**CLEAN DEVELOPMENT MECHANISM**
**SMALL-SCALE PROGRAMME OF ACTIVITIES DESIGN DOCUMENT FORM**
**(CDM-SSC-PoA-DD) Version 01**

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NOTE:

(i) This form is for the submission of a CDM PoA whose CPAs apply a small scale approved methodology.

(ii) At the time of requesting registration this form must be accompanied by a CDM-SSC-CPA-DD form that has been specified for the proposed PoA, as well as by one completed CDM-SSC-CPA-DD (using a real case).

## SECTION A. General description of small-scale programme of activities (PoA)

### A.1 Title of the small-scale programme of activities (PoA):

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Title: SH Corporation Solar photovoltaic housing complex programme in Republic of Korea

Current version number and the date:

| | |
|---|---|
| Ver. 01 | 01/10/2011 (for GSP) |
| Ver. 02 | 25/04/2012 (at validation) |
| Ver. 03 | 16/05/2012 (at validation) |
| Ver. 04 | 25/07/2012 (at validation) |

Completion date PoA-DD: 25/ 07/2012

### A.2. Description of the small-scale programme of activities (PoA):

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**Background**

SH Corporation established by the Metropolis of Seoul has built about 110,000 houses in the Metropolis of Seoul since 1989. SH Corporation works hard to get non-homeowners settled in places of their own by providing more affordable rental apartments and contributes to improvement in the quality of life of the citizens of the Metropolis of Seoul.

SH Corporation as an affiliate of the Metropolis of Seoul has been trying to meet its goal. Metropolis of Seoul has Green Energy Master Plan 2030[1] in the Metropolis of Seoul, based on Article 7 of Energy Act and Article 10 of Seoul Basic Energy Ordinance, to be a world-wide green city by 2030.

Under the master plan, Metropolis of Seoul sets up a variety of goals as follows:

- Reducing 40% of GHG emissions by 2030 compared to 1990
- Reducing 20% of energy consumption by 2030 compared to 2000
- Supplying 20% of energy consumption as new & renewable energy by 2030

In order to support achieving the goal, SH Corporation voluntarily planed to install solar photovoltaic electrical system (hereafter referred to as the "Solar PV") and/or Building integrated photovoltaic system

[1] http://environment.seoul.go.kr/archives/1490

(hereafter referred to as the "BIPV") at housing complexes[2] which are built by SH Corporation. And SH Corporation will expands the plan to the Metropolis of Seoul but there is investment barrier to installation Solar photovoltaic. As a result, SH Corporation develops this small scale programme of activity that is "SH Corporation Solar photovoltaic housing complex programme in Republic of Korea (hereafter referred to as "the PoA")".

**General operation and implementing framework of PoA**

The programme is geographically located in the metropolis of Seoul. The PoA is a programme that installs solar PV and/or BIPV that utilize incoming solar radiation for the production of electrical energy that is used for households.

In other words, the PoA will include installation of Solar PV and/or BIPV at housing complex for households and total capacity of Solar PV and/or BIPV installed in each CPA does not exceed 5MW. The Solar PV and/or BIPV power plant will generate electricity utilizing solar energy which emits zero greenhouse gas (GHG) into the atmosphere and will be installed at housing complex that would mostly be built by SH Corporation. In the absence of the PoA, households are supplied the amount of electricity that would be generated by CPAs from the carbon intensive Korea Power Grid (hereafter referred to as "the grid").
Thus, the PoA will contribute to reducing GHG emission by using solar energy and supplying the generated electricity to households. Additionally, the PoA can reduce the burden of electricity charge for households.

SH Corporation (hereafter referred to as "the CME") will be responsible for all CPAs which is included in the PoA and would be CPA implementers. Therefore, the CME will determine whether CPAs meet all criteria and collect all data related to the CPA.

If solar PV is installed by the CME, the company will deal with maintenance requests and action for Solar PV and/or BIPV that have failure. If solar PV is installed by other parties, other parties will deal with all matter related to Solar PV and/or BIPV.

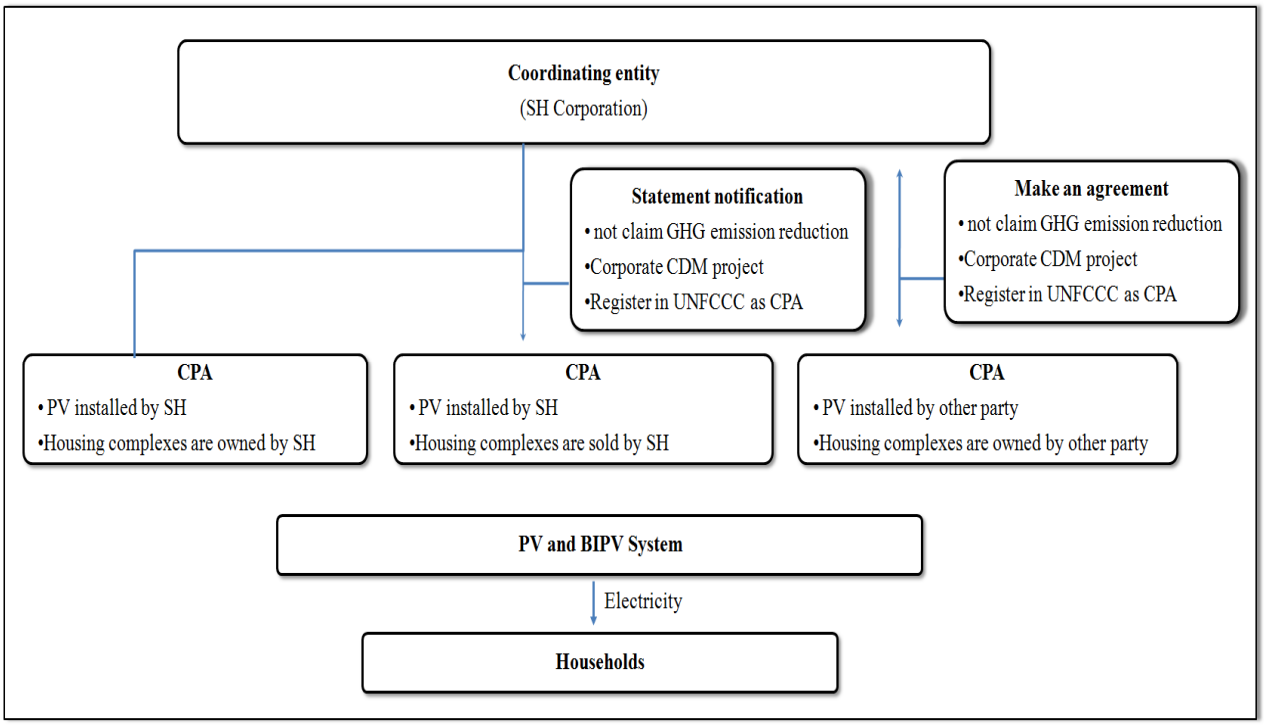
If the CPA implementer and the CME are not the same company/person, they make an agreement confirming that the GHG emission reductions will not be claimed by the end-user of electricity for using zero-emission energy source.

[2] The housing complex comprises housing complex and apartment complex.

If Solar PV and/or BIPV are installed in housing complexes by the CME and the housing complexes are sold, the CME notifies following information by statement notification for apartment distribution before the user(s) purchase an apartment or house.

- PV and/or BIPV installed in the housing complexes are registered in UNFCCC as CPA under the PoA.
- The end-user of electricity for using zero-emission energy source is notified that the GHG emission reductions will not be claimed

The process mentioned above is schematized as follows:




**<Figure A.1> Operating and implementing framework of the PoA**

**Policy/measure or stated goal of the PoA**

The objective of the PoA is as follows:

- Take Aggressive action for climate change by installing solar energy system at housing complexes
- Achieve the Metropolis of Seoul's goal that the Metropolis of Seoul becomes eco-friendly city by 2030
- Reduce electricity based on coal or other carbon-intensive fossil
- Contribute to growing and strengthening the solar industry in Republic of Korea

**Confirmation that the proposed PoA is a voluntary action by the coordinating/managing entity**

The PoA is a scheme developed by the CME to introduce Solar PV and/or BIPV into housing complex. In Korea, there is a law related to introduce renewable energy in public buildings. But the law does not apply to housing complexes including an apartment house. The CME voluntarily developed the PoA to support achieving the Metropolis of Seoul's goal.

Therefore, the PoA is a voluntary action, not required by law, undertaken by the CME.

## A.3. Coordinating/managing entity and participants of SSC-POA:

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| Name of Party involved(indicates a host party) | Private and/or public entity(ies) project participants(as applicable) | Kindly indicate if the Party involved wishes to be considered as project participant(Yes/No) |
|---|---|---|
| Republic of Korea(host) | - Public entity : SH Corporation<br>-private entity : RCC Co., Ltd | No |

## A.4. Technical description of the small-scale programme of activities:

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### A.4.1. Location of the programme of activities:

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The metropolis of Seoul

#### A.4.1.1. Host Party(ies):

>>

Republic of Korea

### A.4.1.2. Physical/ Geographical boundary:

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All CPAs associated with the PoA will be implemented within the geographical boundary of the metropolis of Seoul.

CPAs will be implemented in the Metropolis of Seoul because CPAs will be developed by the CME that only builds housing complex in the Metropolis of Seoul. But other companies can participate in the PoA if they meet all criteria specified in A4.2.2.

Therefore, the boundary is within the geographical boundary of the metropolis of Seoul.


**<Figure A.2> Geographical boundary of PoA**

### A.4.2. Description of a typical small-scale CDM programme activity (CPA):

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A typical small-scale CPA takes place in the boundary of the metropolis of Seoul. (See Figure A.2)

Each of CPA will install solar PV and/or BIPV system, which is not connected to the grid, at housing complex where there was no solar electrical system operating prior to the implementation of the activity. (Greenfield installation)

Total capacity of a CPA is limited to be 5MW of installed capacity and each independent subsystem/measures in a CPA is smaller or equal to 1,500 kW installed capacity. Solar PV (module) shall obtain a certification from an officially approved institute. And BIPV (module) shall obtain a certification of test from an officially approved institute to confirm the output. The electricity generated by a CPA will be supplied for household.

Therefore, in the absence of a CPA, user(s) will be supplied the amount of electricity that would be generated by the project from the grid.

**A.4.2.1. Technology or measures to be employed by the SSC-CPA:**

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Solar electrical technologies, one of the most promising renewable energy technologies, is a truly elegant means of producing electricity on site, directly from the sun, without concern for environmental harm.

Solar PV power plant consists of Solar cell module and inverter. DC electricity energy will be generated by the Solar cell modules in the sunshine, and then the DC electricity generated directly from the solar cell modules will be converted into AC electricity by the inverter. In the end, the AC electricity will be used for households.

Each SSC-CPA will install solar energy systems such as solar PV and BIPV system on collective housing. These systems will reduce to use electricity based on fossil fuels in collective housing.

**Photovoltaic** (**PV**) is a method of generating electrical power by converting solar radiation into direct current electricity using semiconductors. Photovoltaic power generation employs solar panels composed of a number of solar cells containing a photovoltaic material. Materials presently used for photovoltaic include monocrystalline silicon, polycrystalline silicon, amorphous silicon, cadmium telluride, and copper indium gallium selenide/sulfide.

**Building-integrated photovoltaic** (**BIPV**) are photovoltaic materials that are used to replace conventional building materials in parts of the building envelope such as the roof, skylights, or facades. They are increasingly being incorporated into the construction of new buildings as a principal or ancillary source of electrical power, although existing buildings may be retrofitted with BIPV modules as well. The advantage of integrated photovoltaic over more common non-integrated systems is that the initial cost can be offset by

reducing the amount spent on building materials and labor that would normally be used to construct the part of the building that the BIPV modules replace.

**<Figure A.3> Solar PV Power plant**

**A.4.2.2. Eligibility criteria for inclusion of a SSC-CPA in the PoA:**

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According to "Standard for demonstration of additionality, development of eligibility criteria and application of multiple methodologies for programme of activities (Version 01, Annex3, EB 65)", the eligibility criteria for inclusion of CPA in the PoA:

A SSC-CPA to be included in the PoA should result all assessment as "yes"

| No | Eligibility criteria | Self Assessment |
|---|---|---|
| **1** | **The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA;** | |
| 1.1 | A CPA is performed within the territory of the metropolis of Seoul. | □ Yes<br>□ No |
| 1.2 | A CPA is available identified its location from GPS location. | □ Yes<br>□ No |
| **2** | **Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo);** | |

| | | |
|---|---|---|
| 2.1 | A CPA is a new project which is not registered large scale CDM or SSC-CPA in the other PoA or other carbon off-set program. | □ Yes<br>□ No |
| 2.2 | There is unique identification of a PV and BIPV or end-user location. | □ Yes<br>□ No |
| **3** | **The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;** | |
| 3.1 | Is it possible to submit specification of technology/measure when the DOE validates or verify? | □ Yes<br>□ No |
| 3.2 | Solar PV (module) has a Certification from an officially approved institute. And BIPV (module) shall obtain a certification of test from an officially approved institute to confirm the output. | □ Yes<br>□ No |
| **4** | **Conditions to check the start date of the CPA through documentary evidence;** | |
| 4.1 | Confirmation that the start date of a CPA is not, or will not be, prior to the commencement of validation of the PoA. | □ Yes<br>□ No |
| **5** | **Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs** | |
| 5.1 | Does a CPA meet the applicability of AMS-I.F as described in PoA-DD section E.2? | □ Yes<br>□ No |
| 5.1.1 | A CPA comprises photovoltaic generation units that supply electricity to user(s). A CPA will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from the grid; | □ Yes<br>□ No |
| 5.1.2 | A CPA meets the situation described as follows:<br><br>Project displaces grid electricity consumption at the user end. | □ Yes<br>□ No |
| 5.1.3 | A CPAs Installs a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant). | □ Yes<br>□ No |
| 5.1.4 | If electricity and/or steam/heat produced by a CPA is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions. | □ Yes<br>□ No |

| | | |
|---|---|---|
| **6** | **The conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality** | |
| 6.1 | A CPA is a voluntary project which is not related to the mandatory policy or regulation by the Government of the Republic of Korea. | □ Yes<br>□ No |
| 6.2 | A CPA employs solar energy technology. And total capacity of a CPA is less than five megawatts. | □ Yes<br>□ No |
| 6.3 | Each independent subsystem/measures in the SSC-CPA is smaller or equal to 1,500 kW installed capacity. | □ Yes<br>□ No |
| 6.4 | A CPA is designed for distributed energy generation (not connected to a national or regional grid). | □ Yes<br>□ No |
| 6.5 | The end users of electricity produced by each independent activity are households, communities or SMEs. | □ Yes<br>□ No |
| **7** | **The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis** | |
| 7.1 | Confirmation that a CPA performs local stakeholder consultation before the inclusion of SSC-CPA. | □ Yes<br>□ No |
| 7.2 | Confirmation that a CPA does not need to performs the environmental impacts analysis according to the regulation of the Republic of Korea. | □ Yes<br>□ No |
| **8** | **Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance** | |
| 8.1 | A CPA uses own capitals or government subsidies that are not public funding. | □ Yes<br>□ No |
| **9** | **Where applicable, target group (e.g. domestic/commercial/industrial, rural/urban, grid-connected/off-grid) and distribution mechanisms (e.g. direct installation)** | |
| 9.1 | The target group of a CPA is households. | □ Yes<br>□ No |
| 9.2 | PV Power generation system is newly installed at housing complex and the generated electricity is supplied for households. | □ Yes<br>□ No |
| **10** | **Where applicable, the conditions related to sampling requirements for a PoA in accordance with the approved guidelines/standard from the Board pertaining to sampling and surveys** | |

| | | |
|---|---|---|
| 10.1 | A CPA measures all monitoring parameters without sampling or survey method. (Except the parameter for electricity imported from grid. It could be calculated in accordance with B.6.1 of the PoA) | □ Yes<br>□ No |
| **11** | **Where applicable, the conditions that ensure that every CPA in aggregate meets the small-scale or microscale threshold criteria and remains within those thresholds throughout the crediting period of the CPA** | |
| 11.1 | A CPA remains within the thresholds of Paragraph 2 of the "Guidelines for demonstrating additionality of microscale project activities" (Version 04) during the crediting period. | □ Yes<br>□ No |
| **12** | **Where applicable, the requirements for the debundling check, in case CPA belong to small-scale(SSC) or microscale project categories** | |
| 12.1 | Is a CPA confirmed to a single project which is not a de-bundled component of another large-scale CPA or CDM project activity as per the latest guidance given in CDM EB? | □ Yes<br>□ No |
| **13** | **Etc.** | |
| 13.1 | Confirmation that the crediting period of a CPA shall not exceed the end date of the PoA. | □ Yes<br>□ No |
| 13.2 | Can a CPA be checked the monitoring parameters and requirement of the PoA? | □ Yes<br>□ No |
| 13.3 | An agreement between a CPA implementer and CME is made by a written agreement. | □ Yes<br>□ No |

**A.4.3. Description of how the anthropogenic emissions of GHG by sources are reduced by a SSC-CPA below those that would have occurred in the absence of the registered PoA (assessment and demonstration of additionality):**

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The information presented here shall constitute the demonstration of additionality of the PoA as a whole.

**(i) The proposed PoA is a voluntary coordinated action;**

As mentioned in A.2, the CME voluntarily planed to install solar PV and/or BIPV at housing complexes to achieve the Metropolis of Seoul's goal, including solar energy for the generation of electricity and thereby reducing the reliance on electricity generation based on fossil-fuel.

In Korea, there is a law, Act on the promotion of the development, use and diffusion of new and renewable energy by Republic of Korea dated 9/03/2011(Act No.10445), imposes the introduction of renewable energy in public buildings. But the law does not apply to housing complexes including an apartment house.

Additionally, Participation in the PoA is also voluntary; the CME will give CPA implementers a choice whether to participate in the PoA or not.

Thus, the PoA is a voluntary coordinated action.

**(ii) If the PoA is implementing a voluntary coordinated action, it would not be implemented in the absence of the PoA;**

The additionality of SSC-CPAs is demonstrated using the "Guidelines for demonstrating additionality of microscale project activities" (Version 04), reported as Annex 26 to the EB 68. Paragraph 2 of the guideline reads as follows:

Project activities up to five megawatts that employ renewable energy technology are additional if any one of the conditions below is satisfied:

(c) The project activity is designed for distributed energy generation (not connected to a national or regional grid) with both conditions satisfied;

- Each of the independent subsystems/measures in the project activity is smaller than or equal to 1,500kW electrical installed capacity;
- End users of the subsystems or measures are households/communities/small and medium enterprises

(SMEs).

Each and every SSC-CPA that would be included into the PoA shall fit into the following conditions:

- A CPA employs solar energy technology;
- Total capacity of each CPA is smaller or equal to 5 MW;
- Each independent subsystems/measures in a CPA is smaller or equal to 1,500 kW installed capacity;
- A CPA is designed for distributed energy generation (not connected to a national or regional grid); and
- The end users of electricity produced by each independent activity are households, communities or SMEs.

Thus, All CPAs to be included into the PoA will be additional and would not be implemented in the absence of the PoA.

**(iii) If the PoA is implementing a mandatory policy/regulation, this would/is not enforced;**

In Korea, there is a law, Act on the promotion of the development, use and diffusion of new and renewable energy by Republic of Korea dated 9/03/2011(Act No.10445), imposes the introduction of renewable energy in public buildings. But the law does not apply to housing complexes including an apartment house. The PoA will lead to achieving the Metropolis of Seoul's goal.

**(iv) If mandatory a policy/regulation is enforced, the PoA will lead to a greater level of enforcement of the existing mandatory policy/regulation.**

In Korea, there is a law, Act on the promotion of the development, use and diffusion of new and renewable energy by Republic of Korea dated 9/03/2011(Act No.10445), imposes the introduction of renewable energy in public buildings. But the law does not apply to housing complexes including an apartment house.

