and monthly recording	100%	Electronic	During the crediting period and two years after	Data will be aggregated weekly, monthly and yearly Double checked against receipt of sales. Electricity transmission except Electricity consumed in the plant *
2. EFy	Emission factor	CO_2 emission factor of the Korea grid	tCO_2/ MWh	c	Starting point of every crediting period	100%	Electronic	During the crediting period and two years after	Data will be used of 3 year vintage data. Calculated as a weighted sum of the OM and BM emission factors.
3. $EF_{OM, y}$	Emission factor	CO_2 OM emission factor of the Korea grid	$kgCO_2$/ kWh	c	Starting point of every crediting period	100%	Electronic	During the crediting period and two years after	Data will be used of 3 year vintage data. Calculated as indicated in the relevant OM baseline method above.
4. $EF_{BM, y}$	Emission factor	CO_2 BM emission factor of the Korea grid	$kgCO_2$/ kWh	c	Starting point of every crediting period	100%	Electronic	During the crediting period and two years after	Data will be used of a year vintage data. Calculated as [∑ i, m F i, m, y · COEF i, m]/ [∑ m GEN m, y] over recently built power plants defined in the baseline methodology.
5. $F_{i, y}$	Fuel quantity	Amount of each fossil fuel consumed by each power source / plant	Mass or volume	m	Starting point of every crediting period	100%	Electronic	During the crediting period and two years after	Data will be used of 3 year vintage data. Obtained from the KEPCO.

6. $COEF_i$	Emission factor coefficient	CO_2 emission coefficient of each fuel type i	t CO_2/ mass or t CO_2/ volume	c	Starting point of every crediting period	100%	Electronic	During the crediting period and two years after	Caculated as [NCVi · EF_{co2}i · OXIDi]. Data will be calculated by each energy source in accordance with IPCC 1996 default value..
7. NCVi (Local value)	Net Caloric Value	Net Caloric coefficient of each fuel type i to calculate $COEF_i$	Kcal/ Mass or Kcal/ volume	m	Starting point of every crediting period	100%	Electronic	During the crediting period and two years after	NCVi (Local value) is obtained from the KEPCO. Data will be calculated by each energy source in accordance with IPCC 1996 default value.
8. GENy	Electricity quantity	Electricity generation of each power source / plant	MWh/ each plant	m	Starting point of every crediting period	100%	Electronic	During the crediting period and two years after	Data will be used of 3 year vintage data. Obtained from the KEPCO.
9. OM plant	Plant name	Identification of power source / plant for the OM	text	e	Starting point of every crediting period	100% of set of plants	Electronic	During the crediting period and two years after	Identification of plants to calculate Operating Margin emission factors.
10. BM plant	Plant name	Identification of power source / plant for the BM	text	e	Starting point of every crediting period	100% of set of plants	Electronic	During the crediting period and two years after	Identification of plants to calculate Build Margin emission factors.

D.4. Qualitative explanation of how quality control (QC) and quality assurance (QA) procedures are undertaken:

All variables, except one related to off-site transportation, used to calculate project and baseline emissions are directly measured or are publicly available official data. To ensure the quality of the data, in particular the measured data are double-checked against commercial data. Measuring the quality control and quality assurance which were planned for the project are outlined in the following table.

<Table 8> Data quality control

Data	Uncertainty of data (high/middle/low)	Explanation of planned QA/QC procedures for data or the reason that the procedures are not needed
1.EGy	Low	QA/QC procedure for this are planned. The electricity output from each hydroelectric power plant to the grid will be monitored and recorded at the on-site control The allowable error of data must be within ± 0.5%.
5. $F_{i, y}$	Low	QA/QC procedure for this are planned. The data will be obtained by KEPCO.
6.$COEF_i$	Low	QA/QC procedure for this are planned. Data will be checked against other sources.
Others	Low	QA/QC procedure for this are planned. All the data and grid statistics data will be used, and provided by KEPCO

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

1. Monitoring equipment

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

2. The amount of electricity monitoring

2-1. The amount of electricity transmitted to the grid shall be measured automatically by established meters. The measured data are simultaneously transferred to central control system of Small-Scale hydroelectric Power Plant and Korea Power Exchange.
2-2. The measured amount of electricity shall be collected daily, weekly, and monthly and shall be archived in electronic way.

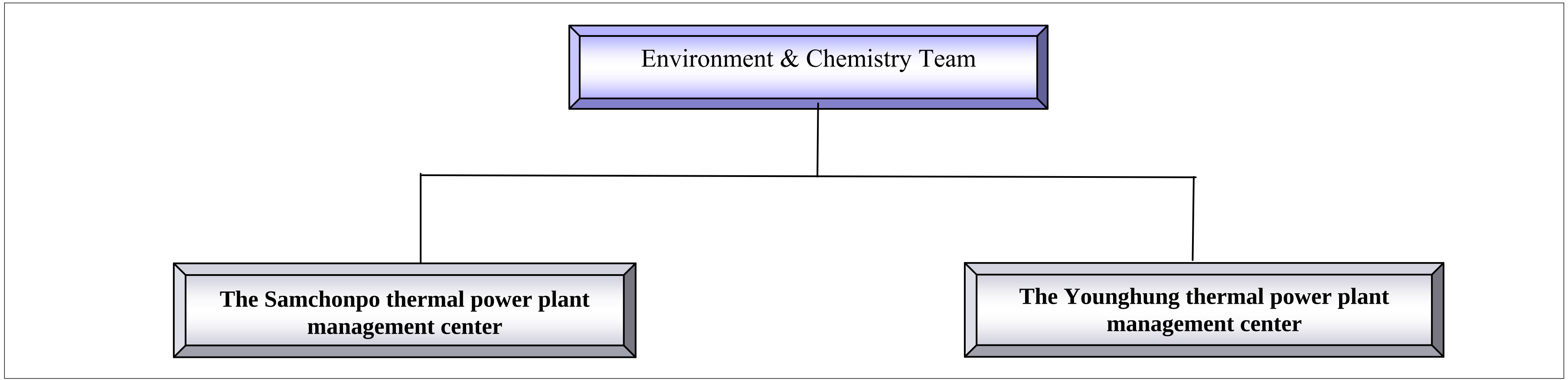
2-3. The collected data in article 2-2. shall be compared with those of Korea power Exchange.
2-4. If the two data compared in article 2-3. are different, the operation condition of electricity meters and other equipments shall be examined. In case meters are improperly operated equipments, internal investigation and correction procedure shall be followed and be certified by the final decision-maker and Korea Power exchange.

3. Management of monitoring and electricity safety

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

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

D.5. Please describe briefly the operational and management structure that the project participant(s) will implement in order to monitor emission reductions and any leakage effects generated by the project activity:



Department in charge of monitoring for the project and responsible department are as follows:
- Department in charge of monitoring: the Samchonpo thermal power plant management center, The Younghung thermal power plant management center.
- Responsible department: Environment & Chemistry Team

D.6. Name of person/entity determining the monitoring methodology:

Dr. Jaesoo Jung(civilenvi@ecoeye.com) / Ecoeye Co., Ltd. which is not a project participant.
Contacted : +82-31-716-2108, acu0725@ecoeye.com

SECTION E.: Estimation of GHG emissions by sources:

E.1. Formulae used:

E.1.1 Selected formulae as provided in appendix B:

Not applicable

E.1.2 Description of formulae when not provided in appendix B:

Project emission reduction = BE(Baseline emissions) – PE(Project emissions)

E.1.2.1 Describe the formulae used to estimate anthropogenic emissions by sources of GHGs due to the project activity within the project boundary:

GHGs emissions due to the project activity is not occurred.(For further information, refer to Section D.2)

E.1.2.2 Describe the formulae used to estimate leakage due to the project activity, where required, for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities

Leakage due to the project activity is not occurred.(for more detailed information, refer to Section D.2)

E.1.2.3 The sum of E.1.2.1 and E.1.2.2 represents the small-scale project activity emissions:

Project activity emission is 0.

E.1.2.4 Describe the formulae used to estimate the anthropogenic emissions by sources of GHGs in the baseline using the baseline methodology for the applicable project category in appendix B of the simplified modalities and procedures for small-scale CDM project activities:

Step 0. Calculating baseline emissions

A. The result of calculating anthropogenic emissions

OM ($EF_{OM, 2003, 2004, 2005}$)	BM ($EF_{BM, 2005}$)	Emission Factor (=$0.5\times EF_{OM} + 0.5\times EF_{BM}$)	Annual MWh to be produced between in 2007~2017	Anthropogenic emissions
0.7187 (Ton-CO_2eq/Mwh)	**0.3920** (Ton- CO_2eq/Mwh)	**0.5554** (Ton- CO_2eq/Mwh)	**38,155 (MWh/yr)**	**21,189 (Ton- CO_2 eq/yr)**

B. The result of calculating baseline emissions factors

	Year	CO2 emission (ton-CO_2eq)	Annual MWh to be produced (MWh)	Emission factor (OM, EF_{AOM}) (Ton- CO_2eq/Mwh)	EF (Ton- CO_2eq/Mwh)
OM(2003,2004,2005) (Not including low-operating cost and must run power plants.)	2003	123,011,080	166,911,025	$=\sum CO_2$ Emission (2003,2004,2005) $\div \sum$ Annual MWh(2003,2004,2005) =(123,011,080+133,090,687+138,696,677) ÷ (166,911,025+187,510,832+194,888,237) **=0.7187**	
	2004	133,090,687	187,510,832		
	2005	138,696,677	194,888,237		$=0.5\times EF_{AOM}$ $+0.5\times EF_{BM}$ **=0.5554**
BM(2005) (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)	Year	CO2 emission (ton-CO_2eq)	Annual MWh to be produced (MWh)	Emission factor (BM, EF_{BM}) (Ton- CO_2eq/Mwh)	
	2005	27,642,376	70,513,665	= CO_2 Emission ÷ Annual MWh **= 0.3920**	

Step 1. Calculation of the Operating Margin emission factor (OM)

Low-cost and must-run plants have to be deducted from the data in the calculation of OM factor.

The OM is calculated as follows, using 3-year average data.

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

$F_{i,j,y}$ is the amount of fuel *i* (in a mass or volume unit) consumed by relevant power sources *j* in year(s) *y*,
j refers to the power sources delivering electricity to the grid, not including low cost and must-run,
$COEF_{i,j,y}$ ($COEF\ i = NCV\ i \cdot EFco_2 i \cdot OXID\ i$) 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*.

The data used for the formula are on Annex 3 and the result are as follows.

According to the OM calculation formula and variables of above tables, OM is 0.7187 $kgCO_2$ equ/kWh.

Step 2. – Calculation of the Build Margin (BM)

Participants have to use the most recent data from the sample group that has already been built. Among the sample groups, the participants have to choose one that has a larger annual generation than the other.

- 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

<Table 9> Sample Plant group (m) for determining Build margin Emission factor

Sample group(m) Classification	"The five power plants that have been built most recently"	"The power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently."	Comments
Electricity quantity	1,319 GWh	70,513 GWh	Total generation is 348,187 GWh in Korea (based on KEPCO's data of the year 2005)
Proportion (ratio to total generation in Korea)	0.38%	20.25%	
Selected Group		**O**	

The annual generation of "the five power plants that have been built most recently" was 1,319 GWh (0.38% of total generation of the grid system), and the annual generation of "the power plants capacity additions in the electricity system that comprise 20.25 % of the system generation and that have been built most recently" was 70,513 GWh. Therefore, the latter was chosen as a lager figure than the other one.

The calculation of BM_y is as follows;

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

<Table 10> Sample group plants used in the Build Margin calculation and Carbon Emission Factor of the Build Margin