## A.4.4. Operational, management and monitoring plan for the programme of activities (PoA):

### A.4.4.1. Operational and management plan:

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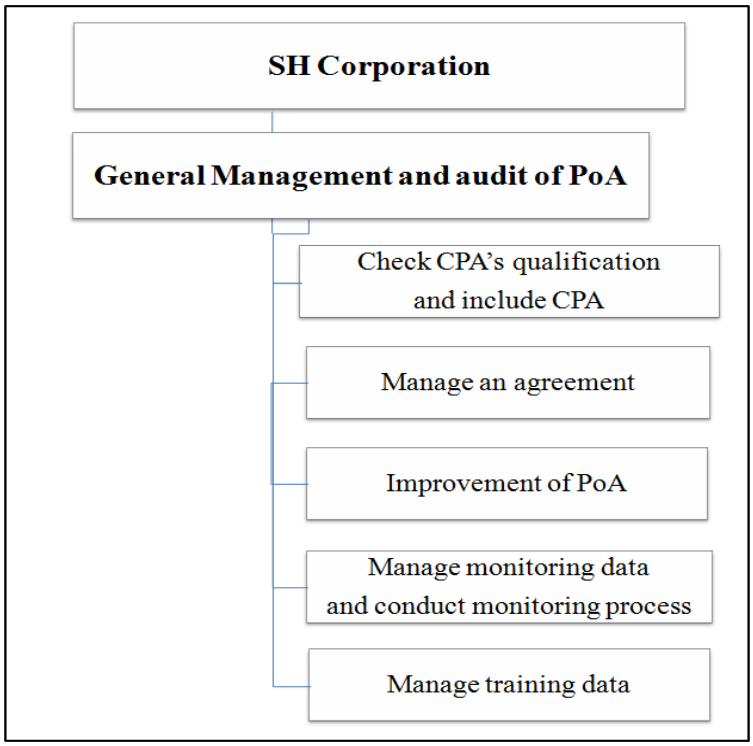
**The operational and management process of the PoA**

The CME has established the operational and management plan which includes the following:




**<Figure A.4> The roles of operational and management entity**

1. General management and audit of the PoA
   - General management for the PoA
   - Audit that all of activities under the PoA is implemented properly

2. Check CPA's Qualification and include a CPA
   - Review CPAs wishing to be included in the PoA in accordance with Eligibility Criteria as mentioned in PoA-DD (already registered either as a CDM project or as a CPA of another PoA, de-bundling check etc.)
   - Determine whether the CPA can be involved this PoA or not with consideration for all aspects of qualification

- Provide CPA implementers with information about the PoA; CPA implementers have their understanding of the program and make an agreement on participation in the program.
- Implement the procedure for the inclusion of a CPA
- Report the process and result to the person who in charge of the general management

3. Manage an agreement
   - Make an agreement with other party that wish to be involved in the PoA
   - Manage the form of agreement
   - Communicate all CPA implementers
   - Report the process and result to the person who in charge of the general management

4. Improvement of PoA
   - Place an advertisement in local and national media in order to promote the Programme implemented by the CME
   - Update the PoA as per guidelines of programme CDM
   - Keep revising "the guideline on management of the PoA" as per changes related to management of the PoA
   - Report the process and result to the person who in charge of the general management

5. Manage monitoring data and conduct monitoring process
   - Manage and record monitoring data from each CPA
   - Implement the procedure for issuing CERs
   - Monthly report the recorded data to the person who in charge of the general management

6. Manage the data related to training
   - Manage training data
   - Report the process and result to the person who in charge of the general management

**A record keeping system for each CPA under the PoA**

The CME will build a database (hereafter referred as "the DB") to manage information of CPA. CPA implementers monthly send the data about electricity generated and consumed by CPAs to the CME by e-mail. And a person responsible for management of monitoring data records the data transferred from CPA implementers in the DB along with the other data related to validation and verification.

The DB includes following:

- Name of the CPA(unique identification e.g CPA1)
- Implementing entity of the CPA
- Installed capacity of the CPA
- Location of the CPA
- The amount of electricity generated by the CPA(monthly, yearly)
- The date of calibration for meters
- Other data to prove the CPA (training, un-normal situation, approval, start work, etc.)

**A system/procedure to avoid double accounting**

In order to avoid double accounting and to ensure that the implementing entity of a CPA is aware and has agreed that their activity is being involved in the PoA, the implementing entity of a CPA shall be confirmed of the following by a public announcement or enter into a contractual arrangement with the CME.

1. The CPA has not been and will not be registered as a single CDM project activity or as a CPA under another PoA.
2. The implementing entity of CPA is aware that the CPA will be subscribed to the PoA.
3. The implementing entity of CPA cedes its rights to claim and own emission reductions under the Clean Development Mechanism of the UNFCCC to the managing entity of the present PoA

Additionally, The CME will check whether a CPA has already been registered either as a CDM project activity or as a CPA of another PoA. The process is as follows:

1. The CME interviews CPA implementers to check whether a CPA has already been registered either as a CDM project activity or as a CPA of another PoA.
2. The CME checks UNFCCC web site to confirm that a CPA has already been registered either as a CDM project activity or as a CPA of another PoA.

**The SSC-CPA included in the PoA is not a de-bundled component of another CPA or CDM project activity**

This information shall also be utilized by the validating DOE to determine that a CPA is not a de-bundled component of another CDM programme activity (CPA) or CDM project activity.

According to the CDM's regulations of de-bundling under PoA, a CPA of a PoA is a de-bundled component of a large-scale activity if another CDM activity within 1 km has the same activity implementer or managing entity of the PoA.

The Registration and the progress of CDM project activity should be explained in the PDD of each CPA in order to prove that the CPAs of this programme are not de-bundled components of another CDM project activity.

**The provisions to ensure that those operating the CPA are aware of and have agreed that their activity is being subscribed to the PoA**

As mentioned above, the stakeholders who participate in the implementation of SSC-CPAs will sign the agreement indicating their understanding of the program, their role in the program and their willingness to participate.

**A.4.4.2. Monitoring plan:**

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The monitoring will be carried for each individual CPA. For each CPA, the amount of generated and used electricity from PV system will be monitored respectively. The Monitoring plan and collected data will be submitted to the CME which will store the data in an electronic database.
Verification will occur either separately for each CPA or in groups.
In any case, data shall be verified per CPA and the verification status of each CPA will be recorded by the CME in the database.

**A.4.5. Public funding of the programme of activities (PoA):**

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The PoA will not receive any public funds resulting from official development assistance from Parties included in Annex I to the Convention.

## SECTION B. Duration of the programme of activities (PoA)

**B.1. Starting date of the programme of activities (PoA):**

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01/04/2013(The expected date of contract for purchasing the equipment in Neagok7 apartment complex)

**B.2. Length of the programme of activities (PoA):**

>>

28year

## SECTION C. Environmental Analysis

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**C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:**

1. Environmental Analysis is done at PoA level ☑
2. Environmental Analysis is done at SSC-CPA level ☐

**C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:**

>>

The negative environmental impacts of small-scale solar photovoltaic electrical system are not considered significant. Because the PoA is to install small-scale solar PV and/or BIPV at housing complexes, damages to forest on sites are also not considered. The positive impacts include:

- Decreased air pollution linked to the use of fossil fuels
- Displacement of fossil fuels and GHG emission reductions
- Decrease dependency on fossil fuels.

**C.3. Please state whether in accordance with the host Party laws/regulations, an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA),:**

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According to the "Environmental Impact Assessment Act", one of the laws in Korea, if the design capacity of the any power plant using solar, wind or fuel cell as a power source is over than 100,000kW, the environmental impacts induced by such a plant have to be estimated.
However, total capacity of each CPA under the PoA is limited to 5MW. Thus, all CPAs under the PoA are not required to assess environmental impact.

## SECTION D. Stakeholders' comments

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**D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:**

1. Local stakeholder consultation is done at PoA level ☐
2. Local stakeholder consultation is done at SSC-CPA level ☑

Note: If local stakeholder comments are invited at the PoA level, include information on how comments by local stakeholders were invited, a summary of the comments received and how due account was taken of any comments received, as applicable.

**D.2. Brief description how comments by local stakeholders have been invited and compiled:**

>>

Not Applicable

**D.3. Summary of the comments received:**

>>

Not Applicable

**D.4. Report on how due account was taken of any comments received:**

>>

Not Applicable

## SECTION E. Application of a baseline and monitoring methodology

This section shall demonstrate the application of the baseline and monitoring methodology to a typical SSC-CPA. The information defines the PoA specific elements that shall be included in preparing the PoA specific form used to define and include a SSC-CPA in this PoA (PoA specific CDM-SSC-CPA-DD).

**E.1. Title and reference of the approved SSC baseline and monitoring methodology applied to a SSC-CPA included in the PoA:**

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The approved SSC simplified baseline and monitoring methodology, AMS-I.F version 2 *Renewable electricity generation for captive use and mini-grid* approved at EB 61, is applied to each SSC-CPA included in the PoA.

NOTE: The approved SSC baseline and monitoring methodology should be approved for use in a PoA by the Board.

**E.2. Justification of the choice of the methodology and why it is applicable to a SSC-CPA:**

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According to the approved SSC Methodology AMS-I.F (version 2), applicability of the methodology is as follows.

<table>
<tr><th>No.</th><th>Requirements</th><th>Fulfilment of conditions</th></tr>
<tr><td>1</td><td>The methodology comprises renewable energy generation units, such as photovoltaic, hydro, tidal/wave, wind, geothermal and renewable biomass that supply electricity to user(s). The project activity will displace electricity from an electricity distribution system that is or would have been supplied by at least one fossil fuel fired generating unit i.e. in the absence of the project activity, the users would have been supplied electricity from one or more sources listed below:<br>(a) A national or a regional grid;<br>(b) Fossil fuel fired captive power plant<br>(c) A carbon intensive mini-grid.</td><td>Applicable:<br>CPAs under the PoA is applied to solar PV and/or BIPV. And in the absence of the project activity, the users would have been supplied electricity from the notional gird(a). Thus, all CPAs applicable to the condition 1.</td></tr>
<tr><td>2</td><td>For the purpose of this methodology, a mini-grid is defined as small-scale power system with a total capacity not exceeding 15 MW (i.e. the sum of installed capacities of all generators connected to the mini-grid is equal to or less than 15 MW) which is not connected to a national or a regional grid.</td><td>Not relevant:<br>CPAs do not involve mini-gird. Thus, the condition2 is not applicable.</td></tr>
<tr><td>3</td><td>Illustration of respective situations under which each of the methodology (AMS-I.D, AMS-I.F and AMS-I.A) is as follows.
<table>
<tr><th>No.</th><th>Project type</th><th>AMS-I.A</th><th>AMS-I.D</th><th>AMS-I.F</th></tr>
<tr><td>1</td><td>Project supplies electricity to a national/regional grid</td><td></td><td>O</td><td></td></tr>
<tr><td>2</td><td>Project displaces grid electricity consumption (e.g. grid import) and/or captive fossil fuel electricity generation at the user end (excess electricity may be supplied to a grid)</td><td></td><td></td><td>O</td></tr>
<tr><td>3</td><td>Project supplies electricity to an identified consumer facility via national/regional grid (through a contractual arrangement such as wheeling)</td><td></td><td>O</td><td></td></tr>
<tr><td>4</td><td>Project supplies electricity to a mini grid system where in the baseline all generators use exclusively fuel oil and/or diesel fuel</td><td></td><td></td><td>O</td></tr>
<tr><td>5</td><td>Project supplies electricity to household users (included in the project boundary) located in off grid areas</td><td>O</td><td></td><td></td></tr>
</table></td><td>Applicable:<br>CPAs displace grid electricity consumption (AMS-I.F) and do not supply electricity to a national grid (AMS-I.D) or household users located in off grid areas (AMS-I.A). As a result, each CPA under the programme shall satisfy AMS-I.F</td></tr>
</table>

| | | |
|---|---|---|
| 4 | Hydro power plants with reservoirs that satisfy at least one of the following conditions are eligible to apply this methodology:<br>· The project activity is implemented in an existing reservoir with no change in the volume of reservoir;<br>· The project activity is implemented in an existing reservoir, where the volume of reservoir is increased and the power density of the project activity, as per definitions given in the project emissions section, is greater than 4 W/m2;<br>· The project activity results in new reservoirs and the power density of the power plant, as per definitions given in the project emissions section, is greater than 4 W/m2. | **Not relevant:**<br>CPAs do not involve hydro power plant.<br>Thus, the condition4 is not applicable. |
| 5 | For biomass power plants, no other biomass other than renewable biomass is to be used in the project plant. | **Not relevant:**<br>CPAs do not involve biomass power plants.<br>Thus, the condition5 is not applicable. |
| 6 | This methodology is applicable for project activities that: (a) Install a new power plant at a site where there was no renewable energy power plant operating prior to the implementation of the project activity (Greenfield plant); (b) Involve a capacity addition, (c) Involve a retrofits of (an) existing plant(s); or (d) Involve a replacement of (an) existing plant(s). | **Applicable:**<br>CPAs under the PoA install a new power plant at a site where there was no solar energy power plant operating prior to the implementation of the project activity (Greenfield plant). Thus, all CPAs applicable to the condition 6. |
| 7 | In the case of project activities that involve the capacity addition of renewable energy generation units at an existing renewable power generation facility, the added capacity of the units added by the project should be lower than 15 MW and should be physically distinct from the existing units. | **Not relevant:**<br>CPAs do not involve the capacity addition of Solar PV and/or BIPV.<br>Thus, the condition7 is not applicable. |

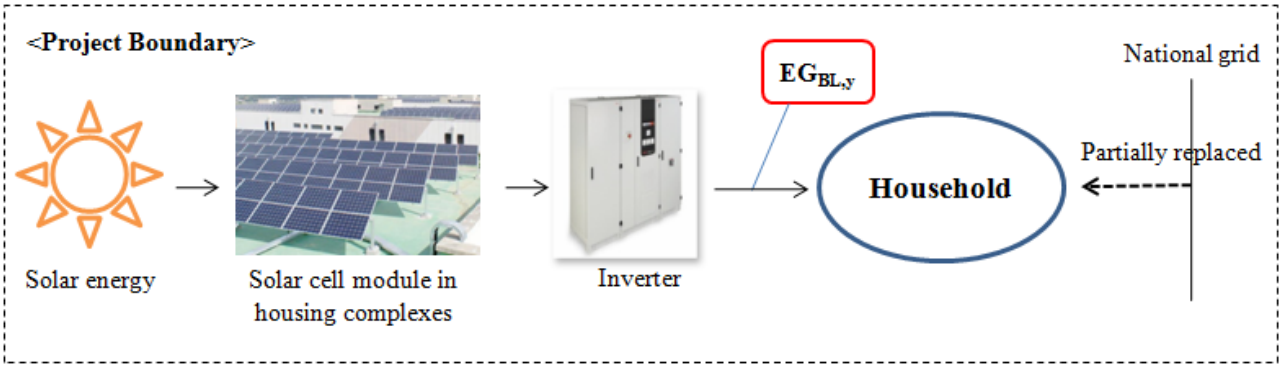
| | | |
|---|---|---|
| 8 | In the case of retrofit or replacement, to qualify as a small-scale project, the total output of the retrofitted or replacement unit shall not exceed the limit of 15MW. | **Not relevant:**<br>CPAs do not involve retrofit or replacement of Solar PV and/or BIPV. Thus, the condition8 is not applicable. |
| 9 | If the unit added has both renewable and non renewable components (e.g. a wind/diesel unit), the eligibility limit of 15 MW for a small-scale CDM project activity applies only to the renewable component. If the unit added co-fires fossil fuel, the capacity of the entire unit shall not exceed the limit of 15 MW. | **Not relevant:**<br>CPAs under the PoA is only applied to solar PV and/or BIPV. Thus, the condition9 is not applicable. |
| 10 | Combined heat and power (co-generation) systems are not eligible under this category. | **Not relevant:**<br>CPAs do not involve Combined heat and power (co-generation) systems. Thus, the condition10 is not applicable. |
| 11 | If electricity and/or steam/heat produced by the project activity is delivered to a third party i.e. another facility or facilities within the project boundary, a contract between the supplier and consumer(s) of the energy will have to be entered that ensures that there is no double counting of emission reductions. | **Applicable:**<br>Electricity produced by CPAs will be delivered to households.<br>Thus, the implementing entity of a CPA shall notify households about the CPA by the notification before the households move into the housing complex.<br><br>Thus, all CPAs applicable to the condition 11. |

## E.3. Description of the sources and gases included in the SSC-CPA boundary

>>

The spatial extent of the project boundary includes industrial, commercial facilities consuming energy generated by the system. In the case of electricity generated and supplied to distributed users (e.g. residential users), the project boundary may be confined to physical, geographical site of solar energy generating units. The boundary also extends to the project power plant and all power plants connected physically to the electricity system that the CDM project power plant is connected to.

| Source | | Gas | Included? | Justification |
|---|---|---|---|---|
| Baseline | $CO_2$ emissions from electricity generation in fossil fuel fired power plants that are displaced due to the project activity | $CO_2$ | Included | Major source of emissions in the baseline |
| | | $CH_4$ | Excluded | Excluded for simplification. This is conservative |
| | | $N_2O$ | Excluded | Excluded for simplification. This is conservative |
| Project Activity | Electricity generation from solar energy sources | $CO_2$ | Excluded | Power generation utilizing solar energy results in zero emission |
| | | $CH_4$ | Excluded | Power generation utilizing solar energy results in zero emission |
| | | $N_2O$ | Excluded | Power generation utilizing solar energy results in zero emission |




**<Figure E.1> Project boundary of each CPA**

**E.4. Description of how the baseline scenario is identified and description of the identified baseline scenario:**

>>

The prevalent source of electrical energy supply for households in the metropolis of Seoul is from a national grid which is predominately fossil-fuelled. Therefore, in the absence of the PoA, user(s) that would be supplied electricity by the PoA is supplied the amount of electricity generated by the project from the grid.

Thus, baseline emissions are the product of amount electricity displaced with the electricity produced by the solar energy generating unit and an emission factor.

$BE_y = EG_{BL,y} * EF_{CO2,y}$

Where:

$BE_y$ = Baseline emissions in year $y$ (t $CO_2$)

$EG_{BL,y}$ = Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year $y$ (MWh)

$EF_{CO2,y}$ = Emission factor ($tCO_2$/MWh)

- Emission factor of a grid shall be calculated as per the procedures provided in AMS-I.D;

$EG_{BL,y} = C * H * U$

Where:

C = Capacity of PV and/or BIPV system (MW)

H = Hours in a year (hr)

U = Coefficient of utilization for PV and/or BIPV system (%)

**E.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the SSC-CPA being included as registered PoA (assessment and demonstration of additionality of SSC-CPA): >>**

**E.5.1. Assessment and demonstration of additionality for a typical SSC-CPA:**

>>

CPAs under the PoA should comply with Paragraph 2 of the Guidelines for demonstrating additionality of microscale project activities (Version 04), reported as Annex 26 to the EB 68.

The guideline reads as follows:

Project activities up to five megawatts that employ renewable energy technology are additional if any one of the conditions below is satisfied:

(c) The project activity is designed for distributed energy generation (not connected to a national or regional grid) with both conditions satisfied;

- Each of the independent subsystems/measures in the project activity is smaller than or equal to 1,500kW electrical installed capacity;
- End users of the subsystems or measures are households/communities/small and medium enterprises (SMEs).

Each and every SSC-CPA that is included into the PoA shall fit into the following conditions:

- A CPA employs solar energy technology;
- Total capacity of each CPA is smaller or equal to 5MW installed capacity;
- Each independent subsystems/measures in a SSC-CPA is smaller or equal to 1,500 kW installed capacity;
- A CPA is designed for distributed energy generation (not connected to a national or regional grid); and
- The end users of electricity produced by each independent activity are households, communities or

SMEs.

All CPAs to be included into the PoA will comply with the guideline. Thus, All CPAs under the PoA will be additional.

### E.5.2. Key criteria and data for assessing additionality of a SSC-CPA:

>>

Key criteria and data for assessing additionality of a SSC-CPA are as follows:

- A CPA employs solar energy technology;
- Total capacity of each CPA is smaller or equal to 5MW installed capacity;
- Each independent subsystems/measures in a CPA is smaller or equal to 1,500 kW installed capacity;
- A CPA is designed for distributed energy generation (not connected to a national or regional grid); and
- The end users of electricity produced by each independent activity are households, communities or SMEs.

A CPA is additional since all criteria are satisfied.

## E.6. Estimation of Emission reductions of a CPA:

### E.6.1. Explanation of methodological choices, provided in the approved baseline and monitoring methodology applied, selected for a typical SSC-CPA:

>>

A CPA is applicable to AMS-I.F (Renewable electricity generation for captive use and mini-grid)(version 2) as described in E.2.