Plant name		Technology	year operation	Fuel	MWh in 2005	% of total output	CEF	Result
Suncheon Solar		solar	2005.12	solar	215	0.00%	0	0
Samcheonpo solar energy		solar	2005.10	Solar	37	0.00%	0	0
Dangjin	#5	steam	2005.10	Anthracite	1,318,670	1.88%	0.9113	0.0171
Yangyang		small hydro power	2005.08	hydro	2,141	0.00%	0	0
Taean solar energy		Solar	2005.08	Solar	43	0.00%	0	0
Wunjeong LFG		Steam by LFG	2005.07	LFG	13,166	0.02%	0	0
Yulchon		Combined cycle power	2005.07	LNG	1,300,627	1.85%	0.4556	0.0084
Incheon		Combined cycle power	2005.06	LNG	2,055,016	2.92%	0.4170	0.0122
Daegok		small hydro power	2005.06	Hydro	522	0.00%	0	0
Donghwa		small hydro power	2005.05	Hydro	2,399	0.00%	0	0
Ulchin	#6	Nuclear	2005.04	nuclear	7,085,820	10.08%	0	0
Hanryo LFG		LFG	2005.04	LFG	4,774	0.01%	0	0
Busan Bio-gas		Steam	2005.01	LFG	120	0.00%	0	0
Maebongsan-wind power		Wind	2004.12	Wind	5,543	0.01%	0	0
Yongheng	#2	Steam	2004.11	bituminous	4,658,862	6.63%	0.8900	0.0590
new solar energy		Solar power	2004.09	solar	209	0.00%	0	0
Daegwanryung-wind power		Wind power	2003.11/2004.08	Wind	4,137	0.01%	0	0
Yongheng	#1	Steam	2004.07	bituminous	5,623,299	8.00%	0.8833	0.0707
Ulchin	#5	Nuclear	2004.07	nuclear	7,313,595	10.41%	0	0
Busan	C/C	Combined cycle power	2003.05/2004.03	LNG	9,076,327	12.92%	0.4054	0.0524

Hankyung-wind power		Wind	2004.02	Wind	18,265	0.03%	0	0
Chunsang		small hydro power	2004.01	Hydro	40	0.00%	0	0
Cheongju LFG		Internal	2004.01	LFG	6,168	0.01%	0	0
Daejon Geumgodong		Internal	2003.06	LFG	12,794	0.02%	0	0
Hoicheon ENC		Internal	2003.05	LFG	3,650	0.01%	0	0
Gunsan-wind power		Internal	2002.11/2003.09	Wind	6,582	0.01%	0	0
Sangwon ENC		Internal	2001.12/2003.03/2003.06	LFG	39,309	0.06%	0	0
Muju		small hydro power	2003.04	Hydro	569	0.00%	0	0
Seohee- ENC		Internal	2003.04	LFG	31,360	0.04%	0	0
Yonggwang	#6	nuclear	2002.12	nuclear	7,776,138	11.06%	0	0
Taean	#6	Steam	2002.05	bituminous	3,999,847	5.69%	0.8791	0.0500
Yonggwang	#5	nuclear	2002.05	nuclear	7,748,431	11.03%	0	0
Sanchong pumping #2		Pumping	2001.11	Hydro	138,862	0.20%	0	0
Milyang		small hydro power	2001.10	Hydro	6,147	0.01%	0	0
Sanchong pumping #1		Pumping	2001.09	Hydro	224,274	0.32%	0	0
Yongdam		small hydro power	2001.09	Hydro	172,266	0.25%	0	0
Yeongcheon		small hydro power	2001.08	Hydro	1,708	0.00%	0	0
Hadong	#6	Steam	2001.07	bituminous	4,037,763	5.75%	0.8766	0.0504
Dangjin	#4	Steam	2001.03	bituminous	4,079,557	5.80%	0.8729	0.0507
Pohang-wind power		wind	2001.02	Wind	-	0.00%	0	0.0000
Taean	#5	Steam	2001.01	bituminous	3,744,413	5.15%	0.8830	0.0455
Total					70,513,665	100%	BM Factor	0.3920

Source: Statistics of Electric Power in KOREA (2006) (KEPCO), Current status of power generating facility(2006, Korea power exchange)

According to the BM calculation formula and variables of above tables, BM is 0.3920 kgCO_2 equ/kWh

Step 3. – Calculation of the baseline emission factor (EF_y)

The average of OM and BM factors calculated by step 1 and 2 is EF_y, baseline emission factor.

$$EF_y = (EF_{OM\,y} + EF_{BM,y}) / 2$$

According to Step 2. and Step 3, EF(Emission factor) is 0.5554 CO_2 ton/MWh.

Step 4. – Calculation of the baseline emission

Baseline emission = Electricity transferred to a grid(kWh) x Baseline emission factor(kgCO_2 equ/kWh)

<Table 11>Annual electricity generation and baseline emission at each SS hydro power plant

Category	Annual electricity generation
Samchonpo thermal power plant SS hydropower	22,728 MWh/yr
Younghung thermal power plant SS hydropower	15,426 MWh/yr
Project electricity generation	38,155 MWh/yr
Baseline emission factor	0.5554 CO_2 ton/MWh
Baseline emission	21,189 CO_2 ton/yr

According to the formula above, baseline emission is 21,189 CO_2 ton/yr.

E.1.2.5 Difference between E.1.2.4 and E.1.2.3 represents the emission reductions due to the project activity during a given period:

Total emission reduction due to the project activity during a crediting period is 211,898 CO_2 tons/10yrs.

E.2 Table providing values obtained when applying formulae above:

<Table 12>Estimated emission reductions by the project activity

Years	**Estimated emission by the project activity (tonnes of CO_2 e)**	**Estimated baseline emission (tonnes of CO_2 e)**	**Estimated leakage (tonnes of CO_2 e)**	**Estimated emission reductions (tonnes of CO_2 e)**
Year 1 (2007.11.1 ~ 2008.10.31)	0	21,189	0	21,189
Year 2 (2008.11.1 ~ 2009.10.31)	0	21,189	0	21,189
Year 3 (2009.11.1 ~ 2010.10.31)	0	21,189	0	21,189
Year 4 (2010.11.1 ~ 2011.10.31)	0	21,189	0	21,189
Year 5 (2011.11.1 ~ 2012.10.31)	0	21,189	0	21,189
Year 6 (2012.11.1 ~ 2013.10.31)	0	21,189	0	21,189
Year 7 (2013.11.1 ~ 2014.10.31)	0	21,189	0	21,189
Year 8 (2014.11.1 ~ 2015.10.31)	0	21,189	0	21,189
Year 9 (2015.11.1 ~ 2016.10.31)	0	21,189	0	21,189
Year 10 (2016.11.1 ~ 2017.10.31)	0	21,189	0	21,189
Total (tones of CO_2 e)	0	211,898	0	211,898

SECTION F.: Environmental impacts:

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

Approval letters from government office related to this project should be issued after checking expected environmental impacts. Although this project is not the object of the evaluation of the environment impacts, KOSEP has tried to reduce environmental impacts which the related government offices had anticipated.
The expected environmental impacts and its countermeasures are as follows.

● Younghung small hydroelectric power plant
: Change of the sea water temperature caused by draining thermal waste water.

Both #3 and #4 Younghung thermal power plant and small hydroelectric power plant are under the construction.

The thermal waste water is drained from only #3 and #4 Younghung thermal power plant, not from small hydroelectric power plant. The environmental impact is also caused by the change of the sea water temperature. Therefore this environmental impact will be managed by post-treatment of #3 and #4 thermal power plants in the environmental impact evaluation.

● Samchonpo
: 1. Environmental impact on the oceanic ecosystem should be considered and how to cope with the impact should be studied.

To get the approval letter of the public surface occupation and use, the letter of the sea-area utilization council is needed on which there are standardized counter-plans on the expected environmental impacts . KOSEP is constructing this SSC hydroelectric power plant according to this council letter hence it is expected that there are no serious environmental impacts.

: 2. The influence of the thermal waste water should be considered and how to cope with the impact should be studied.

The thermal waste water is going to be drained at the point of -1.3 meter of the average sea level.
Therefore bubble production will be reduced by SSC-hydroelectric power plant. In addition, it is expected that the influence of thermal waste water will be abated because the thermal waste water stays for 1~2 minutes during adjusting sea level in the dam.

SECTION G. Stakeholders' comments:

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

⦿ Samchonpo and Younghung small hydro power project stakeholders & the process getting comments

A. Stakeholders

Stakeholders	Samchonpo	Younghung
Authorities related to these projects	•Gyeongsangnam-do •The Ministry of Maritime Affairs and Fisheries •The Ministry of Environment •The Ministry of Commerce, Industry and Energy	•Incheon Metropolitan City •The Ministry of Maritime Affairs and Fisheries •The Ministry of Commerce, Industry and Energy
Other Stakeholders	•Namdong Marine Products Co., Ltd. •Local Resident (Fishermen)	•Local Resident (Farmers)

B. The process getting comments

KOSEP received written permissions for approval of Samchonpo and Younghung small hydro power plant projects. Written permissions were issued by authorities related to these projects. And The documents contained problems to solve by KOSEP which are issues about local environment and local residents. KOSEP collected comments from the written permissions and responded to them.

⦿ Counter plan for local residents complaints

KOSEP carried out these SSC-hydro power plant projects through newspapers and KOSEP environmental reports. Additionally, KOSEP informed this CDM project on its website to introduce its project and collect opinions from local residents or other stakeholders.

A. Open to media about Samchonpo and Younghung small hydro power plant

·Announcements in Electimes.

The Electimes put the news about breaking ground of Samchonpo SSC-hydroelectric power plants on its web-site.

일렉타임즈

http://www.electimes.com

남동발전, 신재생 하이브리드 발전소 착공

·Announcements in CBS news.

CBS put the news about the construction of Samchonpo SSC-hydroelectric power plants on its web-site. Many residents are subscribing the CBS to know the local news.

·Announcements in The Energy Economic News.

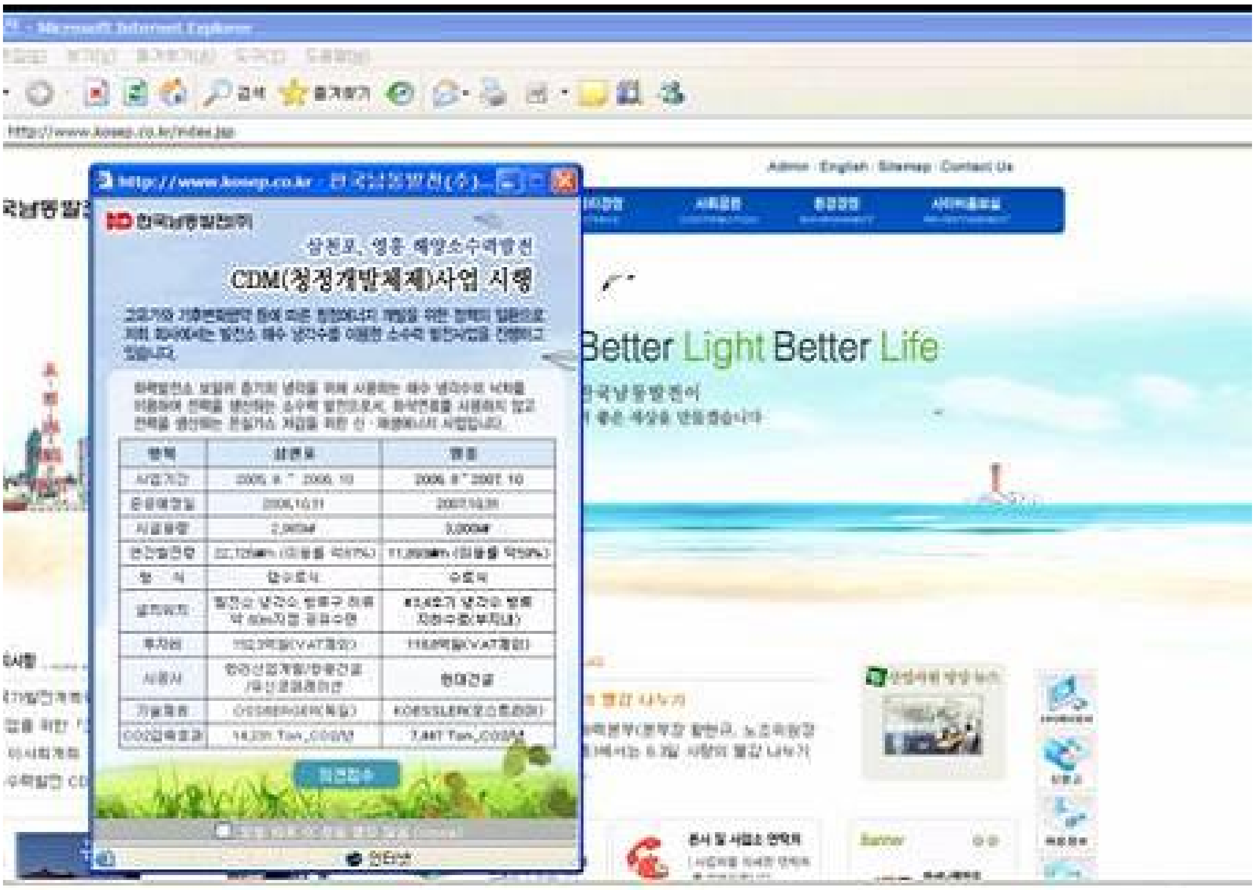
The Energy Economic News broke the news about Samchonpo SSC-hydroelectric power plants on its web-site.