The PoA replaces existing energy based on fossil fuel with solar energy. Therefore, in the absence of the project, user(s) that would be supplied electricity by the project is supplied the amount of electricity generated by the project from the grid.

| Type | Producing energy | Replacing energy source | Energy source for operation |
|---|---|---|---|
| Photovoltaic | Electricity | National grid electricity | None |

**E.6.2. Equations, including fixed parametric values, to be used for calculation of emission reductions of a SSC-CPA:**

>>

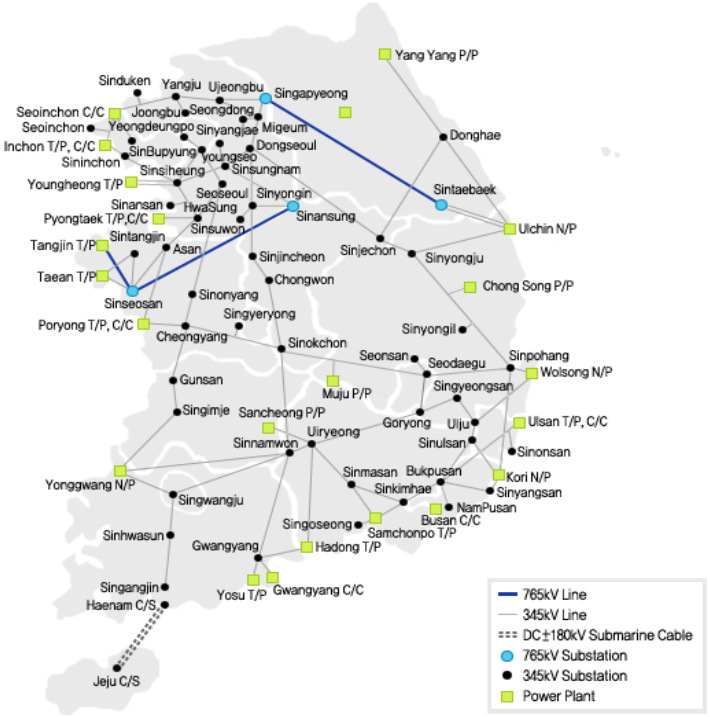
**1. Emission factor**

According to AMS-I.F (version 2), baseline emission factor is calculated by "Tool to calculate the emission factor for an electricity system (ver. 02.2.1). Baseline emission factor is calculated by combined margin (CM), which is weighted average of operating margin (OM) and build margin (BM).
Baseline emissions will be calculated using the following 6 steps.

STEP 1. Identify the relevant electric power system.
STEP 2. Choose whether to include off-grid power plants in the project electricity system.
STEP 3. Select a method to determine the operating margin (OM).
STEP 4. Calculate the operating margin emission factor according to the selected method.
STEP 5. Calculate the build margin emission factor.
STEP 6. Calculate the combined margin (CM) emission factor.

**STEP 1. Identify the relevant electric power system**

For determining the electricity emission factors, identify the relevant project electricity system. Similarly, identify any connected electricity system.
It is clear that the project electric power system is connected with the whole Korea national grid system. Because all power plants are physically connected to each other through transmission and distribution lines constituting the grid. Therefore the Korea national grid has been chosen as relevant electricity power system for purpose of determining the electricity emission factors.




**<Figure E.2> Electric Power Grid Nationwide in Republic of Korea[3]**

**Step 2. Choose whether to include off-grid power plants in the project electricity system (optional).**

Project participants may choose between the following two options to calculate the operating margin and build margin emission factor:

Option I : Only grid power plants are included in the calculation.

Option II : Both grid power plants and off-grid power plants are included in the calculation.

For the PoA, Option I is chosen; there are no off-grid power plants included in the calculation.

**STEP 3. Select a method to determine the Operating Margin (OM)**

The calculation of the Operating Margin emission factor ($EF_{grid,OM,y}$) is based on one of the four following methods, which are described under Step 4:

(a) Simple OM, or

(b) Simple adjusted OM, or

(c) Dispatch Data Analysis OM, or

(d) Average OM.

Among the above options, the simple OM method can be used where low cost/must run resources constitute less than 50% of total grid generation average of the five most recent years.

For the simple OM, the simple adjusted OM and the average OM, the emissions factor can be calculated using either of the two following data vintages:

- *Ex ante* option: If the *ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use 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. For off-grid power plants, use a single calendar year within the five 5 most recent calendar years prior to the time of submission of the CDM-PDD for validation.
- *Ex post* option: If the *ex post* option is chosen, the emission factor is determined for 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.

The CME chooses Ex ante option. Thus, the emission factor is determined once at the validation stage and no monitoring and recalculation of the emissions factor during the crediting period is required. However the ex-ante value will be revised at the point of the renewal of crediting period of the PoA.

During the 5 year period (2006 ~ 2010), the average low-cost/must run generation holds 39.43% of total KPX grid generation. (See Annex 3)[4]. Thus the Simple OM method is employed in order to calculate the OM emission factor. The Simple OM emission factor ($EF_{OM,simple,y}$) is calculated using a 3-year generation-weighted average(ex-ante) of all generating power plants serving the system, based on the most recent data available at the time of submission of the PDD.

[3] Source: http://www.kpx.or.kr/, 2009

**STEP4. Calculate the operating margin emission factor according to the selected method.**

According to the "Tool to calculate the emission factor for an electricity system (Version 02.2.1)", the Simple OM emission factor is calculated as the generation-weighted average emissions per electricity unit ($tCO_2$/MWh) of all generating power plants serving the system, not including low-operating cost and must-run power plants/units.

The simple OM may be calculated by one of the following two options:

.

- Based on the net electricity generation and a $CO_2$ emission factor of each power unit (Option A), or
- Based on the total net electricity generation of all power plants serving the system and the fuel types and total fuel consumption of the project electricity system. (Option B),

As the data on fuel consumption and net electricity generation of each power plant is available in Korea, the PoA can employ Option A. Where Option A is used, the simple OM emission factor is calculated as follows:

$$EF_{grid,OMsimple,y} = \frac{\sum_m EG_{m,y} \cdot EF_{EL,m,y}}{\sum_m EG_{m,y}}$$

**$EF_{grid,OMsimple,y}$** = Simple operating 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** = All power units serving the grid in year *y* except low-cost / must-run power units

**y** = The relevant year as per the data vintage chosen in Step 3

***Determination of $EF_{EL,m,y}$***

The emission factor of each power unit m should be determined as follows:

- Option A1. : If for a power unit m data on fuel consumption and electricity generation is available.
- Option A2. : If for a power unit *m* only data on electricity generation and the fuel types used is

[4] As the anthracite was used as must-run resource, it was excluded from the set of plants for calculating Operating margin. And the bituminous coal was included in OM calculation.

available, the emission factor should be determined based on the $CO_2$ emission factor of the fuel type used and the efficiency of the power unit

- Option A3. : If for a power unit *m* only data on electricity generation is available, an emission factor of 0 $tCO_2/MWh$ can be assumed as a simple and conservative approach.

As the data on fuel consumption and net electricity generation is available in Korea, the PoA can employ Option A1.

The emission factor of each power unit *m* should be determined as follows:

$$EF_{EL,m,y} = \frac{\sum_i FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}}{EG_{m,y}}$$

Where:

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

**$FC_{i,m,y}$** = Amount of fossil fuel type i consumed by power plant m in year y(mass or volume unit)

**$NCV_{i,y}$** = Net calorific value 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 quantity of electricity generated and delivered to the grid by power plant m in year y (MWh)

**m** = All power plants serving the grid in year y except low-cost / must-run power units

**i** = All fossil fuel types combusted in power plant m in year y

**y** = The relevant year as per the data vintage chosen in Step 3

For the PoA, $NCV_{i,y}$ provided by official data source of Korea is used.
IPCC default value is used as $CO_2$ emission factor of fuel. Simple OM factor during 3 years (2008~ 2010) is 0.6933 $tCO_2/MWh$ and the ex-ante value will be revised at the point of the renewal of crediting period of the PoA.
Detailed baseline information used in the calculation is presented in Annex 3.

**STEP 5. Calculate the build margin emission factor**

According to "Tool to calculate the emission factor for an electricity system", in terms of the vintage of data, project participants can choose between one of the two options (Option 1 and Option 2).

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.

And here, option 1 is chosen for the PoA. As Option 1 is chosen to calculate BM emission factor, the emission factor will not be updated annually. Instead, it was calculated ex-ante based on the most recent information for the crediting period and will be fixed and used during the crediting period. However, the ex-ante value will be revised at the point of the renewal of crediting period of the PoA.

According to "Tool to calculate the emission factor for an electricity system (Version 02.2.1)", the sample group of power unit *m* used to calculate the build margin should be determined as per the following procedure, consistent with the data vintage selected above:

(a) Identify the set of five power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently ($SET_{5\text{-}units}$) and determine their annual electricity generation ($AEG_{SET\text{-}5\text{-}units}$, in MWh);

(b) Determine the annual electricity generation of the project electricity system, excluding power units registered as CDM project activities ($AEG_{total}$, in MWh). Identify the set of power units, excluding power units registered as CDM project activities, that started to supply electricity to the grid most recently and that comprise 20% of $AEG_{total}$ (if 20% falls on part of the generation of a unit, the generation of that unit is fully included in the calculation) ($SET_{\geq 20\%}$) and determine their annual electricity generation ($AEG_{SET\text{-}\geq 20\%}$, in MWh);

(c) From $SET_{5\text{-units}}$ and $SET_{\geq 20\%}$ select the set of power units that comprises the larger annual electricity generation ($SET_{sample}$);

Identify the date when the power units in $SET_{sample}$ started to supply electricity to the grid. If none of the power units in $SET_{sample}$ started to supply electricity to the grid more than 10 years ago, then use $SET_{sample}$ to calculate the build margin.

As the annual generation of "the power plants capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently" was 92,307,706 MWh on 2010 and the annual generation of "the five power plants that have been built most recently" in 2010 was 1,281,700 MWh. Therefore, the former is a larger figure than the latter; $AEG_{SET\geq 20\%}$ is selected as $SET_{sample}$.

Additionally, none of the power units in $SET_{sample}$ started to supply electricity to the grid more than 10 years ago. Therefore, $SET_{sample}$ is used to calculate the build margin.
The detailed data used in the calculation are presented in Annex 3.

According to the "Tool to calculate the emission factors for electricity system (Version 02.2.1)", the build margin emissions factor is the generation-weighted average emission factor (t $CO_2$/MWh) of all power units *m* during the most recent year y for which electricity generation data is available, calculate as follows:

$$EF_{grid,BM,y} = \frac{\sum_{m} EG_{m,y} \times EF_{EL,m,y}}{\sum_{m} EG_{m,y}}$$

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 electricity generation data is available

The $CO_2$ emission factor of each power unit m ($EF_{EL,m,y}$) should be determined as per the guidance in step 4 (a)

for the simple OM, using option A1, A2, A3, using for y the most recent historical year for which power generation data is available, and using for m the power units included in the build margin.

(For the PoA step 4 (a) Simple OM, option A1 was chosen)

For BM emission factor, $EF_{EL,m,y}$ was calculated by multiplying $FC_{i,m,y}$ by $NCV_{i,y}$* $EF_{CO2,i,y}$ and divide it by power generation of each plant.

And then $EF_{EL,m,y}$ was multiplied by power generation of each plant and finally it was divided by total power generation.(2006 IPCC Guidelines on National GHG Inventories Table 1.2, Table 1.4)

BM emission factor is 0.6357 $tCO_2e$/ MWh. And further information on the calculation for the BM emission factor is shown in Annex 3.

**STEP 6. Calculate the combined emission factor**

According to the tool to calculate the emission factor for electricity system (Version 02.2.1), the combined emissions factor is calculated as follows:

$EF_{grid,CM,y} = EF_{grid,OM,y} * W_{OM} + EF_{grid,BM,y} * W_{BM}$

Where:

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

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

$W_{OM}$ = Weighting of operating margin emissions factor (75% for PV power project)

$W_{BM}$ = Weighting of build margin emissions factor (25% for PV power project)

$EF_{grid,CM,y}$ = 0.6933 * 0.75 + 0.6357 * 0.25 = 0.6789 ($tCO_2e$/MWh)

**2. Baseline emission**

$BE_y = EG_{BL,y} * EF_{CO2,y}$

Where:

$BE_y$ = Baseline emissions in year $y$ (t $CO_2$)

$EG_{BL,y}$ = Quantity of net electricity displaced as a result of the implementation of the CDM project activity in year $y$ (MWh)

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$EF_{CO2,y}$ = Emission factor ($tCO_2/MWh$)

- Emission factor of a grid shall be calculated as per the procedures provided in AMS-I.D;

Ex-ante calculation for $\boldsymbol{EG_{BL,y}}$ is calculated as below:

$EG_{BL,y} = C * H * U$

Where:

C = Capacity of PV and/or BIPV system (MW)
H = Hours in a year (hr)
U = Coefficient of utilization for PV and/or BIPV system (%)

**3. Project emissions**

For most renewable energy project activities, $PE_y = 0$. CPAs under the PoA will install Solar PV and/or BIPV and no use fossil fuel. Thus, project emission is 0. However, CPAs consume electricity to operate the facility. It will be deducted from gross electricity generation.

**4. Leakage**

If the energy generating equipment is transferred from another activity, leakage is to be considered. However, CPAs under the PoA does not use equipments transferred from another activity. Thus, leakage is not considered.

**5. Emission Reductions**

$ER_y = BE_y - PE_y - LE_y$

Where:

$ER_y$ = Emission reductions in year y ($t\ CO_2e/y$)

$BE_y$ = Baseline emissions in year y (t $CO_2$/y)

$PE_y$ = Project emissions in year y (t $CO_2$/y)

$LE_y$ = Leakage emissions in year y (t $CO_2$/y)

**E.6.3. Data and parameters that are to be reported in CDM-SSC-CPA-DD form:**

| **Data / Parameter:** | **$EF_{CO2,y}$** |
|---|---|
| Data unit: | $tCO_2$/MWh |
| Description: | $CO_2$ emissions factor for the project electricity system in year y |
| Source of data used: | Calculated |
| Value applied: | 0.6789 $tCO_2e$/MWh |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This value was calculated according to "Tool to calculate the emission factor for an electricity system (version 02.2.1)." The applied value was calculated by referring Statistics of Electric Power in Korea (2009, 2010, 2011) (KEPCO) and Status of Generation facility (2011) (Korea Power Exchange). |
| Any comment: | - The ex-ante grid emission factor will be revised at the point of the renewal of crediting period of the PoA.<br>- For details about the calculation method, refer to Annex 3. |

| **Data / Parameter:** | $EF_{grid,OM,y}$ |
|---|---|
| Data unit: | $tCO_2$/MWh |
| Description: | Operating Margin $CO_2$ emissions factor for the project electricity system in year y |
| Source of data used: | Calculated |
| Value applied: | 0.6933 $tCO_2$/MWh |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This value was calculated according to "Tool to calculate the emission factor for an electricity system (version 02.2.1)." The applied value was calculated by referring Statistics of Electric Power in Korea (2009, 2010, 2011) (KEPCO) and Status of Generation facility (2011) (Korea Power Exchange). |
| Any comment: | - The ex-ante value will be revised at the point of the renewal of crediting period of the PoA.<br>- For details about the calculation method, refer to Annex 3. |

| **Data / Parameter:** | $EF_{grid,BM,y}$ |
|---|---|
| Data unit: | $tCO_2/MWh$ |
| Description: | Build Margin $CO_2$ emissions factor for the project electricity system in year y |
| Source of data used: | Calculated |
| Value applied: | 0.6357 $tCO_2e/MWh$ |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | This value was calculated according to "Tool to calculate the emission factor for an electricity system (version 02.2.1)." The applied value was calculated by referring Statistics of Electric Power in Korea (2009, 2010, 2011) (KEPCO) and Status of Generation facility (2011) (Korea Power Exchange). |
| Any comment: | - The ex-ante value will be revised at the point of the renewal of crediting period of the PoA.<br>- For details about the calculation method, refer to Annex 3. |

| **Data / Parameter:** | **$FC_{i,m,y}$** |
|---|---|
| Data unit: | Mass: Bituminous, LNG<br>Volume: Heavy oil, Diesel |
| Description: | Amount of fossil fuel type i consumed by power plant m in year y<br>$i$ : bituminous, heavy oil, diesel, LNG<br>$m$ : all power units serving the grid in year y except low-cost/must-run power units.<br>$y$ : the relevant year. |
| Source of data used: | 2010 Statistics of Electric Power in Korea<br>2009 Statistics of Electric Power in Korea<br>2008 Statistics of Electric Power in Korea |
| Value applied: | See the Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The applied value was calculated by referring Statistics of Electric Power in Korea (2009, 2010, 2011) (KEPCO) |
| Any comment: | - The ex-ante value will be revised at the point of the renewal of crediting period of the PoA. |

| **Data / Parameter:** | $NCV_{i\,y}$ |
|---|---|
| Data unit: | kJ/ mass or volume unit |
| Description: | Net calorific value of fuel<br>*i* : bituminous, heavy oil, diesel oil, LNG |
| Source of data used: | 2010 Statistics of Electric Power in Korea<br>2009 Statistics of Electric Power in Korea<br>2008 Statistics of Electric Power in Korea |
| Value applied: | See the Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The applied value was calculated by referring Statistics of Electric Power in Korea (2009, 2010, 2011) (KEPCO) |
| Any comment: | - The ex-ante value will be revised at the point of the renewal of crediting period of the PoA. |

| **Data / Parameter:** | $EF_{co2,i,y}$ |
|---|---|
| Data unit: | $tCO_2$ /GJ |
| Description: | $CO_2$ emission factor of fuel *i*<br>*i* : bituminous, heavy oil, diesel oil, LNG |
| Source of data used: | Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories |
| Value applied: | See the Annex 3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | IPCC default values at the lower limit of the uncertainty at 95% confidence interval as provided in table 1.4 of Chpter1 of Vol.2(Energy) |
| Any comment: | - The ex-ante value will be revised at the point of the renewal of crediting period of the PoA. |

| **Data / Parameter:** | $EG_{m,y}$ |
|---|---|
| Data unit: | MWh |
| Description: | Net electricity generated and delivered to the grid by power plant/unit *m*,*j*,*k* or *n* in year *y* or hour *h* |
| Source of data used: | 2010 Statistics of Electric Power in Korea<br>2009 Statistics of Electric Power in Korea<br>2008 Statistics of Electric Power in Korea |
| Value applied: | See the Annex3 |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | The applied value was calculated by referring Statistics of Electric Power in Korea (2009, 2010, 2011) (KEPCO) |
| Any comment: | - The ex-ante value will be revised at the point of the renewal of crediting period of the PoA. |

| **Data / Parameter:** | **C** |
|---|---|
| Data unit: | MW |
| Description: | Capacity of PV and/or BIPV system |
| Source of data used: | |
| Value applied: | |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | - The value is just used to estimate emission reduction. |

| **Data / Parameter:** | **H** |
|---|---|
| Data unit: | hr |
| Description: | Hours in a year |
| Source of data used: | Calculated(24hr * 365 days) |
| Value applied: | 8760hr |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | - The value is just used to estimate emission reduction. |

| **Data / Parameter:** | **U** |
|---|---|
| Data unit: | % |
| Description: | Coefficient of utilization for PV and/or BIPV system |
| Source of data used: | |
| Value applied: | |
| Justification of the choice of data or description of measurement methods and procedures actually applied : | |
| Any comment: | - The value is just used to estimate emission reduction. |

## E.7. Application of the monitoring methodology and description of the monitoring plan:

| D.7.1. Data and parameters to be monitored by each SSC-CPA: | |
|---|---|
| **Data / Parameter:** | **$EG_{BL,y}$** |
| Data unit: | MWh |
| Description: | The quantity of net electricity displaced as a result of the implementation of the CDM project activity in year y |
| Source of data to be used: | Measured by meters. |
| Value of data applied for the purpose of calculating expected emission reductions in section B.5 | |
| Description of measurement methods and procedures to be applied: | -Data will be measured by measuring device.<br>-Data will be continuously monitored and<br>- hourly measured<br>- recorded monthly<br>-100% of data will be monitored and archived at least for 2years after the end of the last crediting period. |
| QA/QC procedures to be applied: | The Measurement will be in compliance with the National Guidelines and requirement for accuracy and reliability.<br>The calibration will be carried out in accordance with the CDM guideline. |
| Any comment: | $EG_{BL,y}$ means a net amount of electricity supplied to user(s) excluding electricity consumed by the project and received from grid.<br>If electricity consumed by the project cannot be measured, the auxiliary electricity consumption will be conservatively calculated. |

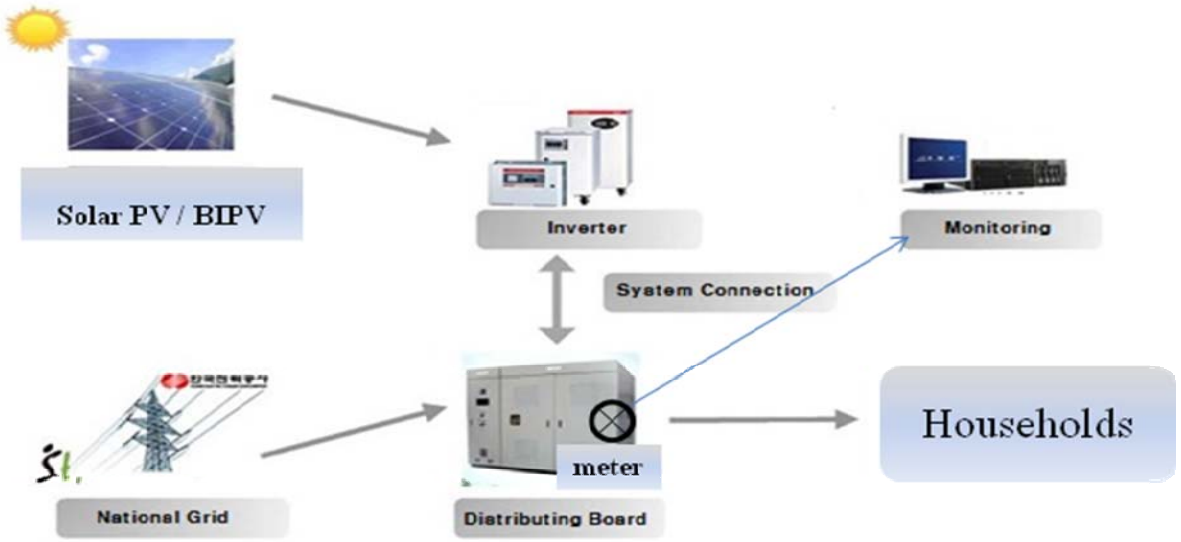
**E.7.2. Description of the monitoring plan for a SSC-CPA:**

>>

Monitoring will be implemented at the CPA level. For each CPA, all parameters will be monitored by CPA implementers according to the procedures and monitoring frame work under the PoA and will be submitted to E. Energy team of SH Corporation (the CME) monthly.