·Announcements in the 2006 environmental report of KOSEP.

KOSEP introduced Samchonpo and Younghung SSC hydroelectric power plants on its 2006 environmental report . This report is available to read through KOSEP web-site.

B. Provision space for stakeholders comment collection on KOSEP website. (from 01/09/2006)

KOSEP informs the stakeholders to the information of SSC-hydro power plants CDM project through KOSEP homepage. The stakeholders can raise their opinions or comments on KOSEP homepage. KOSEP collects stakeholders' comments and reflect them positively.



G.2. Summary of the comments received:

⦿ **Comments received from Stakeholers**

A.Samchonpo small hydro power construction project
a. Local residents' opinion
On the process of issue of written permissions from individual authorities, if there are complains from local residents, projects should be processed after being solved complains. So far, no major complaints have been received or appealed from relevant stakeholders. If there are complaints, it will be passively solved.

b. Namdong Marine Products
For the readily small hydro power construction, agreement form from Namdong Marine Products Co., Ltd. should be obtained to construct the adjacent ground and install entry road.

B. Younghung small hydro power construction project
When construction enforcement and installation facilities are performed, management of adjacent farmland and rural life environment never get damage. Therefore, the plan for damage prevention is necessary to be processed. The vincinity of Younghung small hydro power plant, most of ground is owned by KOSEP, therefore, there are no farmland which can be affected by small hydro power project.

⦿ **Counter plan for complaints from local residents**

A. Open to media about Samchonpo and Younghung small hydro power
·Announcements in Electimes.
After sending out this news, there were no civil appeal or exception from the local residents toward.

·Announcements in CBS news.
After sending out this news, there are no civil appeal or exception from the local residents toward.

·Announcements in The Energy Economic News.
After sending out this news, there are no civil appeal or exception from the local residents.

·Announcements in the 2006 environmental report of KOSEP.
After sending out this report, there are no civil appeal or exception.

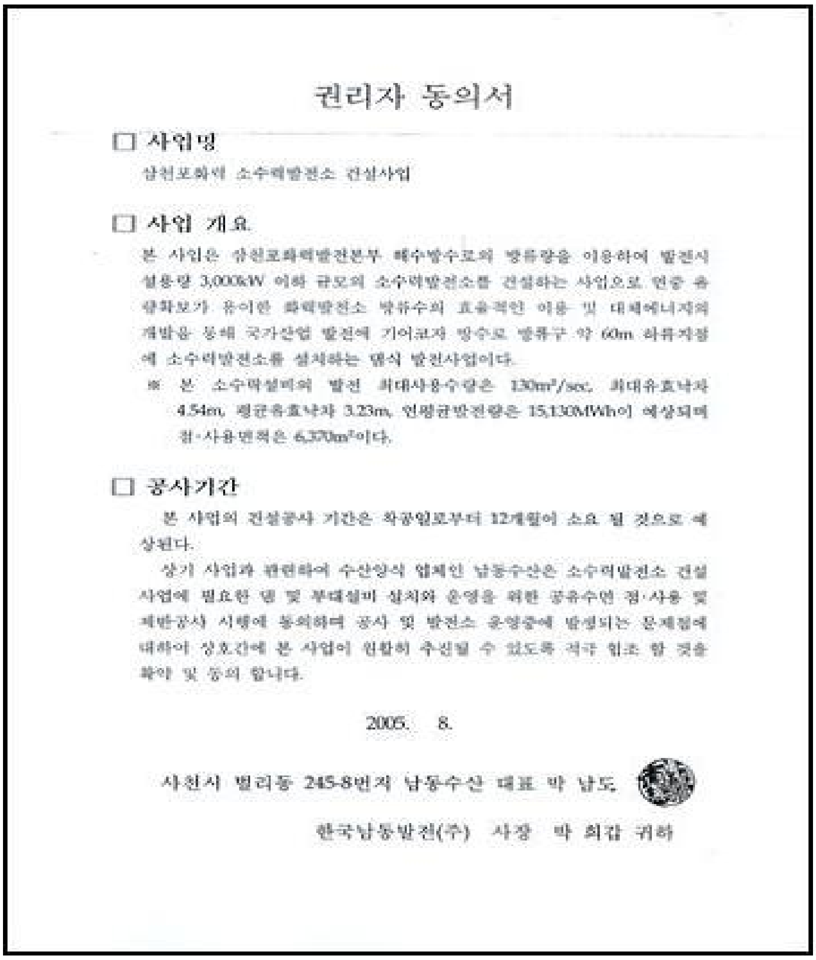
B. Provision space for stakeholders comment collection on KOSEP website

It was started in 01/09/2006 and there were no comments from now on.

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

⦿ Agreement form from Namdong Marine Products Co. Ltd,. ’ rightful person

Agreement form below of usage of adjacent road and share surface of water was received from Namdong Marine Product Co. Ltd,.



권리자 동의서

□ 사업명

삼천포화력 소수력발전소 건설사업

□ 사업 개요

본 사업은 삼천포화력발전본부 배수방수로의 방류량을 이용하여 발전시설용량 3,000kW 이하 규모의 소수력발전소를 건설하는 사업으로 연중 유량확보가 용이한 화력발전소 방류수의 효율적인 이용 및 대체에너지의 개발을 통해 국가산업 발전에 기여코자 방수로 방류구 약 60m 하류지점에 소수력발전소를 설치하는 댐식 발전사업이다.

※ 본 소수력설비의 발전 최대사용수량은 130m³/sec, 최대유효낙차 4.54m, 평균유효낙차 3.23m, 연평균발전량은 15,130MWh이 예상되며 점·사용면적은 6,370m²이다.

□ 공사기간

본 사업의 건설공사 기간은 착공일로부터 12개월이 소요 될 것으로 예상된다.

상기 사업과 관련하여 수산양식 업체인 남동수산은 소수력발전소 건설사업에 필요한 댐 및 부대설비 설치와 운영을 위한 공유수면 점·사용 및 제반공사 시행에 동의하며 공사 및 발전소 운영중에 발생되는 문제점에 대하여 상호간에 본 사업이 원활히 추진될 수 있도록 적극 협조 할 것을 확약 및 동의 합니다.