As CPAs under the PoA supplies electricity generated by solar energy to user(s), emission reduction quantity depends on the amount of energy generated from Solar PV and/or BIPV and exported to user(s). Additionally, according to the monitoring methodology of AMS I.F. (version 2), the methodology covers monitoring of quantity of electricity displaced to the grid and auxiliary/station electricity consumption. And the net electricity generation is the difference between the total quantity of electricity which is generated by the project activity and supplied to user(s) and the auxiliary electricity consumption which is supplied from the grid for operating the project.

The monitoring data will be compiled for verification of DOE.




**<Figure E.3> Monitoring Diagram**

**<Monitoring Equipment>**

Monitoring data is quantity of net electricity displaced to the grid and auxiliary/station electricity consumption. Monitoring equipments will measure above data.
In case that electricity consumed by the project cannot be measured or installation of monitoring equipment for electricity consumed by the project is unnecessary because the amount of the electricity is very small, the auxiliary electricity consumption should conservatively be calculated(e.g. Equation : The auxiliary electricity consumption = Standby power[5] (of connector bands and inverters) * Numbers * Hours). Monitoring equipments shall be set up transparently in accordance with relevant laws and standards of Korea to measure electricity supplied to user(s) and electricity consumed by the project.
Monitoring equipments shall be authorized with the formal certifying process according to related regulations. Monitoring equipments is continuously monitoring and hourly measurement. And the allowable error for meters shall be specified in CPA-DD. The measuring equipment of CPAs will be calibrated before installation and re-calibrated in accordance with the CDM guideline. The calibration should be conducted by authorized third parties.

**<Data Management>**

CPAs under the PoA will be operated and managed by CPA implementers. Collected data from CPAs will be recorded and managed by CPA implementers and transmitted to the CME monthly.
The CME takes charge of monitoring and management of CPAs under the PoA. Thus, the CME will collect and record transmitted data from CPA implementers.

CPA implementers will record below data and archive the data electronically at least for 2 years after the crediting period (10years) to which the records pertain.

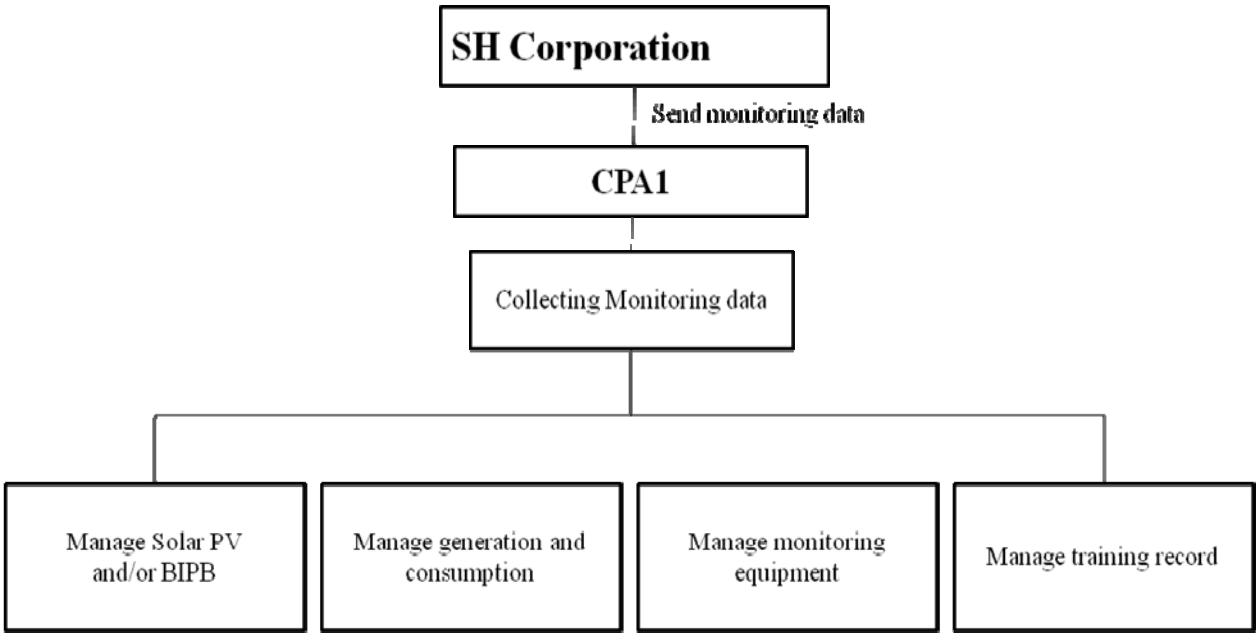
- Electricity generated by PV and/or BIPV(monthly recorded by EXCEL)
- Electricity consumed by the project(monthly recorded by EXCEL)
- The data related to monitoring equipment(calibration)
- The data and record related to training
- The record related to un-normal situation affecting the monitoring
- The record about civil complaint around the project boundary

[5] Standby power is the electric power consumed by electronic appliances while they are switched off or in a standby mode and is based on the letter (or evidence) from manufacturers.

The above data recorded by each responsible person is collected by a person in charge of monitoring and recorded in its database. The recorded data will be sent to the CME monthly.

The people in the project will be trained about monitoring and CDM project.

The operational and management structure to be implemented is the following:




**<Figure E.4> The roles of operational and management entity**

**<Quality Assurance and Quality Control>**

The quality assurance and quality control procedures involve the process of data monitoring, recording, maintenance and calibration of monitoring equipments**.**

All meters used in a CPA should be accorded with national standard or manufacture's recommendation, including precision requirement, calibration. Electricity meters for measuring the amount of electricity shall be set up transparently in accordance with relevant regulations. The meters shall be investigated by certificated examination standard. Calibration regarding the meters shall be performed according to the CDM guideline by authorized organization after the installation. The accuracy of measuring equipment shall be presented in CPA-DD.

In case of measurement equipment trouble or data transferring error, the person in charge is responsible for promptly grasping the problem and restoring it in due course. Also the person shall report progress to the CME.

Additionally, the monitoring data stored by CPA implementers will be cross-checked quarterly with the data stored by the CME for accuracy of the data.

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

>>

Date of completion of the methodology application: The application of the baseline study and monitoring methodology of the Project were completed on 25/07/2012.

Entity responsible for the application of the baseline and monitoring methodology

Jong-Kyu Kim, Ph/RCC Co., Ltd.
Pohang Techno Park #205, Venture 1st building
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E-mail: jkkim@rcc-posco.co.kr , +82-54-223-2304
lhs@ircc.co.kr , +82-54-223-2303

## Annex 1
## CONTACT INFORMATION ON COORDINATING/MANAGING ENTITY and PARTICIPANTS IN THE PROGRAMME of ACTIVITIES

| | |
|---|---|
| Organization: | SH Corporation |
| Street/P.O.Box: | 621 Gaepo-ro |
| Building: | |
| City: | Seoul |
| State/Region: | Gangnam-gu |
| Postfix/ZIP: | |
| Country: | Republic of Korea |
| Telephone: | |
| FAX: | |
| E-Mail: | |
| URL: | |
| Represented by: | |
| Title: | Deputy General Manager |
| Salutation: | Mr. |
| Last Name: | Kim |
| Middle Name: | |
| First Name: | Jong kwon |
| Department: | E. Energy team |
| Mobile: | +82 (0)10 7156 1933 |
| Direct FAX: | +82 (0)2 3410 7686 |
| Direct tel: | +82 (0)2 3410 7963 |
| Personal E-Mail: | jokykim@i-sh.co.kr |

| | |
|---|---|
| Organization: | RCC Co., Ltd |
| Street/P.O.Box: | 790-834 |
| Building: | #205 venture Bldg Pohang Technopark |
| City: | Pohang |
| State/Region: | Nam-gu |
| Postfix/ZIP: | |
| Country: | Republic of Korea |
| Telephone: | |
| FAX: | |
| E-Mail: | |
| URL: | |
| Represented by: | |
| Title: | Director |
| Salutation: | Mr. |
| Last Name: | Kim |
| Middle Name: | |
| First Name: | Jong Kyu |
| Department: | CDM development team |
| Mobile: | +82 (0)10 9981 2708 |
| Direct FAX: | +82 (0)54 223 2310 |
| Direct tel: | +82 (0)54 223 2304 |
| Personal E-Mail: | jkkim@ircc.co.kr |

## Annex 2

## INFORMATION REGARDING PUBLIC FUNDING

This project will not receive any public funding.

**Annex 3**

**BASELINE INFORMATION**

## Simple OM calculation

The simple OM method can be used where low cost/must run resources constitute less than 50% of total grid generation in average of the five most recent years.

**< Generation of power plants groups (GWh, Gross)>**

| year | Low cost/must run | | | | | Total grid generation | Low cost/must run ratio |
|---|---|---|---|---|---|---|---|
| | Hydro | Coal (Anthracite) | Nuclear | Alternative* | Subtotal | | |
| 2006 | 5,219 | 4,312 | 148,749 | 511 | 158,791 | 365,153 | 43.49% |
| 2007 | 5,042 | 4,470 | 142,937 | 829 | 153,278 | 386,367 | 39.67% |
| 2008 | 5,563 | 5,010 | 150,958 | 1,092 | 162,623 | 404,813 | 40.17% |
| 2009 | 5,641 | 5,559 | 147,771 | 1,791 | 160,762 | 415,170 | 38.72% |
| 2010 | 6,472 | 4,613 | 148,596 | 3,984 | 163,665 | 455,096 | 35.96% |
| Average of five recent years | **5,587** | **4,793** | **147,802** | **1,641** | **159,824** | **405,319** | **39.43%** |

*Alternative: Geothermal, Wind, Low-cost biomass, Solar, LFG

Source: 2010 KEPCO in Brief (2011.03)

***Carbon Emission Factor***

$CO_2$ Emission Factor of fossil fuel type i (unit: $tCO_2/GJ$) ($EF_{CO2,i,y}$)

| | |
|---|---|
| Bituminous coal | 0.089500 |
| Heavy Oil | 0.075500 |
| Diesel Oil | 0.072600 |
| LNG | 0.054300 |

*Source:: IPCC 2006

IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 of 2006 IPCC Guidance.

***Simple OM for the project activity***

| | Net Generation (EGm,y) (MWh) | CO2emisson (tCO2/yr) | Operating Margin |
|---|---|---|---|
| **2008** | 237,888,671 | 163,529,778 | 0.6874 |
| **2009** | 247,072,945 | 175,832,796 | 0.7117 |
| **2010** | 279,038,210 | 190,305,764 | 0.6820 |
| **Sub total** | 763,999,826 | 529,668,388 | |
| **Average(2008-2010)** | 0.6933 | | |

***Operating Margin for 2010(continued)***

| Power plant (m) | | Fuel (i) Type | *Net Generation ($EG_{m,y}$) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Honam | #1 | Coal-thermal | 1,321,140 | 661,468 | 1,855 | 301 | 0 | 3,491,212 | 18,200 | 2,680 | 0 | 5,014 | 9,321 | 8,458 | 0 | 1,242,811 | 5,465 | 774 | 0 | 1,249,050 |
| | #2 | Coal-thermal | 1,462,407 | 722,994 | 897 | 305 | 0 | 3,848,285 | 8,802 | 3,125 | 0 | 5,057 | 9,322 | 9,734 | 0 | 1,369,923 | 2,643 | 902 | 0 | 1,373,468 |
| Samchonpo | #1 | Coal-thermal | 4,433,574 | 1,899,819 | 0 | 518 | 0 | 10,768,455 | 0 | 4,616 | 0 | 5,385 | 0 | 8,466 | 0 | 3,833,383 | 0 | 1,333 | 0 | 3,834,716 |
| | #2 | Coal-thermal | 4,418,264 | 1,891,944 | 0 | 421 | 0 | 10,729,632 | 0 | 3,748 | 0 | 5,388 | 0 | 8,457 | 0 | 3,819,563 | 0 | 1,082 | 0 | 3,820,645 |
| | #3 | Coal-thermal | 3,766,380 | 1,581,512 | 0 | 1,261 | 0 | 8,944,193 | 0 | 11,254 | 0 | 5,373 | 0 | 8,478 | 0 | 3,183,978 | 0 | 3,250 | 0 | 3,187,227 |
| | #4 | Coal-thermal | 4,544,757 | 1,909,672 | 0 | 369 | 0 | 10,771,131 | 0 | 3,291 | 0 | 5,358 | 0 | 8,473 | 0 | 3,834,336 | 0 | 950 | 0 | 3,835,286 |
| | #5 | Coal-thermal | 4,174,333 | 1,949,826 | 0 | 293 | 0 | 9,674,524 | 0 | 2,641 | 0 | 4,714 | 0 | 8,563 | 0 | 3,443,963 | 0 | 763 | 0 | 3,444,726 |
| | #6 | Coal-thermal | 3,767,928 | 1,758,651 | 0 | 573 | 0 | 8,734,467 | 0 | 5,161 | 0 | 4,718 | 0 | 8,557 | 0 | 3,109,319 | 0 | 1,490 | 0 | 3,110,809 |
| Yongheng | #1 | Coal-thermal | 5,558,681 | 2,201,446 | 0 | 2,189 | 0 | 12,587,273 | 0 | 19,325 | 0 | 5,432 | 0 | 8,387 | 0 | 4,480,851 | 0 | 5,580 | 0 | 4,486,431 |
| | #2 | Coal-thermal | 5,627,774 | 2,264,564 | 0 | 1,531 | 0 | 12,951,441 | 0 | 13,507 | 0 | 5,433 | 0 | 8,381 | 0 | 4,610,489 | 0 | 3,900 | 0 | 4,614,389 |
| | #3 | Coal-thermal | 6,887,344 | 2,778,041 | 0 | 739 | 0 | 15,751,410 | 0 | 6,527 | 0 | 5,386 | 0 | 8,391 | 0 | 5,607,229 | 0 | 1,885 | 0 | 5,609,114 |
| | #4 | Coal-thermal | 6,943,045 | 2,821,533 | 0 | 663 | 0 | 15,975,433 | 0 | 5,849 | 0 | 5,379 | 0 | 8,381 | 0 | 5,686,977 | 0 | 1,689 | 0 | 5,688,666 |
| Boryeong | #1 | Coal-thermal | 4,012,817 | 1,771,953 | 0 | 732 | 0 | 9,654,223 | 0 | 6,474 | 0 | 5,176 | 0 | 8,402 | 0 | 3,436,736 | 0 | 1,869 | 0 | 3,438,606 |
| | #2 | Coal-thermal | 3,706,927 | 1,635,347 | 0 | 1,068 | 0 | 8,908,047 | 0 | 9,390 | 0 | 5,175 | 0 | 8,353 | 0 | 3,171,110 | 0 | 2,711 | 0 | 3,173,822 |
| | #3 | Coal-thermal | 3,855,846 | 1,618,460 | 0 | 464 | 0 | 8,869,119 | 0 | 4,064 | 0 | 5,206 | 0 | 8,321 | 0 | 3,157,253 | 0 | 1,174 | 0 | 3,158,426 |
| | #4 | Coal-thermal | 4,232,288 | 1,775,851 | 0 | 289 | 0 | 9,732,109 | 0 | 2,540 | 0 | 5,206 | 0 | 8,349 | 0 | 3,464,462 | 0 | 733 | 0 | 3,465,196 |
| | #5 | Coal-thermal | 3,817,181 | 1,604,934 | 0 | 911 | 0 | 8,786,324 | 0 | 7,972 | 0 | 5,201 | 0 | 8,313 | 0 | 3,127,779 | 0 | 2,302 | 0 | 3,130,081 |
| | #6 | Coal-thermal | 4,226,837 | 1,778,254 | 0 | 359 | 0 | 9,737,206 | 0 | 3,143 | 0 | 5,202 | 0 | 8,317 | 0 | 3,466,277 | 0 | 908 | 0 | 3,467,184 |
| | #7 | Coal-thermal | 4,189,558 | 1,670,727 | 0 | 662 | 0 | 9,221,913 | 0 | 5,799 | 0 | 5,244 | 0 | 8,322 | 0 | 3,282,841 | 0 | 1,675 | 0 | 3,284,516 |
| | #8 | Coal-thermal | 3,787,312 | 1,493,422 | 0 | 439 | 0 | 8,260,560 | 0 | 3,843 | 0 | 5,255 | 0 | 8,316 | 0 | 2,940,616 | 0 | 1,110 | 0 | 2,941,726 |
| Taean | #1 | Coal-thermal | 3,817,336 | 1,512,930 | 0 | 865 | 0 | 8,692,027 | 0 | 7,674 | 0 | 5,458 | 0 | 8,428 | 0 | 3,094,211 | 0 | 2,216 | 0 | 3,096,427 |
| | #2 | Coal-thermal | 4,058,392 | 1,626,596 | 0 | 518 | 0 | 9,291,872 | 0 | 4,596 | 0 | 5,427 | 0 | 8,429 | 0 | 3,307,745 | 0 | 1,327 | 0 | 3,309,073 |
| | #3 | Coal-thermal | 3,776,949 | 1,506,479 | 0 | 476 | 0 | 8,614,930 | 0 | 4,227 | 0 | 5,433 | 0 | 8,436 | 0 | 3,066,766 | 0 | 1,221 | 0 | 3,067,986 |
| | #4 | Coal-thermal | 4,165,579 | 1,656,710 | 0 | 296 | 0 | 9,514,987 | 0 | 2,624 | 0 | 5,456 | 0 | 8,422 | 0 | 3,387,170 | 0 | 758 | 0 | 3,387,928 |
| | #5 | Coal-thermal | 3,657,234 | 1,450,465 | 0 | 680 | 0 | 8,384,441 | 0 | 6,039 | 0 | 5,491 | 0 | 8,437 | 0 | 2,984,716 | 0 | 1,744 | 0 | 2,986,460 |
| | #6 | Coal-thermal | 3,339,271 | 1,319,263 | 0 | 1,094 | 0 | 7,618,266 | 0 | 9,705 | 0 | 5,486 | 0 | 8,428 | 0 | 2,711,971 | 0 | 2,802 | 0 | 2,714,773 |
| | #7 | Coal-thermal | 3,940,580 | 1,521,262 | 0 | 879 | 0 | 8,758,319 | 0 | 7,800 | 0 | 5,469 | 0 | 8,430 | 0 | 3,117,810 | 0 | 2,252 | 0 | 3,120,062 |
| | #8 | Coal-thermal | 4,335,230 | 1,674,579 | 0 | 240 | 0 | 9,617,658 | 0 | 2,130 | 0 | 5,456 | 0 | 8,431 | 0 | 3,423,720 | 0 | 615 | 0 | 3,424,335 |
| Hadong | #1 | Coal-thermal | 3,948,643 | 1,651,998 | 0 | 386 | 0 | 9,151,952 | 0 | 3,072 | 0 | 5,263 | 0 | 7,561 | 0 | 3,257,936 | 0 | 887 | 0 | 3,258,823 |
| | #2 | Coal-thermal | 4,181,012 | 1,758,216 | 0 | 133 | 0 | 9,738,153 | 0 | 1,179 | 0 | 5,262 | 0 | 8,421 | 0 | 3,466,614 | 0 | 340 | 0 | 3,466,954 |
| | #3 | Coal-thermal | 4,229,016 | 1,760,793 | 0 | 94 | 0 | 9,755,957 | 0 | 858 | 0 | 5,264 | 0 | 8,671 | 0 | 3,472,952 | 0 | 248 | 0 | 3,473,199 |
| | #4 | Coal-thermal | 3,877,595 | 1,623,350 | 0 | 610 | 0 | 8,987,558 | 0 | 5,404 | 0 | 5,260 | 0 | 8,416 | 0 | 3,199,415 | 0 | 1,560 | 0 | 3,200,975 |
| | #5 | Coal-thermal | 4,210,179 | 1,762,407 | 0 | 369 | 0 | 9,756,069 | 0 | 3,357 | 0 | 5,259 | 0 | 8,643 | 0 | 3,472,991 | 0 | 969 | 0 | 3,473,961 |
| | #6 | Coal-thermal | 3,972,047 | 1,642,064 | 0 | 367 | 0 | 9,096,744 | 0 | 3,254 | 0 | 5,263 | 0 | 8,423 | 0 | 3,238,283 | 0 | 940 | 0 | 3,239,223 |
| | #7 | Coal-thermal | 3,497,189 | 1,314,119 | 0 | 674 | 0 | 7,647,412 | 0 | 6,012 | 0 | 5,528 | 0 | 8,474 | 0 | 2,722,346 | 0 | 1,736 | 0 | 2,724,082 |
| | #8 | Coal-thermal | 4,221,464 | 1,586,695 | 0 | 34 | 0 | 9,228,319 | 0 | 307 | 0 | 5,525 | 0 | 8,578 | 0 | 3,285,122 | 0 | 89 | 0 | 3,285,210 |

*, **, ***: 2010Statistics of Electric Power in Korea, KEPCO, 2011.5.

***Operating Margin for 2010(continued)***

| Power plant (m) | | Fuel (i) Type | *Net Generation ($EG_{m,y}$) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Dangjin | #1 | Coal-thermal | 4,240,235 | 1,802,866 | 0 | 89 | 0 | 9,755,269 | 0 | 777 | 0 | 5,140 | 0 | 8,294 | 0 | 3,472,707 | 0 | 224 | 0 | 3,472,931 |
| | #2 | Coal-thermal | 4,271,208 | 1,812,592 | 0 | 168 | 0 | 9,793,117 | 0 | 1,507 | 0 | 5,133 | 0 | 8,522 | 0 | 3,486,180 | 0 | 435 | 0 | 3,486,615 |
| | #3 | Coal-thermal | 3,924,887 | 1,660,911 | 0 | 430 | 0 | 8,985,559 | 0 | 3,862 | 0 | 5,140 | 0 | 8,532 | 0 | 3,198,703 | 0 | 1,115 | 0 | 3,199,818 |
| | #4 | Coal-thermal | 3,757,184 | 1,593,667 | 0 | 974 | 0 | 8,613,065 | 0 | 8,683 | 0 | 5,134 | 0 | 8,469 | 0 | 3,066,102 | 0 | 2,507 | 0 | 3,068,609 |
| | #5 | Coal-thermal | 4,133,329 | 1,676,374 | 0 | 332 | 0 | 9,172,326 | 0 | 2,982 | 0 | 5,198 | 0 | 8,533 | 0 | 3,265,189 | 0 | 861 | 0 | 3,266,050 |
| | #6 | Coal-thermal | 4,242,960 | 1,722,658 | 0 | 157 | 0 | 9,419,756 | 0 | 1,408 | 0 | 5,195 | 0 | 8,520 | 0 | 3,353,270 | 0 | 407 | 0 | 3,353,676 |
| | #7 | Coal-thermal | 3,870,155 | 1,572,939 | 0 | 347 | 0 | 8,621,062 | 0 | 3,117 | 0 | 5,207 | 0 | 8,534 | 0 | 3,068,949 | 0 | 900 | 0 | 3,069,849 |
| | #8 | Coal-thermal | 4,272,886 | 1,729,056 | 0 | 90 | 0 | 9,447,782 | 0 | 805 | 0 | 5,191 | 0 | 8,497 | 0 | 3,363,247 | 0 | 232 | 0 | 3,363,479 |
| Ulsan | #1 | Heavy oil-therm | 220,710 | 0 | 59,593 | 278 | 0 | 0 | 590,930 | 2,449 | 0 | 0 | 9,420 | 8,369 | 0 | 0 | 177,455 | 707 | 0 | 178,162 |
| | #2 | Heavy oil-therm | 185,534 | 0 | 50,627 | 249 | 0 | 0 | 502,173 | 2,197 | 0 | 0 | 9,423 | 8,382 | 0 | 0 | 150,802 | 634 | 0 | 151,436 |
| | #3 | Heavy oil-therm | 261,312 | 0 | 70,519 | 286 | 0 | 0 | 694,236 | 2,517 | 0 | 0 | 9,352 | 8,361 | 0 | 0 | 208,478 | 727 | 0 | 209,205 |
| | #4 | Heavy oil-therm | 927,792 | 0 | 229,069 | 4,116 | 0 | 0 | 2,293,236 | 36,179 | 0 | 0 | 9,511 | 8,350 | 0 | 0 | 688,655 | 10,447 | 0 | 699,102 |
| | #5 | Heavy oil-therm | 823,717 | 0 | 204,124 | 4,395 | 0 | 0 | 2,046,788 | 38,631 | 0 | 0 | 9,526 | 8,350 | 0 | 0 | 614,647 | 11,155 | 0 | 625,802 |
| | #6 | Heavy oil-therm | 887,331 | 0 | 217,795 | 3,058 | 0 | 0 | 2,179,304 | 26,877 | 0 | 0 | 9,506 | 8,350 | 0 | 0 | 654,441 | 7,761 | 0 | 662,202 |
| Youngnam | #1 | Heavy oil-therm | 354,224 | 0 | 91,050 | 1,170 | 0 | 0 | 930,156 | 10,820 | 0 | 0 | 9,705 | 8,785 | 0 | 0 | 279,324 | 3,124 | 0 | 282,449 |
| | #2 | Heavy oil-therm | 304,146 | 0 | 80,387 | 786 | 0 | 0 | 820,950 | 7,195 | 0 | 0 | 9,702 | 8,696 | 0 | 0 | 246,530 | 2,078 | 0 | 248,607 |
| Yosu | #1 | Heavy oil-therm | 481,530 | 0 | 118,289 | 370 | 0 | 0 | 1,187,687 | 3,252 | 0 | 0 | 9,539 | 8,350 | 0 | 0 | 356,660 | 939 | 0 | 357,599 |
| | #2 | Heavy oil-therm | 956,556 | 0 | 236,662 | 278 | 0 | 0 | 2,377,287 | 2,442 | 0 | 0 | 9,543 | 8,345 | 0 | 0 | 713,895 | 705 | 0 | 714,600 |
| Pyongtaek | #1 | Heavy oil-therm | 794,103 | 0 | 188,829 | 121 | 3,409 | 0 | 1,875,419 | 1,088 | 44,291 | 0 | 9,435 | 8,542 | 11,693 | 0 | 563,185 | 314 | 9,062 | 572,562 |
| | #2 | Heavy oil-therm | 742,439 | 0 | 172,352 | 102 | 6,484 | 0 | 1,710,891 | 911 | 84,224 | 0 | 9,430 | 8,485 | 11,691 | 0 | 513,778 | 263 | 17,233 | 531,274 |
| | #3 | Heavy oil-therm | 830,437 | 0 | 194,662 | 115 | 4,814 | 0 | 1,934,896 | 1,031 | 62,594 | 0 | 9,443 | 8,517 | 11,702 | 0 | 581,046 | 298 | 12,807 | 594,151 |
| | #4 | Heavy oil-therm | 669,443 | 0 | 158,042 | 91 | 3,646 | 0 | 1,570,954 | 818 | 47,199 | 0 | 9,443 | 8,540 | 11,651 | 0 | 471,755 | 236 | 9,657 | 481,648 |
| Namjeju | #1 | Heavy oil-therm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #2 | Heavy oil-therm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #3 | Heavy oil-therm | 594,537 | 0 | 151,950 | 105 | 0 | 0 | 1,505,154 | 940 | 0 | 0 | 9,410 | 8,505 | 0 | 0 | 451,995 | 271 | 0 | 452,267 |
| | #4 | Heavy oil-therm | 580,342 | 0 | 146,544 | 134 | 0 | 0 | 1,451,580 | 1,195 | 0 | 0 | 9,410 | 8,472 | 0 | 0 | 435,907 | 345 | 0 | 436,252 |
| Jeju | #1 | Heavy oil-therm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #2 | Heavy oil-therm | 298,469 | 0 | 76706 | 78 | 0 | 0 | 757,327 | 693 | 0 | 0 | 9,379 | 8,440 | 0 | 0 | 227,424 | 200 | 0 | 227,624 |
| | #3 | Heavy oil-therm | 344,920 | 0 | 89373 | 82 | 0 | 0 | 882,369 | 733 | 0 | 0 | 9,379 | 8,492 | 0 | 0 | 264,974 | 212 | 0 | 265,186 |
| Seoul | #4 | Gas-thermal | 356,493 | 0 | 0 | 0 | 77,219 | 0 | 0 | 0 | 1,007,818 | 0 | 0 | 0 | 11,746 | 0 | 0 | 0 | 206,209 | 206,209 |
| | #5 | Gas-thermal | 815,062 | 0 | 0 | 1 | 169,145 | 0 | 0 | 7 | 2,207,592 | 0 | 0 | 6,650 | 11,746 | 0 | 0 | 2 | 451,693 | 451,695 |

*, **, ***: 2010Statistics of Electric Power in Korea, KEPCO, 2011.5.

## ***Operating Margin for 2010***

| Power plant (m) | Fuel (i) Type | *Net Generation ($EG_{m,y}$) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Incheon #1 | Gas-thermal | 477,252 | 0 | 0 | 0 | 95,108 | 0 | 0 | 0 | 1,241,344 | 0 | 0 | 0 | 11,747 | 0 | 0 | 0 | 253,990 | 253,990 |
| #2 | Gas-thermal | 544,351 | 0 | 0 | 0 | 105,649 | 0 | 0 | 0 | 1,379,128 | 0 | 0 | 0 | 11,748 | 0 | 0 | 0 | 282,182 | 282,182 |
| #3 | Gas-thermal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Namjeju D/P | Internal combusti | 91,340 | 0 | 20,334 | 369 | 0 | 0 | 200,885 | 3,299 | 0 | 0 | 9,385 | 8,493 | 0 | 0 | 60,325 | 953 | 0 | 61,278 |
| Jeju G/T | Internal combusti | 1,115 | 0 | 0 | 697 | 0 | 0 | 0 | 6,273 | 0 | 0 | 0 | 8,550 | 0 | 0 | 0 | 1,811 | 0 | 1,811 |
| Jeju D/P | Internal combusti | 405,634 | 0 | 85,093 | 0 | 0 | 0 | 839,393 | 0 | 0 | 0 | 9,371 | 0 | 0 | 0 | 252,068 | 0 | 0 | 252,068 |
| Pyongtaek C/C | Combined cycl | 1,472,808 | 0 | 0 | 0 | 237,805 | 0 | 0 | 0 | 3,088,971 | 0 | 0 | 0 | 11,691 | 0 | 0 | 0 | 632,031 | 632,031 |
| Ilsan C/C | Combined cycl | 4,306,850 | 0 | 0 | 0 | 755,305 | 0 | 0 | 0 | 9,856,823 | 0 | 0 | 0 | 11,745 | 0 | 0 | 0 | 2,016,794 | 2,016,794 |
| Bundang C/C | Combined cycl | 4,311,466 | 0 | 0 | 0 | 725,097 | 0 | 0 | 0 | 9,464,132 | 0 | 0 | 0 | 11,747 | 0 | 0 | 0 | 1,936,446 | 1,936,446 |
| Ulsan C/C | Combined cycl | 5,709,782 | 0 | 0 | 0 | 846,672 | 0 | 0 | 0 | 10,889,910 | 0 | 0 | 0 | 11,576 | 0 | 0 | 0 | 2,228,173 | 2,228,173 |
| Seoincheon C/C | Combined cycl | 11,756,041 | 0 | 0 | 76 | 1,633,316 | 0 | 0 | 700 | 21,315,161 | 0 | 0 | 8,750 | 11,745 | 0 | 0 | 202 | 4,361,272 | 4,361,474 |
| Shinincheon C/C | Combined cycl | 9,595,856 | 0 | 0 | 0 | 1,349,902 | 0 | 0 | 0 | 17,618,873 | 0 | 0 | 0 | 11,747 | 0 | 0 | 0 | 3,604,979 | 3,604,979 |
| Boryeong C/C | Combined cycl | 7,053,566 | 0 | 0 | 0 | 1,016,783 | 0 | 0 | 0 | 13,271,568 | 0 | 0 | 0 | 11,747 | 0 | 0 | 0 | 2,715,481 | 2,715,481 |
| Incheon C/C | Combined cycl | 7,789,931 | 0 | 0 | 0 | 1,035,486 | 0 | 0 | 0 | 13,513,313 | 0 | 0 | 0 | 11,745 | 0 | 0 | 0 | 2,764,944 | 2,764,944 |
| Busan C/C | Combined cycl | 12,489,596 | 0 | 0 | 12 | 1,666,675 | 0 | 0 | 54 | 21,755,416 | 0 | 0 | 4,275 | 11,748 | 0 | 0 | 16 | 4,451,352 | 4,451,368 |
| Hallim C/C | Combined cycl | 45,450 | 0 | 0 | 12,737 | 0 | 0 | 0 | 114,447 | 0 | 0 | 0 | 8,536 | 0 | 0 | 0 | 33,048 | 0 | 33,048 |
| GS Anyang C/C | Combined cycl | 1,824,654 | 0 | 0 | 0 | 308,918 | 0 | 0 | 0 | 4,272,462 | 0 | 0 | 0 | 12,447 | 0 | 0 | 0 | 874,184 | 874,184 |
| GS Bucheon C/C | Combined cycl | 1,806,919 | 0 | 0 | 263 | 303,789 | 0 | 0 | 0 | 4,206,893 | 0 | 0 | 0 | 12,463 | 0 | 0 | 0 | 860,768 | 860,768 |
| POSCO Power | Combined cycl | 4,297,788 | 0 | 0 | 0 | 809,100 | 0 | 0 | 0 | 10,258,780 | 0 | 0 | 0 | 11,411 | 0 | 0 | 0 | 2,099,038 | 2,099,038 |
| GS EPS Bugog #1 | Combined cycl | 3,026,986 | 0 | 0 | 0 | 428,568 | 0 | 0 | 0 | 5,363,434 | 0 | 0 | 0 | 11,263 | 0 | 0 | 0 | 1,097,406 | 1,097,406 |
| GS EPS Bugog #2 | Combined cycl | 3,026,986 | 0 | 0 | 0 | 378,514 | 0 | 0 | 0 | 5,178,813 | 0 | 0 | 0 | 12,314 | 0 | 0 | 0 | 1,059,631 | 1,059,631 |
| Gunsan C/C | Combined cycl | 2,937,873 | 0 | 0 | 0 | 398,151 | 0 | 0 | 0 | 5,196,105 | 0 | 0 | 0 | 11,746 | 0 | 0 | 0 | 1,063,169 | 1,063,169 |
| Yeongwol C/C | Combined cycl | 1,281,206 | 0 | 0 | 263 | 182,365 | 0 | 0 | 2,353 | 2,380,779 | 0 | 0 | 8,499 | 11,750 | 0 | 0 | 679 | 487,129 | 487,808 |
| Yulchon C/C | Combined cycl | 2,680,710 | 0 | 0 | 0 | 372,560 | 0 | 0 | 0 | 4,863,307 | 0 | 0 | 0 | 11,748 | 0 | 0 | 0 | 995,076 | 995,076 |
| | **$\Sigma_m EG_{m,y}$=** | **279,038,210** | | | | | | | | | | | | | | | | $\sum_{i,m} FC_{i,m,y} \cdot CV_{i,y} \cdot EF_{CO2,i,y}$= | **190,305,764** |

*, **, ***: 2010Statistics of Electric Power in Korea, KEPCO, 2011.5.

$$EF_{grid,OMsimple,y} = \Sigma_{i,m} FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y} / \Sigma_m EG_{m,y} = \mathbf{0.6820}$$