2005. 8.

사천시 벌리동 245-8번지 남동수산 대표 박 남도

한국남동발전(주) 사장 박 희갑 귀하

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	Korea South-East Power Co. (KOSEP)
Street/P.O.Box:	# 167
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City:	Seoul
State/Region:	Samseong-dong
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Telephone:	+82-2-3456-7145
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E-Mail:	
URL:	http://www.kosep.co.kr/
Represented by:	
Title:	President & CEO
Salutation:	Mr
Last Name:	Park
Middle Name:	
First Name:	Hee Gab
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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

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

Annex 3

Data for the formula of Operating Margin

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

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

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

Energy sources	Plant Name		Fuel consumption 2003 (kl)	Fuel consumption 2004 (kl)	Fuel consumption 2005 (kl)
Diesel Oil	Honam	#1	409	300	278
		#2	366	335	185
	Samchonpo	#1	1,144	1,674	1,220
		#2	657	744	626
		#3	838	814	377
		#4	299	785	1,029
		#5	2,118	230	1,415
		#6	1,570	652	1,001
	Boryeong	#1	968	311	761
		#2	934	616	551
		#3	59	574	90

	#4	307	179	603
	#5	152	422	156
	#6	356	350	627
Taean	#1	319	999	621
	#2	730	310	395
	#3	193	390	650
	#4	628	254	365
	#5	994	329	742
	#6	1,011	230	417
Hadong	#1	390	533	284
	#2	445	145	792
	#3	613	670	472
	#4	302	737	567
	#5	435	318	614
	#6	223	689	331
Dangjin	#1	926	294	637
	#2	787	211	632
	#3	510	605	141
	#4	746	528	134
	#5	-	-	5,701
	#6	-	-	1,779
Ulsan	#1	484	114	750
	#2	1,061	82	585
	#3	500	554	662
	#4	1,450	1,238	1,971
	#5	1,740	931	1,676
	#6	1,525	1,603	1,708
Youngnam	#1	1,024	837	844
	#2	270	274	584
Yosu	#1	370	571	434
	#2	86	436	346
Pyongtaek	#1	167	247	118
	#2	195	232	140
	#3	111	240	132
	#4	123	225	138
Namjeju	#1	20	6	15
	#2	24	13	12
Jeju	#1	23	7	12
	#2	65	73	-
	#3	-	41	48
Seoul	#4	-	1	-
	#5	4	3	1
Incheon	#1	6	-	-
	#2	6	-	-
	#3	247	149	372

Energy sources	Plant Name		Fuel consumption 2003 (ton)	Fuel consumption 2004 (ton)	Fuel consumption 2005 (ton)
		#4	170	-	400
	Pyongtaek C/C		96,032	21	1
	Ilsan	C/C	40,006	-	-
	Bundang	C/C	-	-	-
	Ulsan	C/C	63,295	-	-
	Seoincheon	C/C	44,792	88	335
	Shinincheon	C/C	47,393	-	-
	Boryeong	C/C	97,106	-	-
	Hallim	C/C	16,286	28,796	29,686
	Anyang	C/C	-	-	30,022
	Bucheon	C/C	-	-	-
	K I E Co.	C/C	103,057	-	-
	L G Bugog	C/C	67,273	-	-
	Namjeju	D/P	84	80	37
	Busan		1,213	2,687	-
	Yonghung	#1	-	27,916	4,541
		#2	-	18,314	2,903
	Yulchon	C/C	-	596	159
	Jeju	G/T	-	2,232	2,869
Energy sources	**Plant Name**		**Fuel consumption 2003 (ton)**	**Fuel consumption 2004 (ton)**	**Fuel consumption 2005 (ton)**
LNG	Pyongtaek	#1	2,727	2,095	3,553
		#2	2,402	2,515	2,641
		#3	2,238	3,791	1,784
		#4	2,370	3,217	2,047
	Seoul	#4	32,670	22,409	49,143
		#5	126,211	117,908	108,761
	Incheon	#1	25,930	10,523	4,365
		#2	28,612	11,094	8,505
		#3	34,035	4,235	746
		#4	24,093	-	6,620
	Pyongtaek C/C		76,012	98,846	110,953
	Ilsan	C/C	530,874	593,548	533,188
	Bundang	C/C	598,396	653,880	671,944
	Ulsan	C/C	189,997	347,076	470,131
	Seoincheon	C/C	1,012,670	1,209,806	989,645
	Shinincheon	C/C	1,405,724	1,587,638	1,458,763
	Boryeong	C/C	571,742	988,548	1,161,510
	Anyang	C/C	325,207	270,559	261,202
	Bucheon	C/C	266,577	258,596	261,705
	K I E Co.	C/C	381,684	467,583	445,253
	GS Bugog	C/C	121,037	260,653	297,976

	Busan	C/C	234,533	1,298,418	1,211,144

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

<Table Annex-2> Caloric value(2003)

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

	#2	-	9,043	8,993	-
Yosu	#1	-	9,979	8,975	-
	#2	-	9,983	8,970	-
Pyongtaek	#1	-	9,838	8,974	-
	#2	-	9,844	8,972	12,955
	#3	-	9,845	8,977	12,929
	#4	-	9,842	8,976	12,950
Namjeju	#1	-	9,852	8,900	-
	#2	-	9,853	8,958	-
Jeju	#1	-	10,009	9,238	-
	#2	-	9,945	8,928	-
	#3	-	9,943	8,928	-
Seoul	#4	-	-	9,070	13,013
	#5	-	-	7,515	13,003
Incheon	#1	-	9,828	7,526	13,018
	#2	-	9,833	8,986	13,018
	#3	-	9,822	8,993	13,017
	#4	-	9,830	8,988	13,015
Pyongtaek	C/C	-	-	8,926	13,026
Ilsan	C/C	-	-	8,966	13,021
Bundang	C/C	-	-	-	13,030
Ulsan	C/C	-	-	9,053	13,007
Seoincheon	C/C	-	-	9,151	12,999
Shinincheon	C/C	-	-	9,150	13,005
Boryeong	C/C	-	-	9,131	13,016
Busan	C/C	-	-	9,242	12,997
Hallim	C/C	-	-	8,964	-
Anyang C/C	(Other co.)	-	-	-	13,033
Bucheon C/C	(")	-	-	-	13,022
K I E Co.	(")	-	-	9,092	13,014
L G Bugog	(")	-	-	9,033	13,018
Namjeju	D/P	-	9,852	8,881	-