***Operating Margin for 2009(continued)***

| Power plant (m) | | Fuel (i) Type | *Net Generation ($EG_{m,y}$) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Honam | #1 | Coal-thermal | 1,843,823 | 923,895 | 471 | 167 | 0 | 4,874,229 | 4,622 | 1,496 | 0 | 5,012 | 9,323 | 8,510 | 0 | 1,735,141 | 1,388 | 432 | 0 | 1,736,961 |
| | #2 | Coal-thermal | 1,696,597 | 853,508 | 818 | 201 | 0 | 4,476,187 | 8,020 | 1,800 | 0 | 4,982 | 9,314 | 8,507 | 0 | 1,593,445 | 2,408 | 520 | 0 | 1,596,373 |
| Samchonpo | #1 | Coal-thermal | 3,881,067 | 1,611,736 | 0 | 299 | 0 | 9,470,960 | 0 | 2,674 | 0 | 5,582 | 0 | 8,496 | 0 | 3,371,498 | 0 | 772 | 0 | 3,372,270 |
| | #2 | Coal-thermal | 3,869,863 | 1,596,153 | 0 | 447 | 0 | 9,313,471 | 0 | 3,974 | 0 | 5,543 | 0 | 8,446 | 0 | 3,315,434 | 0 | 1,148 | 0 | 3,316,582 |
| | #3 | Coal-thermal | 4,494,850 | 1,818,061 | 0 | 110 | 0 | 10,611,118 | 0 | 983 | 0 | 5,545 | 0 | 8,490 | 0 | 3,777,374 | 0 | 284 | 0 | 3,777,658 |
| | #4 | Coal-thermal | 3,873,780 | 1,552,530 | 0 | 486 | 0 | 9,082,296 | 0 | 4,289 | 0 | 5,557 | 0 | 8,384 | 0 | 3,233,140 | 0 | 1,239 | 0 | 3,234,378 |
| | #5 | Coal-thermal | 4,225,306 | 1,909,143 | 0 | 151 | 0 | 9,747,607 | 0 | 1,357 | 0 | 4,850 | 0 | 8,537 | 0 | 3,469,979 | 0 | 392 | 0 | 3,470,371 |
| | #6 | Coal-thermal | 3,902,690 | 1,765,537 | 0 | 576 | 0 | 9,020,441 | 0 | 5,188 | 0 | 4,854 | 0 | 8,557 | 0 | 3,211,121 | 0 | 1,498 | 0 | 3,212,619 |
| Yeongheung | #1 | Coal-thermal | 6,121,660 | 2,316,758 | 0 | 1,996 | 0 | 13,855,162 | 0 | 17,745 | 0 | 5,681 | 0 | 8,446 | 0 | 4,932,198 | 0 | 5,124 | 0 | 4,937,322 |
| | #2 | Coal-thermal | 6,309,794 | 2,437,083 | 0 | 1,632 | 0 | 14,505,767 | 0 | 14,117 | 0 | 5,654 | 0 | 8,218 | 0 | 5,163,802 | 0 | 4,076 | 0 | 5,167,878 |
| | #3 | Coal-thermal | 6,711,338 | 2,533,024 | 0 | 966 | 0 | 15,043,737 | 0 | 8,612 | 0 | 5,642 | 0 | 8,469 | 0 | 5,355,310 | 0 | 2,487 | 0 | 5,357,796 |
| | #4 | Coal-thermal | 7,183,514 | 2,740,096 | 0 | 117 | 0 | 16,286,850 | 0 | 833 | 0 | 5,647 | 0 | 6,764 | 0 | 5,797,836 | 0 | 241 | 0 | 5,798,077 |
| Boryeong | #1 | Coal-thermal | 2,076,329 | 896,958 | 0 | 1,982 | 0 | 4,965,573 | 0 | 17,726 | 0 | 5,259 | 0 | 8,496 | 0 | 1,767,658 | 0 | 5,119 | 0 | 1,772,777 |
| | #2 | Coal-thermal | 3,148,655 | 1,361,908 | 0 | 5,689 | 0 | 7,586,023 | 0 | 50,212 | 0 | 5,292 | 0 | 8,385 | 0 | 2,700,493 | 0 | 14,499 | 0 | 2,714,992 |
| | #3 | Coal-thermal | 4,153,516 | 1,686,579 | 0 | 180 | 0 | 9,521,590 | 0 | 1,606 | 0 | 5,363 | 0 | 8,476 | 0 | 3,389,521 | 0 | 464 | 0 | 3,389,985 |
| | #4 | Coal-thermal | 3,823,603 | 1,554,579 | 0 | 672 | 0 | 8,734,064 | 0 | 6,049 | 0 | 5,337 | 0 | 8,551 | 0 | 3,109,175 | 0 | 1,747 | 0 | 3,110,922 |
| | #5 | Coal-thermal | 4,136,937 | 1,681,591 | 0 | 516 | 0 | 9,477,969 | 0 | 4,576 | 0 | 5,354 | 0 | 8,425 | 0 | 3,373,993 | 0 | 1,321 | 0 | 3,375,314 |
| | #6 | Coal-thermal | 3,802,516 | 1,538,187 | 0 | 935 | 0 | 8,707,900 | 0 | 8,231 | 0 | 5,378 | 0 | 8,363 | 0 | 3,099,861 | 0 | 2,377 | 0 | 3,102,238 |
| | #7 | Coal-thermal | 3,720,811 | 1,438,768 | 0 | 568 | 0 | 8,163,761 | 0 | 4,974 | 0 | 5,390 | 0 | 8,319 | 0 | 2,906,157 | 0 | 1,436 | 0 | 2,907,594 |
| | #8 | Coal-thermal | 4,417,673 | 1,701,650 | 0 | 341 | 0 | 9,643,209 | 0 | 3,109 | 0 | 5,384 | 0 | 8,661 | 0 | 3,432,815 | 0 | 898 | 0 | 3,433,713 |
| Taean | #1 | Coal-thermal | 4,087,057 | 1,561,372 | 0 | 348 | 0 | 9,280,102 | 0 | 3,077 | 0 | 5,646 | 0 | 8,400 | 0 | 3,303,555 | 0 | 889 | 0 | 3,304,444 |
| | #2 | Coal-thermal | 3,858,541 | 1,483,233 | 0 | 22 | 0 | 8,822,160 | 0 | 191 | 0 | 5,651 | 0 | 8,248 | 0 | 3,140,536 | 0 | 55 | 0 | 3,140,591 |
| | #3 | Coal-thermal | 4,041,441 | 1,550,278 | 0 | 209 | 0 | 9,220,322 | 0 | 1,832 | 0 | 5,650 | 0 | 8,327 | 0 | 3,282,275 | 0 | 529 | 0 | 3,282,804 |
| | #4 | Coal-thermal | 3,843,816 | 1,471,251 | 0 | 410 | 0 | 8,736,374 | 0 | 3,604 | 0 | 5,641 | 0 | 8,351 | 0 | 3,109,998 | 0 | 1,041 | 0 | 3,111,038 |
| | #5 | Coal-thermal | 3,689,068 | 1,409,802 | 0 | 978 | 0 | 8,417,006 | 0 | 8,616 | 0 | 5,672 | 0 | 8,369 | 0 | 2,996,308 | 0 | 2,488 | 0 | 2,998,796 |
| | #6 | Coal-thermal | 4,064,658 | 1,548,690 | 0 | 285 | 0 | 9,272,248 | 0 | 2,518 | 0 | 5,688 | 0 | 8,393 | 0 | 3,300,760 | 0 | 727 | 0 | 3,301,487 |
| | #7 | Coal-thermal | 4,232,409 | 1,576,347 | 0 | 394 | 0 | 9,414,450 | 0 | 3,499 | 0 | 5,674 | 0 | 8,437 | 0 | 3,351,381 | 0 | 1,010 | 0 | 3,352,391 |
| | #8 | Coal-thermal | 3,730,433 | 1,382,469 | 0 | 1,397 | 0 | 8,259,637 | 0 | 12,330 | 0 | 5,676 | 0 | 8,385 | 0 | 2,940,288 | 0 | 3,560 | 0 | 2,943,848 |
| Hadong | #1 | Coal-thermal | 4,064,233 | 1,647,434 | 0 | 341 | 0 | 9,484,607 | 0 | 3,021 | 0 | 5,469 | 0 | 8,416 | 0 | 3,376,356 | 0 | 872 | 0 | 3,377,228 |
| | #2 | Coal-thermal | 3,799,030 | 1,551,648 | 0 | 648 | 0 | 8,866,100 | 0 | 5,768 | 0 | 5,428 | 0 | 8,456 | 0 | 3,156,178 | 0 | 1,666 | 0 | 3,157,844 |
| | #3 | Coal-thermal | 3,862,769 | 1,554,931 | 0 | 473 | 0 | 8,940,527 | 0 | 4,203 | 0 | 5,462 | 0 | 8,442 | 0 | 3,182,673 | 0 | 1,214 | 0 | 3,183,886 |
| | #4 | Coal-thermal | 4,049,790 | 1,634,941 | 0 | 226 | 0 | 9,404,544 | 0 | 2,008 | 0 | 5,465 | 0 | 8,441 | 0 | 3,347,855 | 0 | 580 | 0 | 3,348,435 |
| | #5 | Coal-thermal | 3,848,711 | 1,543,027 | 0 | 547 | 0 | 8,880,220 | 0 | 4,856 | 0 | 5,467 | 0 | 8,434 | 0 | 3,161,204 | 0 | 1,402 | 0 | 3,162,607 |
| | #6 | Coal-thermal | 4,085,588 | 1,637,877 | 0 | 286 | 0 | 9,422,188 | 0 | 2,531 | 0 | 5,465 | 0 | 8,407 | 0 | 3,354,136 | 0 | 731 | 0 | 3,354,867 |
| | #7 | Coal-thermal | 4,068,510 | 1,500,309 | 0 | 72 | 0 | 8,865,413 | 0 | 644 | 0 | 5,614 | 0 | 8,497 | 0 | 3,155,933 | 0 | 186 | 0 | 3,156,119 |
| | #8 | Coal-thermal | 3,153,402 | 1,169,132 | 0 | 692 | 0 | 6,922,269 | 0 | 5,575 | 0 | 5,625 | 0 | 7,654 | 0 | 2,464,208 | 0 | 1,610 | 0 | 2,465,818 |

*, **, ***: 2009Statistics of Electric Power in Korea, KEPCO, 2010.5.

***Operating Margin for 2009(continued)***

| Power plant (m) | | Fuel (i) Type | *Net Generation ($EG_{m,y}$) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Dangjin | #1 | Coal-thermal | 4,025,605 | 1,601,422 | 0 | 677 | 0 | 9,145,775 | 0 | 6,130 | 0 | 5,425 | 0 | 8,602 | 0 | 3,255,737 | 0 | 1,770 | 0 | 3,257,508 |
| | #2 | Coal-thermal | 3,964,389 | 1,572,097 | 0 | 291 | 0 | 8,973,906 | 0 | 2,618 | 0 | 5,423 | 0 | 8,547 | 0 | 3,194,555 | 0 | 756 | 0 | 3,195,311 |
| | #3 | Coal-thermal | 4,232,358 | 1,669,969 | 0 | 155 | 0 | 9,546,744 | 0 | 1,399 | 0 | 5,431 | 0 | 8,575 | 0 | 3,398,475 | 0 | 404 | 0 | 3,398,879 |
| | #4 | Coal-thermal | 4,195,301 | 1,658,923 | 0 | 110 | 0 | 9,486,178 | 0 | 994 | 0 | 5,432 | 0 | 8,585 | 0 | 3,376,915 | 0 | 287 | 0 | 3,377,202 |
| | #5 | Coal-thermal | 3,400,082 | 1,324,949 | 0 | 582 | 0 | 7,594,529 | 0 | 5,240 | 0 | 5,445 | 0 | 8,553 | 0 | 2,703,521 | 0 | 1,513 | 0 | 2,705,034 |
| | #6 | Coal-thermal | 3,471,850 | 1,330,803 | 0 | 517 | 0 | 7,659,364 | 0 | 4,642 | 0 | 5,468 | 0 | 8,530 | 0 | 2,726,601 | 0 | 1,340 | 0 | 2,727,941 |
| | #7 | Coal-thermal | 4,172,321 | 1,609,342 | 0 | 133 | 0 | 9,279,492 | 0 | 1,199 | 0 | 5,478 | 0 | 8,564 | 0 | 3,303,338 | 0 | 346 | 0 | 3,303,685 |
| | #8 | Coal-thermal | 3,531,321 | 1,334,679 | 0 | 625 | 0 | 7,745,212 | 0 | 5,625 | 0 | 5,513 | 0 | 8,550 | 0 | 2,757,161 | 0 | 1,624 | 0 | 2,758,786 |
| Yeongnam | #1 | Heavy oil-therm | 437,034 | 0 | 108,767 | 764 | 0 | 0 | 1,108,426 | 6,962 | 0 | 0 | 9,681 | 8,657 | 0 | 0 | 332,858 | 2,010 | 0 | 334,869 |
| | #2 | Heavy oil-therm | 415,404 | 0 | 104,675 | 647 | 0 | 0 | 1,067,038 | 5,931 | 0 | 0 | 9,684 | 8,709 | 0 | 0 | 320,430 | 1,713 | 0 | 322,142 |
| Yeosu | #1 | Heavy oil-therm | 466,519 | 0 | 113,633 | 187 | 0 | 0 | 1,126,663 | 1,645 | 0 | 0 | 9,419 | 8,357 | 0 | 0 | 338,335 | 475 | 0 | 338,810 |
| | #2 | Heavy oil-therm | 805,262 | 0 | 193,394 | 203 | 0 | 0 | 1,919,142 | 1,665 | 0 | 0 | 9,427 | 7,792 | 0 | 0 | 576,315 | 481 | 0 | 576,796 |
| Pyeongtaek | #1 | Heavy oil-therm | 251,576 | 0 | 56,671 | 354 | 2922 | 0 | 564,068 | 4,354 | 37,162 | 0 | 9,456 | 11,684 | 11,446 | 0 | 169,389 | 1,257 | 7,604 | 178,250 |
| | #2 | Heavy oil-therm | 1,211,425 | 0 | 280,922 | 696 | 4203 | 0 | 2,776,916 | 8,718 | 53,611 | 0 | 9,391 | 11,900 | 11,480 | 0 | 833,903 | 2,517 | 10,969 | 847,390 |
| | #3 | Heavy oil-therm | 1,225,561 | 0 | 282,894 | 581 | 4046 | 0 | 2,792,640 | 7,091 | 52,138 | 0 | 9,378 | 11,595 | 11,598 | 0 | 838,625 | 2,048 | 10,668 | 851,340 |
| | #4 | Heavy oil-therm | 834,285 | 0 | 192,380 | 545 | 3838 | 0 | 1,903,402 | 6,092 | 49,541 | 0 | 9,399 | 10,619 | 11,617 | 0 | 571,588 | 1,759 | 10,137 | 583,484 |
| Namjeju | #1 | Heavy oil-therm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #2 | Heavy oil-therm | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #3 | Heavy oil-therm | 550,851 | 0 | 140,564 | 143 | 0 | 0 | 1,388,934 | 1,281 | 0 | 0 | 9,387 | 8,510 | 0 | 0 | 417,094 | 370 | 0 | 417,464 |
| | #4 | Heavy oil-therm | 603,417 | 0 | 153,841 | 89 | 0 | 0 | 1,519,731 | 799 | 0 | 0 | 9,385 | 8,529 | 0 | 0 | 456,373 | 231 | 0 | 456,603 |
| Ulsan | #1 | Heavy oil-therm | 116,425 | 0 | 30,963 | 35 | 0 | 0 | 306,856 | 323 | 0 | 0 | 9,415 | 8,767 | 0 | 0 | 92,148 | 93 | 0 | 92,242 |
| | #2 | Heavy oil-therm | 104,292 | 0 | 27,250 | 41 | 0 | 0 | 270,082 | 375 | 0 | 0 | 9,416 | 8,689 | 0 | 0 | 81,105 | 108 | 0 | 81,213 |
| | #3 | Heavy oil-therm | *26,061* | 0 | 7139 | 35 | 0 | 0 | 70,629 | 318 | 0 | 0 | 9,399 | 8,631 | 0 | 0 | 21,210 | 92 | 0 | 21,302 |
| | #4 | Heavy oil-therm | *1,058,708* | 0 | 253330 | 2,938 | 0 | 0 | 2,529,556 | 26,341 | 0 | 0 | 9,486 | 8,517 | 0 | 0 | 759,621 | 7,606 | 0 | 767,228 |
| | #5 | Heavy oil-therm | 1,318,789 | 0 | 313,474 | 2,805 | 0 | 0 | 3,130,855 | 25,448 | 0 | 0 | 9,488 | 8,619 | 0 | 0 | 940,190 | 7,348 | 0 | 947,539 |
| | #6 | Heavy oil-therm | 1,215,616 | 0 | 288,842 | 2,460 | 0 | 0 | 2,885,571 | 22,272 | 0 | 0 | 9,491 | 8,601 | 0 | 0 | 866,532 | 6,431 | 0 | 872,963 |
| Jeju | #1 | Heavy oil-therm | *0* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #2 | Heavy oil-therm | 324,784 | 0 | 82,010 | 103 | 0 | 0 | 807,998 | 921 | 0 | 0 | 9,360 | 8,495 | 0 | 0 | 242,640 | 266 | 0 | 242,906 |
| | #3 | Heavy oil-therm | 356,297 | 0 | 91,221 | 72 | 0 | 0 | 897,589 | 647 | 0 | 0 | 9,348 | 8,537 | 0 | 0 | 269,544 | 187 | 0 | 269,731 |
| Seoul | #4 | Gas-thermal | 157,606 | 0 | 0 | 0 | 36,893 | 0 | 0 | 1 | 481,444 | 0 | 0 | 0 | 11,745 | 0 | 0 | 0 | 98,508 | 98,508 |
| | #5 | Gas-thermal | 412,265 | 0 | 0 | 0 | 91,258 | 0 | 0 | 4 | 1,190,441 | 0 | 0 | 0 | 11,740 | 0 | 0 | 0 | 243,575 | 243,575 |

*, **, ***: 2009Statistics of Electric Power in Korea, KEPCO, 2010.5.

## ***Operating Margin for 2009***

| Power plant (m) | | Fuel (i) Type | *Net Generation ($EG_{m,y}$) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Incheon | #1 | Gas-thermal | 72,854 | 0 | 0 | 0 | 15,168 | 0 | 0 | 0 | 197,826 | 0 | 0 | 0 | 11,738 | 0 | 0 | 0 | 40,477 | 40,477 |
| | #2 | Gas-thermal | 76,672 | 0 | 0 | 0 | 15,317 | 0 | 0 | 0 | 199,785 | 0 | 0 | 0 | 11,739 | 0 | 0 | 0 | 40,878 | 40,878 |
| | #3 | Gas-thermal | 11,865 | 0 | 0 | 47 | 2,411 | 0 | 0 | 423 | 31,486 | 0 | 0 | 8,550 | 11,753 | 0 | 0 | 122 | 6,442 | 6,564 |
| | #4 | Gas-thermal | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Namjeju D/P | | Internal combusti | 136,189 | 0 | 29,527 | 275 | 0 | 0 | 292,384 | 2,460 | 0 | 0 | 9,407 | 8,498 | 0 | 0 | 87,802 | 710 | 0 | 88,513 |
| Jeju G/T | | Internal combusti | 842 | 0 | 0 | 626 | 0 | 0 | 241,244 | 5,603 | 0 | 0 | 0 | 8,503 | 0 | 0 | 0 | 1,618 | 0 | 1,618 |
| Jeju D/P | | Internal combusti | 345,163 | 0 | 72,724 | 0 | 0 | 0 | 465,558 | 0 | 0 | 0 | 6,082 | 0 | 0 | 0 | 139,806 | 0 | 0 | 139,806 |
| Pyeongtaek C/C | | Combined cycl | 483,959 | 0 | 0 | 0 | 80,050 | 0 | 0 | 0 | 1,044,172 | 0 | 0 | 0 | 11,740 | 0 | 0 | 0 | 213,647 | 213,647 |
| Ilsan C/C | | Combined cycl | 3,270,241 | 0 | 0 | 0 | 595,190 | 0 | 0 | 0 | 7,761,613 | 0 | 0 | 0 | 11,737 | 0 | 0 | 0 | 1,588,095 | 1,588,095 |
| Bundang C/C | | Combined cycl | 3,108,338 | 0 | 0 | 13,142 | 541,739 | 0 | 0 | 0 | 6,946,110 | 0 | 0 | 0 | 11,540 | 0 | 0 | 33,755 | 1,421,236 | 1,454,991 |
| Ulsan C/C | | Combined cycl | 3,299,104 | 0 | 0 | 0 | 489,946 | 0 | 0 | 0 | 6,291,965 | 0 | 0 | 0 | 11,558 | 0 | 0 | 0 | 1,287,392 | 1,287,392 |
| Seoincheon C/C | | Combined cycl | 7,503,395 | 0 | 0 | 0 | 1,061,332 | 0 | 0 | 0 | 13,844,165 | 0 | 0 | 0 | 11,740 | 0 | 0 | 0 | 2,832,640 | 2,832,640 |
| Shinincheon C/C | | Combined cycl | 9,901,080 | 0 | 0 | 0 | 1,394,939 | 0 | 0 | 0 | 18,194,688 | 0 | 0 | 0 | 11,739 | 0 | 0 | 0 | 3,722,795 | 3,722,795 |
| Boryeong C/C | | Combined cycl | 3,655,848 | 0 | 0 | 86 | 543,342 | 0 | 0 | 0 | 7,079,157 | 0 | 0 | 0 | 11,726 | 0 | 0 | 221 | 1,448,459 | 1,448,680 |
| Incheon C/C | | Combined cycl | 6,075,599 | 0 | 0 | 0 | 806,154 | 0 | 0 | | 10,555,663 | 0 | 0 | 0 | 11,784 | 0 | 0 | 0 | 2,159,783 | 2,159,783 |
| Busan C/C | | Combined cycl | 9,268,113 | 0 | 0 | 0 | 1,247,488 | 0 | 0 | 0 | 16,282,354 | 0 | 0 | 0 | 11,747 | 0 | 0 | 0 | 3,331,515 | 3,331,515 |
| Hallim C/C | | Combined cycl | 47,256 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| GS Anyang C/C | | Combined cycl | 1,301,286 | 0 | 0 | 0 | 202,108 | 0 | 0 | 0 | 3,162,717 | 0 | 0 | 0 | 14,084 | 0 | 0 | 0 | 647,120 | 647,120 |
| GS Bucheon C/C | | Combined cycl | 1,556,502 | 0 | 0 | 0 | 230,085 | 0 | 0 | 0 | 3,638,371 | 0 | 0 | 0 | 14,232 | 0 | 0 | 0 | 744,443 | 744,443 |
| POSCO Power | | Combined cycl | 1,859,273 | 0 | 0 | 0 | 342,724 | 0 | 0 | 0 | 4,470,090 | 0 | 0 | 0 | 11,739 | 0 | 0 | 0 | 914,620 | 914,620 |
| GS EPS Bugog #1 | | Combined cycl | 2,172,135 | 0 | 0 | 0 | 343,063 | 0 | 0 | 0 | 4,968,103 | 0 | 0 | 0 | 13,033 | 0 | 0 | 0 | 1,016,518 | 1,016,518 |
| GS EPS Bugog #2 | | Combined cycl | 2,172,135 | | | | 260,169 | 0 | 0 | 0 | 3,431,600 | 0 | 0 | 0 | 11,871 | 0 | 0 | 0 | 702,136 | 702,136 |
| Yulchon C/C | | Combined cycl | 1,995,914 | 0 | 0 | 0 | 282,344 | 0 | 0 | 0 | 3,684,310 | 0 | 0 | 0 | 11,744 | 0 | 0 | 0 | 753,843 | 753,843 |
| | | | **$\Sigma_m EG_{m,y}$= 247,072,945** | | | | | | | | | | | | | | | | **$\Sigma_{i,m} FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ = 175,832,796** | |

*, **, ***: 2009Statistics of Electric Power in Korea, KEPCO, 2010.5.