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

<Table Annex-3> Caloric value (2004)

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

	#2	-	10,009	8,956	-
Pyongtaek	#1	-	9,877	8,917	12,920
	#2	-	9,879	8,941	12,907
	#3	-	9,902	8,907	12,910
	#4	-	9,903	8,915	12,956
Namjeju	#1	-	9,900	9,333	-
	#2	-	9,901	8,846	-
Jeju	#1	-	9,897	8,961	-
	#2	-	9,912	8,936	-
	#3	-	9,919	8,928	-
Namjeju	D/P	-	9,901		-
Seoul	#4	-	-	9,070	13,011
	#5	-	-	9,070	13,014
Incheon	#1	-	-		13,038
	#2	-	-		13,039
	#3	-	-	8,951	13,038
Pyongtaek C/C		-	-	8,758	13,033
Ilsan	C/C	-	-	-	13,017
Bundang	C/C	-	-	-	13,026
Ulsan	C/C	-	-	-	12,920
Seoincheon	C/C	-	-	9,211	13,010
Shinincheon	C/C	-	-	-	13,017
Boryeong	C/C	-	-	-	13,025
Busan	C/C	-	-	-	13,004
Hallim	C/C	-	-	8,972	-
Anyang	C/C	-	-	-	13,025
Bucheon	C/C	-	-	-	13,013
K I E Co.	C/C	-	-	-	13,023
L G Bugog	C/C	-	-	-	13,028
Yulchon	C/C	-	-	11,731	13,014
Namjeju	D/P	-	-	8,867	-
Jeju	G/T	-	-	8,948	-

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

<Table Annex-4> Caloric value (2005)

Plant Name		Caloric value (by source in 2005)			
		Coal (kcal/kg)	Heavy oil (kcal/l)	Diesel oil (kcal/l)	L. N. G (kcal/kg)
Honam	#1	5,693	9,859	8,844	-
	#2	5,655	9,901	8,847	-
Samchonpo	#1	5,846	-	9,009	-
	#2	5,844	-	9,011	-
	#3	5,862	-	8,948	-
	#4	5,855	-	8,992	-
	#5	5,766	-	9,000	-
	#6	5,765	-	9,000	-
Yonghung	#1	6,459	-	8,891	-
Boryeong	#1	6,066	-	8,942	-
	#2	6,075	-	8,944	-
	#3	6,254	-	8,749	-
	#4	6,254	-	8,777	-
	#5	6,254	-	8,749	-
	#6	6,239	-	8,749	-
Taean	#1	6,181	-	9,013	-
	#2	6,192	-	9,013	-
	#3	6,188	-	9,013	-
	#4	6,198	-	9,013	-
	#5	6,155	-	9,013	-
	#6	6,167	-	9,013	-
Hadong	#1	6,149	-	8,941	-
	#2	6,144	-	8,984	-
	#3	6,146	-	8,912	-
	#4	6,145	-	8,957	-
	#5	6,148	-	8,871	-
	#6	6,142	-	8,839	-
Dangjin	#1	6,102	-	8,892	-
	#2	6,121	-	8,904	-
	#3	6,129	-	8,889	-
	#4	6,118	-	8,893	-
	#5	6,115	-	8,904	-
	#6	6,221	-	11,095	-
Ulsan	#1	-	9,861	9,018	-
	#2	-	9,856	9,047	-
	#3	-	9,862	9,035	-
	#4	-	9,921	9,120	-
	#5	-	9,912	9,120	-
	#6	-	9,921	9,120	-
Youngnam	#1	-	9,196	8,997	-
	#2	-	9,043	8,993	-

Yosu	#1	-	9,979	8,975	-
	#2	-	9,983	8,970	-
Pyongtaek	#1	-	9,838	8,974	-
	#2	-	9,844	8,972	12,955
	#3	-	9,845	8,977	12,929
	#4	-	9,842	8,976	12,950
Namjeju	#1	-	9,852	8,900	-
	#2	-	9,853	8,958	-
Jeju	#1	-	10,009	9,238	-
	#2	-	9,945	8,928	-
	#3	-	9,943	8,928	-
Namjeju	D/P	-	9,852	8,881	-
Seoul	#4	-	-	9,070	13,013
	#5	-	-	7,515	13,003
Incheon	#1	-	9,828	7,526	13,018
	#2	-	9,833	8,986	13,018
	#3	-	9,822	8,993	13,017
	#4	-	9,830	8,988	13,015
Pyongtaek C/C		-	-	8,926	13,026
Ilsan	C/C		-	8,966	13,021
Bundang	C/C	-	-	-	13,030
Ulsan	C/C		-	9,053	13,007
Seoincheon	C/C	-	-	9,151	12,999
Shinincheon	C/C	-	-	9,150	13,005
Boryeong	C/C	-	-	9,131	13,016
Busan	C/C		-	9,242	12,997
Hallim	C/C	-	-	8,964	-
Anyang	C/C	-	-	-	13,033
Bucheon	C/C	-	-	-	13,022
K I E Co.	C/C	-	-	9,092	13,014
GS Bugog	C/C	-	-	9,033	13,018
Yulchon	C/C	-	-	10,930	13,023