$CO_2$ Emission Factor of fossil fuel type i (unit: $tCO_2/GJ$) ($EF_{CO2,i,y}$) 2172135.5

**$EF_{grid,OMsimple,y}=\Sigma_{i,m}FC_{i,m,y}*CV_{i,y}*EF_{CO2,i,y} / \Sigma_m EG_{m,y}$= 0.7117**

***Operating Margin for 2008(continued)***

| Power plant (m) | | Fuel (i) Type | *Net Generation ($EG_{m,y}$) (MWh) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Honam | #1 | Coal-thermal | 1,614,014 | 793,048 | 808 | 177 | 0 | 4,248,578 | 7,918 | 1,577 | 0 | 5,089 | 9,310 | 8,464 | 0 | 1,512,420 | 2,378 | 455 | 0 | 1,515,253 |
| | #2 | Coal-thermal | 1,816,464 | 887,772 | 1,225 | 167 | 0 | 4,770,388 | 12,004 | 1,489 | 0 | 5,105 | 9,309 | 8,470 | 0 | 1,698,175 | 3,605 | 430 | 0 | 1,702,210 |
| Samchonpo | #1 | Coal-thermal | 4,230,470 | 1,759,936 | 0 | 137 | 0 | 10,233,477 | 0 | 661 | 0 | 5,524 | 0 | 4,584 | 0 | 3,642,940 | 0 | 191 | 0 | 3,643,131 |
| | #2 | Coal-thermal | 3,931,527 | 1,628,693 | 0 | 1,065 | 0 | 9,439,903 | 0 | 9,383 | 0 | 5,506 | 0 | 8,370 | 0 | 3,360,442 | 0 | 2,709 | 0 | 3,363,151 |
| | #3 | Coal-thermal | 4,024,666 | 1,635,809 | 0 | 614 | 0 | 9,479,978 | 0 | 5,395 | 0 | 5,506 | 0 | 8,347 | 0 | 3,374,708 | 0 | 1,558 | 0 | 3,376,266 |
| | #4 | Coal-thermal | 4,118,892 | 1,662,981 | 0 | 726 | 0 | 9,669,501 | 0 | 6,383 | 0 | 5,524 | 0 | 8,352 | 0 | 3,442,175 | 0 | 1,843 | 0 | 3,444,018 |
| | #5 | Coal-thermal | 3,779,114 | 1,718,759 | 0 | 874 | 0 | 8,754,713 | 0 | 7,864 | 0 | 4,839 | 0 | 8,548 | 0 | 3,116,526 | 0 | 2,271 | 0 | 3,118,797 |
| | #6 | Coal-thermal | 4,071,070 | 1,844,647 | 0 | 448 | 0 | 9,389,450 | 0 | 4,033 | 0 | 4,836 | 0 | 8,552 | 0 | 3,342,481 | 0 | 1,165 | 0 | 3,343,646 |
| Yeongheung | #1 | Coal-thermal | 5,137,490 | 1,894,596 | 0 | 5,594 | 0 | 11,709,558 | 0 | 48,556 | 0 | 5,871 | 0 | 8,246 | 0 | 4,168,400 | 0 | 14,021 | 0 | 4,182,421 |
| | #2 | Coal-thermal | 5,112,704 | 1,881,013 | 0 | 3,033 | 0 | 11,622,058 | 0 | 26,963 | 0 | 5,870 | 0 | 8,445 | 0 | 4,137,251 | 0 | 7,786 | 0 | 4,145,037 |
| | #3 | Coal-thermal | 4,535,951 | 1,694,625 | 0 | 2,173 | 0 | 10,286,804 | 0 | 21,874 | 0 | 5,767 | 0 | 9,563 | 0 | 3,661,924 | 0 | 6,316 | 0 | 3,668,240 |
| | #4 | Coal-thermal | 3,193,481 | 1,217,547 | 0 | 769 | 0 | 7,396,690 | 0 | 6,811 | 0 | 5,771 | 0 | 8,414 | 0 | 2,633,093 | 0 | 1,967 | 0 | 2,635,060 |
| Boryeong | #1 | Coal-thermal | 4,017,302 | 1,697,622 | 0 | 566 | 0 | 9,653,929 | 0 | 5,060 | 0 | 5,402 | 0 | 8,493 | 0 | 3,436,631 | 0 | 1,461 | 0 | 3,438,093 |
| | #2 | Coal-thermal | 3,247,137 | 1,328,646 | 0 | 196 | 0 | 7,611,359 | 0 | 1,753 | 0 | 5,442 | 0 | 8,497 | 0 | 2,709,512 | 0 | 506 | 0 | 2,710,018 |
| | #3 | Coal-thermal | 3,733,602 | 1,528,112 | 0 | 223 | 0 | 8,649,383 | 0 | 2,666 | 0 | 5,377 | 0 | 11,357 | 0 | 3,079,030 | 0 | 770 | 0 | 3,079,800 |
| | #4 | Coal-thermal | 4,162,971 | 1,694,212 | 0 | 339 | 0 | 9,606,801 | 0 | 3,052 | 0 | 5,387 | 0 | 8,553 | 0 | 3,419,855 | 0 | 881 | 0 | 3,420,736 |
| | #5 | Coal-thermal | 3,677,963 | 1,503,611 | 0 | 642 | 0 | 8,515,176 | 0 | 6,224 | 0 | 5,380 | 0 | 9,210 | 0 | 3,031,255 | 0 | 1,797 | 0 | 3,033,052 |
| | #6 | Coal-thermal | 4,170,094 | 1,704,157 | 0 | 301 | 0 | 9,661,509 | 0 | 2,746 | 0 | 5,386 | 0 | 8,667 | 0 | 3,439,330 | 0 | 793 | 0 | 3,440,123 |
| | #7 | Coal-thermal | 2,878,738 | 1,102,498 | 0 | 2,696 | 0 | 6,326,499 | 0 | 23,097 | 0 | 5,451 | 0 | 8,139 | 0 | 2,252,124 | 0 | 6,670 | 0 | 2,258,794 |
| | #8 | Coal-thermal | 748,005 | 227,312 | 0 | 1,060 | 0 | 1,292,365 | 0 | 5,383 | 0 | 5,401 | 0 | 4,824 | 0 | 460,060 | 0 | 1,554 | 0 | 461,614 |
| Taean | #1 | Coal-thermal | 3,894,659 | 1,493,418 | 0 | 589 | 0 | 8,860,505 | 0 | 5,188 | 0 | 5,636 | 0 | 8,368 | 0 | 3,154,186 | 0 | 1,498 | 0 | 3,155,684 |
| | #2 | Coal-thermal | 4,093,884 | 1,570,393 | 0 | 146 | 0 | 9,320,865 | 0 | 1,294 | 0 | 5,639 | 0 | 8,420 | 0 | 3,318,066 | 0 | 374 | 0 | 3,318,440 |
| | #3 | Coal-thermal | 3,763,910 | 1,442,632 | 0 | 551 | 0 | 8,551,775 | 0 | 4,870 | 0 | 5,632 | 0 | 8,397 | 0 | 3,044,284 | 0 | 1,406 | 0 | 3,045,690 |
| | #4 | Coal-thermal | 4,119,808 | 1,582,461 | 0 | 122 | 0 | 9,391,296 | 0 | 1,056 | 0 | 5,638 | 0 | 8,223 | 0 | 3,343,139 | 0 | 305 | 0 | 3,343,444 |
| | #5 | Coal-thermal | 4,089,287 | 1,566,721 | 0 | 363 | 0 | 9,333,755 | 0 | 3,144 | 0 | 5,660 | 0 | 8,228 | 0 | 3,322,655 | 0 | 908 | 0 | 3,323,563 |
| | #6 | Coal-thermal | 3,711,227 | 1,419,495 | 0 | 626 | 0 | 8,460,054 | 0 | 5,494 | 0 | 5,662 | 0 | 8,338 | 0 | 3,011,633 | 0 | 1,586 | 0 | 3,013,219 |
| | #7 | Coal-thermal | 3,482,731 | 1,285,747 | 0 | 1,224 | 0 | 7,714,591 | 0 | 10,763 | 0 | 5,700 | 0 | 8,354 | 0 | 2,746,261 | 0 | 3,108 | 0 | 2,749,369 |
| | #8 | Coal-thermal | 4,186,293 | 1,553,992 | 0 | 635 | 0 | 9,267,809 | 0 | 5,612 | 0 | 5,666 | 0 | 8,396 | 0 | 3,299,179 | 0 | 1,621 | 0 | 3,300,800 |
| Hadong | #1 | Coal-thermal | 3,827,102 | 1,478,000 | 0 | 355 | 0 | 8,680,226 | 0 | 3,131 | 0 | 5,579 | 0 | 8,379 | 0 | 3,090,010 | 0 | 904 | 0 | 3,090,914 |
| | #2 | Coal-thermal | 4,012,667 | 1,551,832 | 0 | 311 | 0 | 9,096,751 | 0 | 2,731 | 0 | 5,569 | 0 | 8,342 | 0 | 3,238,286 | 0 | 789 | 0 | 3,239,074 |
| | #3 | Coal-thermal | 4,074,310 | 1,573,892 | 0 | 474 | 0 | 9,236,752 | 0 | 4,231 | 0 | 5,575 | 0 | 8,480 | 0 | 3,288,124 | 0 | 1,222 | 0 | 3,289,345 |
| | #4 | Coal-thermal | 3,804,790 | 1,469,828 | 0 | 495 | 0 | 8,620,218 | 0 | 4,409 | 0 | 5,572 | 0 | 8,462 | 0 | 3,068,648 | 0 | 1,273 | 0 | 3,069,921 |
| | #5 | Coal-thermal | 4,114,218 | 1,592,246 | 0 | 256 | 0 | 9,340,613 | 0 | 2,288 | 0 | 5,573 | 0 | 8,491 | 0 | 3,325,096 | 0 | 661 | 0 | 3,325,757 |
| | #6 | Coal-thermal | 3,953,083 | 1,525,471 | | 521 | 0 | 8,948,019 | 0 | 4,614 | 0 | 5,572 | 0 | 8,413 | 0 | 3,185,340 | 0 | 1,332 | 0 | 3,186,672 |
| | #7 | Coal-thermal | 870,781 | 310,138 | 0 | 2,900 | 0 | 1,892,701 | 0 | 23,033 | 0 | 5,798 | 0 | 7,545 | 0 | 673,769 | 0 | 6,651 | 0 | 680,420 |

*, **, ***: 2008Statistics of Electric Power in Korea, KEPCO, 2009.5.

***Operating Margin for 2008(continued)***

| Power plant (m) | | Fuel (i) Type | *Net Generation ($EG_{m,y}$) (MWh) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Dangjin | #1 | Coal-thermal | 3,991,074 | 1,559,086 | 0 | 60 | 0 | 9,058,810 | 0 | 545 | 0 | 5,520 | 0 | 8,629 | 0 | 3,224,779 | 0 | 157 | 0 | 3,224,937 |
| | #2 | Coal-thermal | 4,162,369 | 1,621,753 | 0 | 136 | 0 | 9,390,115 | 0 | 1,222 | 0 | 5,501 | 0 | 8,536 | 0 | 3,342,718 | 0 | 353 | 0 | 3,343,071 |
| | #3 | Coal-thermal | 3,800,792 | 1,474,550 | 0 | 751 | 0 | 8,557,506 | 0 | 6,758 | 0 | 5,513 | 0 | 8,549 | 0 | 3,046,324 | 0 | 1,951 | 0 | 3,048,275 |
| | #4 | Coal-thermal | 3,737,406 | 1,457,994 | 0 | 771 | 0 | 8,445,848 | 0 | 6,872 | 0 | 5,503 | 0 | 8,467 | 0 | 3,006,576 | 0 | 1,984 | 0 | 3,008,560 |
| | #5 | Coal-thermal | 3,908,658 | 1,490,658 | 0 | 250 | 0 | 8,739,255 | 0 | 2,267 | 0 | 5,570 | 0 | 8,615 | 0 | 3,111,023 | 0 | 655 | 0 | 3,111,678 |
| | #6 | Coal-thermal | 4,006,307 | 1,509,171 | 0 | 132 | 0 | 8,836,168 | 0 | 1,187 | 0 | 5,562 | 0 | 8,543 | 0 | 3,145,523 | 0 | 343 | 0 | 3,145,865 |
| | #7 | Coal-thermal | 3,336,619 | 1,264,913 | 0 | 645 | 0 | 7,430,976 | 0 | 5,211 | 0 | 5,581 | 0 | 7,675 | 0 | 2,645,299 | 0 | 1,505 | 0 | 2,646,803 |
| | #8 | Coal-thermal | 3,992,732 | 1,494,311 | 0 | 314 | 0 | 8,754,372 | 0 | 2,826 | 0 | 5,566 | 0 | 8,550 | 0 | 3,116,405 | 0 | 816 | 0 | 3,117,221 |
| Ulsan | #1 | Heavy oil-thermal | 114,753 | 0 | 30,689 | 565 | 0 | 0 | 304,937 | 5,140 | 0 | 0 | 9,440 | 8,642 | 0 | 0 | 91,572 | 1,484 | 0 | 93,056 |
| | #2 | Heavy oil-thermal | 108,931 | 0 | 29,228 | 562 | 0 | 0 | 290,548 | 5,127 | 0 | 0 | 9,444 | 8,667 | 0 | 0 | 87,251 | 1,480 | 0 | 88,732 |
| | #3 | Heavy oil-thermal | 123,706 | 0 | 32,541 | 480 | 0 | 0 | 323,370 | 4,381 | 0 | 0 | 9,440 | 8,671 | 0 | 0 | 97,107 | 1,265 | 0 | 98,373 |
| | #4 | Heavy oil-thermal | 945,479 | 0 | 228,138 | 4,016 | 0 | 0 | 2,285,115 | 36,616 | 0 | 0 | 9,516 | 8,662 | 0 | 0 | 686,216 | 10,573 | 0 | 696,789 |
| | #5 | Heavy oil-thermal | 678,426 | 0 | 163,748 | 2,956 | 0 | 0 | 1,642,627 | 27,034 | | 0 | 9,530 | 8,688 | 0 | 0 | 493,278 | 7,806 | 0 | 501,084 |
| | #6 | Heavy oil-thermal | 937,531 | 0 | 225,645 | 3,757 | 0 | 0 | 2,259,541 | 34,253 | | 0 | 9,513 | 8,661 | 0 | 0 | 678,536 | 9,891 | 0 | 688,427 |
| Yeongnam | #1 | Heavy oil-thermal | 229,316 | 0 | 59,763 | 1,476 | 0 | 0 | 608,600 | 13,123 | | 0 | 9,674 | 8,446 | 0 | 0 | 182,762 | 3,789 | 0 | 186,551 |
| | #2 | Heavy oil-thermal | 149,357 | 0 | 40,030 | 802 | 0 | 0 | 407,726 | 7,137 | | 0 | 9,676 | 8,454 | 0 | 0 | 122,439 | 2,061 | 0 | 124,500 |
| Yeosu | #1 | Heavy oil-thermal | 130,854 | 0 | 32,576 | 202 | 0 | 0 | 324,018 | 1,780 | | 0 | 9,449 | 8,371 | 0 | 0 | 97,302 | 514 | 0 | 97,816 |
| | #2 | Heavy oil-thermal | 454,052 | 0 | 111,854 | 341 | 0 | 0 | 1,112,340 | 2,998 | | 0 | 9,447 | 8,352 | 0 | 0 | 334,034 | 866 | 0 | 334,899 |
| Pyeongtaek | #1 | Heavy oil-thermal | 386,361 | 0 | 91,937 | 77 | 2,562 | 0 | 911,951 | 691 | 32,996 | 0 | 9,423 | 8,525 | 11,591 | 0 | 273,857 | 200 | 6,751 | 280,808 |
| | #2 | Heavy oil-thermal | 534,121 | 0 | 125,789 | 90 | 4,744 | 0 | 1,248,562 | 808 | 61,481 | 0 | 9,430 | 8,529 | 11,664 | 0 | 374,941 | 233 | 12,580 | 387,754 |
| | #3 | Heavy oil-thermal | 576,432 | 0 | 135,720 | 145 | 4,232 | 0 | 1,346,657 | 1,286 | 54,613 | 0 | 9,426 | 8,426 | 11,614 | 0 | 404,399 | 371 | 11,174 | 415,944 |
| | #4 | Heavy oil-thermal | 365,269 | 0 | 86,454 | 100 | 3,020 | 0 | 857,048 | 894 | 39,129 | 0 | 9,418 | 8,493 | 11,661 | 0 | 257,370 | 258 | 8,006 | 265,634 |
| Namjeju | #1 | Heavy oil-thermal | *0* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #2 | Heavy oil-thermal | *0* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #3 | Heavy oil-thermal | 559,817 | 0 | 132,984 | 146 | 0 | 0 | 1,317,986 | 1,313 | 0 | 0 | 9,415 | 8,543 | 0 | 0 | 395,789 | 379 | 0 | 396,168 |
| | #4 | Heavy oil-thermal | 517,866 | 0 | 119,301 | 127 | 0 | 0 | 1,174,897 | 1,148 | 0 | 0 | 9,356 | 8,587 | 0 | 0 | 352,819 | 332 | 0 | 353,151 |
| Jeju | #1 | Heavy oil-thermal | *0* | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| | #2 | Heavy oil-thermal | 336,676 | 0 | 84,258 | 81 | 0 | 0 | 835,778 | 724 | 0 | 0 | 9,423 | 8,491 | 0 | 0 | 250,983 | 209 | 0 | 251,192 |
| | #3 | Heavy oil-thermal | 357,666 | 0 | 89,652 | 101 | 0 | 0 | 889,078 | 899 | 0 | 0 | 9,421 | 8,456 | 0 | 0 | 266,989 | 260 | 0 | 267,248 |
| Seoul | #4 | Gas-thermal | 258,052 | 0 | 0 | 1 | 55,095 | 0 | 0 | 7 | 718,601 | 0 | 0 | 6,650 | 11,739 | 0 | 0 | 2 | 147,032 | 147,034 |
| | #5 | Gas-thermal | 596,641 | 0 | 0 | 0 | 138,068 | 0 | | 2 | 1,800,108 | 0 | 0 | 0 | 11,734 | 0 | 0 | 0 | 368,318 | 368,318 |

*, **, ***: 2008Statistics of Electric Power in Korea, KEPCO, 2009.5.