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

<Table Annex-5> Electricity power and CEF

Plant Name		MWh Produced in 2003	MWh Produced in 2004	MWh Produced in 2005	CEF (t CO_2 / MWh) 2003	CEF (t CO_2 / MWh) 2004	CEF (t CO_2 / MWh) 2005
Honam	#1	1,372,873	1,855,554	1,787,715	0.9771	0.9682	0.9698
	#2	1,784,483	1,625,399	1,875,790	0.9736	0.9683	0.9652
Samchonpo	#1	3,745,916	3,974,202	3,810,079	0.8845	0.8340	0.8788
	#2	4,110,134	3,839,080	4,323,618	0.8813	0.9436	0.8751
	#3	4,051,427	3,652,769	4,343,666	0.8723	0.9675	0.8628
	#4	4,250,404	3,811,371	4,112,297	0.8687	0.9691	0.8639
	#5	3,606,167	4,147,957	3,542,728	0.8446	0.7331	0.8450
	#6	3,609,696	4,185,213	3,643,969	0.8469	0.7299	0.8421
Boryeong	#1	3,237,526	4,014,109	3,547,140	0.8732	0.8705	0.8735
	#2	3,380,013	3,915,285	3,433,608	0.8697	0.8676	0.8677
	#3	4,090,927	3,746,265	4,124,745	0.8332	0.8352	0.8357
	#4	3,754,883	4,097,489	3,698,705	0.8327	0.8346	0.8350
	#5	4,063,865	3,660,240	4,121,314	0.8331	0.8351	0.8358
	#6	3,709,092	4,093,207	3,283,477	0.8333	0.8344	0.8357
Taean	#1	3,995,111	3,780,097	3,992,112	0.8368	0.8394	0.8364
	#2	3,651,716	3,975,123	3,484,251	0.8342	0.8368	0.8417
	#3	3,994,351	3,732,363	3,957,054	0.8334	0.8357	0.8368
	#4	3,708,360	4,048,258	3,653,534	0.8376	0.8368	0.8378
	#5	3,370,362	4,091,406	3,744,413	0.8379	0.8362	0.8389
	#6	3,637,652	4,056,835	3,999,847	0.8357	0.8348	0.8351
Hadong	#1	3,995,331	3,688,313	3,997,914	0.8378	0.8383	0.8384
	#2	3,739,800	4,028,529	3,732,583	0.8347	0.8357	0.8359
	#3	3,694,945	3,997,064	3,769,077	0.8358	0.8375	0.8349
	#4	4,029,035	3,724,757	3,989,315	0.8341	0.8438	0.8382
	#5	3,733,243	4,013,845	3,553,901	0.8353	0.8252	0.8375
	#6	4,013,010	3,685,698	4,037,763	0.8316	0.8194	0.8328
Dangjin	#1	3,677,169	3,986,406	3,797,307	0.8384	0.8357	0.8333
	#2	3,685,913	4,038,457	3,798,078	0.8337	0.8347	0.8325
	#3	4,034,969	3,711,787	4,081,017	0.8339	0.8340	0.8308
	#4	4,096,642	3,801,495	4,079,557	0.8270	0.8305	0.8292
	#5	-	-	1,318,670	-	0.0000	0.8657
	#6	-	-	96,365	-	0.0000	0.9803
Ulsan	#1	430,067	271,544	262,393	0.7929	0.8157	0.8143
	#2	404,834	244,246	255,812	0.7836	0.8073	0.7997
	#3	414,630	268,231	200,518	0.7931	0.8067	0.8079
	#4	1,507,363	1,759,376	1,549,091	0.7272	0.7283	0.7417
	#5	2,025,171	2,141,162	1,500,935	0.7251	0.7289	0.7413
	#6	1,363,879	2,196,344	1,454,644	0.7275	0.7299	0.7404
Youngnam	#1	890,011	973,872	1,022,470	0.7907	0.8090	0.8045
	#2	753,536	665,973	531,006	0.8171	0.8723	0.8457
Yosu Ⅱ	#1	703,557	723,968	430,310	0.7524	0.7674	0.7566
(Yosu)	#2	328,981	1,304,109	904,597	0.7947	0.7408	0.7323

Pyongtaek	#1	1,465,460	850,533	1,258,662	0.7032	0.7314	0.7107
	#2	1,393,188	880,646	1,376,342	0.7060	0.7248	0.7096
	#3	1,400,056	751,633	1,321,167	0.7109	0.7365	0.7077
	#4	1,539,552	800,854	1,338,204	0.7080	0.7359	0.7065
Namjeju	#1	38,080	50,294	44,602	0.9880	0.9902	0.9879
	#2	36,860	48,714	44,654	0.9963	0.9937	1.0138
Jeju	#1	30,288	44,659	36,266	1.0451	1.0336	1.0491
	#2	439,474	486,401	532,700	0.7438	0.7358	0.7354
	#3	513,880	509,330	502,189	0.7364	0.7367	0.7400
Seoul	#4	132,599	90,322	207,498	0.6743	0.6789	0.6477
	#5	503,383	480,919	444,324	0.6856	0.6710	0.6697
Incheon	#1	225,023	47,491	16,450	0.6134	0.6075	0.7273
	#2	242,806	49,144	37,727	0.6021	0.6190	0.6176
	#3	267,999	19,018	- 130	0.6291	0.6310	0.0000
	#4	214,153	594	29,202	0.6424	0.0000	0.6569
Pyongtaek		863,292	596,001	659,932	0.5307	0.4546	0.4608
Ilsan		3,097,425	3,281,407	2,873,958	0.5031	0.4951	0.5077
Bundang		3,344,852	3,650,122	3,742,073	0.4902	0.4907	0.4919
Ulsan		1,557,954	2,329,524	3,131,075	0.4408	0.4048	0.4027
Seoincheon		7,012,289	8,353,619	7,001,031	0.4118	0.3963	0.3869
Shinincheon		10,459,986	11,596,955	10,543,280	0.3796	0.3748	0.3787
Boryeong		4,436,234	6,979,928	8,221,926	0.4111	0.3879	0.3872
Busan		1,574,883	9,884,075	9,076,327	0.4091	0.3592	0.3649
Hallim		55,044	96,435	100,346	0.7734	0.7812	0.7742
Anyang (Other co.)		1,793,725	1,506,070	1,433,978	0.4969	0.4921	0.4990
Bucheon (Other co.)		1,454,854	1,425,073	1,404,160	0.5018	0.4966	0.5097
K I E Co. (Other co.)		2,683,591	2,809,983	2,571,095	0.4910	0.4557	0.0000
LG Bugog (Other co.)		1,221,992	1,894,996	2,189,808	0.4162	0.3768	0.3937
Namjeju(D/P)		265,063	274,089	268,073	0.6393	0.6368	0.6371
Yulchon	C/C	-	36,366	1,300,627	-	0.6120	0.4101
Yonghung	#1	-	2,986,382	5,623,299	-	0.8348	0.8391
	#2	-	1,172,450	4,658,862	-	0.8847	0.8455
Incheon	CC	-	-	2,055,016	-	0.0000	0.3753
POSCO POWER	CC	-	-	2,571,095	-	0.0000	0.4744
Total		**166,911,025**	**187,510,832**	**194,888,237**	**0.7370**	**0.7098**	**0.7117**

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

<Table Annex-6>Fuel Carbon Emission Factor

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

Source: IPCC Guidelines, 1996a