***Operating Margin for 2008***

| Power plant (m) | Fuel (i) Type | *Net Generation ($EG_{m,y}$) (MWh) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption ($10^6$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | |
| Incheon #1 | Gas-thermal | 141,085 | 0 | 0 | 0 | 28,582 | 0 | | 0 | 372,705 | 0 | 0 | 0 | 11,736 | 0 | 0 | 0 | 76,259 | 76,259 |
| #2 | Gas-thermal | 152,576 | 0 | 0 | 0 | 30,186 | 0 | | 0 | 393,650 | 0 | 0 | 0 | 11,737 | 0 | 0 | 0 | 80,544 | 80,544 |
| #3 | Gas-thermal | 162,092 | 0 | 0 | 292 | 32,472 | 0 | | 2,606 | 423,524 | 0 | 0 | 8,478 | 11,738 | 0 | 0 | 753 | 86,657 | 87,409 |
| #4 | Gas-thermal | 139,637 | 0 | 0 | 238 | 27,637 | 0 | 0 | 2,119 | 360,318 | 0 | 0 | 8,458 | 11,734 | 0 | 0 | 612 | 73,724 | 74,336 |
| Namjeju D/P | Internal combustion | 93,201 | 0 | 19,875 | 482 | 0 | 0 | 196,494 | 4,337 | 0 | 0 | 9,392 | 8,548 | 0 | 0 | 59,007 | 1,252 | 0 | 60,259 |
| Jeju G/T | Internal combustion | 643 | 0 | 0 | 503 | 0 | 0 | 0 | 4,478 | 0 | 0 | 0 | 8,457 | 0 | 0 | 0 | 1,293 | 0 | 1,293 |
| Jeju D/P | Internal combustion | 223,630 | 0 | 46,728 | 0 | 0 | 0 | 462,719 | 0 | 0 | 0 | 9,407 | 0 | 0 | 0 | 138,954 | 0 | 0 | 138,954 |
| Pyeongtaek C/C | Combined cycle | 903,201 | 0 | 0 | 0 | 150,276 | 0 | 0 | | 1,960,964 | 0 | 0 | 0 | 11,744 | 0 | 0 | 0 | 401,231 | 401,231 |
| Ilsan C/C | Combined cycle | 3,491,175 | 0 | 0 | 0 | 636,633 | 0 | 0 | | 8,298,558 | 0 | 0 | 0 | 11,732 | 0 | 0 | 0 | 1,697,959 | 1,697,959 |
| Bundang C/C | Combined cycle | 3,748,232 | 0 | 0 | 0 | 651,005 | 0 | 0 | | 8,489,943 | 0 | 0 | 0 | 11,737 | 0 | 0 | 0 | 1,737,118 | 1,737,118 |
| Ulsan C/C | Combined cycle | 4,454,326 | 0 | 0 | 0 | 655,938 | 0 | 0 | | 8,489,348 | 0 | 0 | 0 | 11,648 | 0 | 0 | 0 | 1,736,996 | 1,736,996 |
| Seoincheon C/C | Combined cycle | 10,308,626 | 0 | 0 | 721 | 1,436,788 | 0 | 0 | | 18,741,071 | 0 | 0 | 0 | 11,739 | 0 | 0 | 0 | 3,834,590 | 3,834,590 |
| Shinincheon C/C | Combined cycle | 11,531,252 | 0 | 0 | 0 | 1,607,180 | 0 | 0 | | 20,962,220 | 0 | 0 | 0 | 11,739 | 0 | 0 | 0 | 4,289,057 | 4,289,057 |
| Boryeong C/C | Combined cycle | 6,126,641 | 0 | 0 | 0 | 894,790 | 0 | 0 | | 11,664,738 | 0 | 0 | 0 | 11,733 | 0 | 0 | 0 | 2,386,709 | 2,386,709 |
| Incheon C/C | Combined cycle | 3,420,631 | 0 | 0 | 0 | 459,923 | 0 | 0 | | 5,977,405 | 0 | 0 | 0 | 11,697 | 0 | 0 | 0 | 1,223,030 | 1,223,030 |
| Busan C/C | Combined cycle | 10,848,484 | 0 | 0 | 0 | 1,456,370 | 0 | 0 | 0 | 18,981,134 | 0 | 0 | 0 | 11,730 | 0 | 0 | 0 | 3,883,709 | 3,883,709 |
| Hallim C/C | Combined cycle | 23,547 | 0 | 0 | 6,883 | 0 | 0 | 0 | 61,841 | 0 | 0 | 0 | 8,535 | 0 | 0 | 0 | 17,857 | 0 | 17,857 |
| GS Anyang C/C | Combined cycle | 1,638,638 | 0 | 0 | 0 | 292,931 | 0 | 0 | 0 | 3,845,837 | 0 | 0 | 0 | 11,816 | 0 | 0 | 0 | 786,893 | 786,893 |
| GS Bucheon C/C | Combined cycle | 1,657,898 | 0 | 0 | 0 | 302,746 | 0 | 0 | 0 | 3,764,533 | 0 | 0 | 0 | 11,191 | 0 | 0 | 0 | 770,257 | 770,257 |
| POSCO Power | Combined cycle | 3,328,129 | 0 | 0 | 0 | 587,956 | 0 | 0 | 0 | 7,669,589 | 0 | 0 | 0 | 11,740 | 0 | 0 | 0 | 1,569,266 | 1,569,266 |
| GS EPS Bugog #1 | Combined cycle | 2,754,546 | 0 | 0 | 0 | 433,004 | 0 | 0 | 0 | 5,476,761 | 0 | 0 | 0 | 11,383 | 0 | 0 | 0 | 1,120,594 | 1,120,594 |
| GS EPS Bugog #2 | Combined cycle | 2,754,546 | | | | 276,112 | 0 | 0 | 0 | 4,044,539 | 0 | 0 | 0 | 13,183 | 0 | 0 | 0 | 827,549 | 827,549 |
| Yulchon C/C | Combined cycle | 2,488,267 | 0 | 0 | 0 | 347,123 | 0 | 0 | 0 | 4,526,895 | 0 | 0 | 0 | 11,737 | 0 | 0 | 0 | 926,243 | 926,243 |
| | **$\Sigma_m EG_{m,y}$= 237,888,671** | | | | | | | | | | | | | | | | **$\sum_{i,m} FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ =** | | **163,529,778** |

*, **, ***: 2008 Statistics of Electric Power in Korea, KEPCO, 2009.

$CO_2$ Emission Factor of fossil fuel type i (unit: $tCO_2/GJ$) ($EF_{CO2,i,y}$)

**$EF_{grid,OMsimple,y} = \Sigma_{i,m} FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y} / \Sigma_m EG_{m,y}$ = 0.6874**

# Build Margin (BM) calculation

For the calculation of the Build Margin emission factor ($EF_{grid,BM,y}$), the sample group *m* is selected according to Option 1.

| 2010 Net Generation (MWh) | | Percentage | Remark |
|---|---|---|---|
| Grid total | 455,095,515 | 100.00% | |
| Sample group m - five plants | 1,281,700 | 0.28% | |
| Sample group m - 20% plants | 92,307,706 | 20.28% | Selected |

***Carbon Emission Factor***

$CO_2$ Emission Factor of fossil fuel type i (unit: $tCO_2/GJ$) ($EF_{CO2,i,y}$)

| | |
|---|---|
| Bituminous coal | 0.089500 |
| Heavy Oil | 0.075500 |
| Diesel Oil | 0.072600 |
| LNG | 0.054300 |

*Source:: IPCC 2006

IPCC default values at the lower limit of the uncertainty at a 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol. 2 of 2006 IPCC Guidance.

***BM for the project activity***

Build margin for 2010: 0.6357 $tCO_2/MWh$

$$EF_{grid,BM,y} = 0.6357\ tCO_2/MWh$$

***Build Margin for 2010(continued)***

| Plant (m) | | Fuel (i) type | Net Generation ($EG_{m,y}$) (MWh) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption($10^6$ Kcal) | | | | Net Calorific value (NCVi,y) | | | | $FC_{i,m,y} * NCV_{i,y} * EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) | $EF_{EL,m,y}$ ($tCO_2$/MWh) | $EG_{m,y} * EF_{EL,m,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | | | |
| Haengwon hydro | 2010.12 | hydro | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Gunwi hydro | 2010.11 | small hydro | 228 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Haengwon solar | 2010.11 | solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Dangjin solar | 2010.10 | solar | 265 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yeongwol | 2010.10 | Combined | 1,281,206 | 0 | 0 | 263 | 182,365 | 0 | 0 | 2,353 | 2,380,779 | 0 | 0 | 8,499 | 11,750 | 0 | 0 | 679 | 487,129 | 487,808 | 0.381 | 487,808 |
| Yecheon solar | 2010.10 | solar | 5,057 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Seolibo hydro | 2010.08 | hydro | 108 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| singori | 2010.08 | Nuclear | 1,121,956 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Yeongheung wind | 2010.05 | Wind | 2,238 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Gunsan | 2010.05 | Combined | 2,937,873 | 0 | 0 | 0 | 398,151 | 0 | 0 | 0 | 5,196,105 | 0 | 0 | 0 | 11,746 | 0 | 0 | 0 | 1,063,169 | 1,063,169 | 0.362 | 1,063,169 |
| Pangweo | 2010.02 | small hydro | 2,154 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Dangjin hydro | 2010.01 | hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Gosan | 2009.12 | small hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Ilsan fuel cell | 2009. 09 | fuel cell | 18,492 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Boryeong#1 | 2009.07 | small hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Wooldolmok | 2009.05 | small hydro | 1,039 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Seongju | 2009 | small hydro | 4,171 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Boseong | 2009 | small hydro | 3,973 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Hadong #8 | 2009. 06 | Coal-thermal | 4,221,464 | 1,586,695 | 0 | 34 | 0 | 9,228,319 | 0 | 307 | 0 | 5,525 | 0 | 8,578 | 0 | 3,285,122 | 0 | 89 | 0 | 3,285,210 | 0.778 | 3,285,210 |
| Seongsan-wind | 2009. 04 | Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Daehanboryeong | 2009 | small hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yeongwol solar | 2009 | solar | 54 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Hadong #7 | 2008.12 | Coal-thermal | 3,497,189 | 1,572,939 | 0 | 347 | 0 | 7,647,412 | 0 | 6,012 | 0 | 4,619 | 0 | 16,459 | 0 | 2,722,346 | 0 | 1,736 | 0 | 2,724,082 | 0.779 | 2,724,082 |
| Boryeong # 8 | 2008.12 | Coal-thermal | 3,787,312 | 1,493,422 | 0 | 439 | 0 | 8,260,560 | 0 | 3,843 | 0 | 5,255 | 0 | 8,316 | 0 | 2,940,616 | 0 | 1,110 | 0 | 2,941,726 | 0.777 | 2,941,726 |
| Yeongheung #4 | 2008.12 | Coal-thermal | 6,943,045 | 2,821,533 | 0 | 663 | 0 | 15,975,433 | 0 | 5,849 | 0 | 5,379 | 0 | 8,381 | 0 | 5,686,977 | 0 | 1,689 | 0 | 5,688,666 | 0.819 | 5,688,666 |
| Seongnam2 | 2008.10 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Jeju Solar | 2008.09 | Solar | 57 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Boryeong fuel cell | 2008.09 | fuel cell | 1,999 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Busan C/C solar | 2008.07 | Solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Hadong solar | 2008.07 | Solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yeongheung #3 | 2008.06 | Coal-thermal | 6,887,344 | 2,778,041 | 0 | 739 | 0 | 15,751,410 | 0 | 6,527 | 0 | 5,386 | 0 | 8,391 | 0 | 5,607,229 | 0 | 1,885 | 0 | 5,609,114 | 0.814 | 5,609,114 |
| Boryeong #7 | 2008.06 | Coal-thermal | 4,189,558 | 1,670,727 | 0 | 662 | 0 | 9,221,913 | 0 | 5,799 | 0 | 5,244 | 0 | 8,322 | 0 | 3,282,841 | 0 | 1,675 | 0 | 3,284,516 | 0.784 | 3,284,516 |
| Boryeong 2 | 2008.06 | Hydro | 1,338 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Tacan | 2008.06 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Hongikdongjin | 2008.06 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Deacheongdaem | 2008.06 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| kori-wind power | 2008.05 | Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Samlangjin solar | 2008.04 | solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Boryeong solar | 2008.04 | Solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Boryeong | 2008.03 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yeongheung | 2008.03 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yeonggwang solar park | 2008.03 | solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yulhyeon | 2008.02 | Hydro | 1,248 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Hangyeong wind | 2008.02 | Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Daecheong dam | 2008.02 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Kyeongcheon | 2008.02 | Hydro | 1,214 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Seocheon solar | 2008.01 | Solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |

***Build Margin for 2010***

| Plant (m) | | Fuel (i) type | *Net Generation ($EG_{m,y}$) | **Fuel consumption ($FC_{i,m,y}$) | | | | ***Calorific Consumption((10⁴ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{i,m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}$ | | | | $\sum_i FC_{i,m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) | $EF_{EL,m,y}$ ($tCO_2$/MWh) | $EG_{m,y} * EF_{EL,m,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | | | |
| Dangjin #8 | 2007.12 | Coal-thermal | 4,272,866 | 1,729,056 | 0 | 90 | 0 | 9,447,782 | 0 | 805 | 0 | 5,191 | 0 | 8,497 | 0 | 3,363,247 | 0 | 232 | 0 | 3,363,479 | 0.787 | 3,363,479 |
| Gomun | 2007.08 | hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Taean #8 | 2007.08 | Coal-thermal | 4,335,230 | 1,674,579 | 0 | 240 | 0 | 9,617,658 | 0 | 2,130 | 0 | 5,456 | 0 | 8,431 | 0 | 3,423,720 | 0 | 615 | 0 | 3,424,335 | 0.790 | 3,424,335 |
| Dangjin #7 | 2007.06 | Coal-thermal | 3,870,155 | 1,572,939 | 0 | 347 | 0 | 8,621,062 | 0 | 3,117 | 0 | 5,207 | 0 | 8,534 | 0 | 3,068,949 | 0 | 900 | 0 | 3,069,849 | 0.793 | 3,069,849 |
| Yonggwang solar park | 2007.06 | solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Wonjungru | 2007.05 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Baekgok | 2007.05 | Hydro | 1,144 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Damyang | 2007.05 | Hydro | 1,727 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Juam | 2007.05 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Namjeju #4 | 2007.05 | Heavy oil-thermal | 580,342 | 0 | 146,544 | 134 | 0 | 0 | 1,451,580 | 1,195 | 0 | 0 | 9,410 | 8,472 | 0 | 0 | 435,907 | 345 | 0 | 436,252 | 0.752 | 436,252 |
| Samcheonpo | 2007.02 | hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Dalhang | 2007.02 | hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Hapcheon | 2007.02 | Hydro | 7,472 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Taean #7 | 2007.02 | Coal-thermal | 3,940,580 | 1,521,262 | 0 | 879 | 0 | 8,758,319 | 0 | 7,800 | 0 | 5,469 | 0 | 8,430 | 0 | 3,117,810 | 0 | 2,252 | 0 | 3,120,062 | 0.792 | 3,120,062 |
| Cheongsong gumping #2 | 2006.12 | gumping | 305,821 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Bundang fuel cell | 2006.10 | fuel cell | 1,769 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Namjeju #3 | 2006.09 | thermal | 594,537 | 0 | 151,950 | 105 | 0 | 0 | 1,505,154 | 940 | 0 | 0 | 9,410 | 8,505 | 0 | 0 | 451,995 | 271 | 0 | 452,267 | 0.761 | 452,267 |
| Cheongsong gumping #1 | 2006.09 | gumping | 301,551 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Yongheung solar | 2006.09 | solar | 1,160 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Yangyang gumping #4 | 2006.08 | gumping | 204,280 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Donghae solar | 2006.08 | solar | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Gangwon wind power | 2006.07 | Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Yangyang | 2006.06 | Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Yangyang gumping #3 | 2006.06 | gumping | 194,083 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Hadongho | 2006.06 | small hydro power | 2,923 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Jangseong | 2006.05 | small hydro power | 2,056 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Dangjin #6 | 2006.04 | thermal | 4,242,960 | 1,722,658 | 0 | 157 | 0 | 9,419,756 | 0 | 1,408 | 0 | 5,195 | 0 | 8,520 | 0 | 3,353,270 | 0 | 407 | 0 | 3,353,676 | 0.790 | 3,353,676 |
| Yangyang gumping #2 | 2006.04 | gumping | 194,653 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Yangyang gumping #1 | 2006.02 | Hydro-gumping | 122,320 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Samcheonpo solar | 2005.12 | Solar | 1,129 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Janghengdam | 2005.12 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Dangjin #5 | 2005.11 | Coal-thermal | 4,133,329 | 1,676,374 | 0 | 332 | 0 | 9,172,326 | 0 | 2,982 | 0 | 5,198 | 0 | 8,533 | 0 | 3,265,189 | 0 | 861 | 0 | 3,266,050 | 0.790 | 3,266,050 |
| Yangyang | 2005.10 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Taean solar | 2005.10 | Solar | 116 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Jeju D/P | 2005.07 | Internal combustion | 405,634 | 0 | 85,093 | 0 | 0 | 0 | 839,395 | 0 | 0 | 0 | 9,371 | 0 | 0 | 0 | 252,068 | 0 | 0 | 252,068 | 0.621 | 252,068 |
| Yulchon C/C | 2005.07 | Combined cycle | 2,680,710 | 0 | 0 | 0 | 372,560 | 0 | 0 | 0 | 4,863,307 | 0 | 0 | 0 | 11,748 | 0 | 0 | 0 | 995,076 | 995,076 | 0.371 | 995,076 |
| Daegok | 2005.07 | Hydro | 1,038 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Donghwa | 2005.07 | Hydro | 3,289 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | 0 |
| Incheon C/C | 2005.07 | Combined cycle | 7,789,931 | 0 | 0 | 0 | 1,035,486 | 0 | 0 | 0 | 13,513,313 | 0 | 0 | 0 | 11,745 | 0 | 0 | 0 | 2,764,944 | 2,764,944 | 0.355 | 2,764,944 |
| Ulchin #6 | 2005.04 | Nuclear | 7,991,038 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |

***Build Margin for 2010***

| Plant (m) | | Fuel (i) type | *Net Generation ($EG_{m,y}$) | **Fuel consumption ($FC_{m,y}$) | | | | ***Calorific Consumption($10^3$ Kcal) | | | | Net Calorific value ($NCV_{i,y}$) | | | | $FC_{m,y} \cdot NCV_{i,y} \cdot EF_{CO2,i,y}$ | | | | $\sum_i FC_{m,y} * CV_{i,y} * EF_{CO2,i,y}$ ($tCO_2$) | $EF_{EL,m,y}$ ($tCO_2$/MWh) | $EG_{m,y} * EF_{EL,m,y}$ ($tCO_2$) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Bituminous coal (ton) | Heavy oil (kl) | Diesel Oil (kl) | LNG (ton) | Bituminous coal (kcal/kg) | Heavy oil (kcal/l) | Diesel Oil (kcal/l) | LNG (kcal/kg) | Bituminous coal (kJ/kg) | Heavy oil (kJ/l) | Diesel Oil (kJ/l) | LNG (kJ/kg) | Bituminous coal ($tCO_2$) | Heavy oil ($tCO_2$) | Diesel Oil ($tCO_2$) | LNG ($tCO_2$) | | | |
| Sungnam | 2004.12 | Hydro | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yungduk-wind power | 2004.12 | Wind | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yongdam | 2004.12 | Hydro | 26,825 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0.000 | - |
| Yeongheung #2 | 2004.11 | Coal-thermal | 5,627,774 | 2,264,564 | 0 | 1,531 | 0 | 12,951,441 | 0 | 13,507 | 0 | 5,433 | 0 | 8,381 | 0 | 4,610,489 | 0 | 3,900 | 0 | 4,614,389 | 0.820 | 4,614,389 |
| Yeongheung #1 | 2004.07 | Coal-thermal | 5,558,681 | 2,201,446 | 0 | 2,189 | 0 | 12,587,273 | 0 | 19,325 | 0 | 5,432 | 0 | 8,387 | 0 | 4,480,851 | 0 | 5,580 | 0 | 4,486,431 | 0.807 | 4,486,431 |
| | | $\Sigma_m EG_{m,y}$ = | 92,307,706 | | | | | | | | | | | | | | | | | $\sum m EGm,y * EFEL,m,y$ = | | 58,683,170 |

*, **, ***: 2010Statistics of Electric Power in Korea, KEPCO, 2011.5.

*, **, ***: 2010 Stauts of Generation facility, KPX, 2011.5.

$EF_{grid,BM,y} = \Sigma_m EG_{m,y} * EF_{EL,m,y} / \Sigma_m EG_{m,y}$ = **0.6357**

## Annex 4

## MONITORING INFORMATION

Please refer to section E.7.2

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