



**CLEAN DEVELOPMENT MECHANISM  
FORM FOR SUBMISSION OF BUNDLED SMALL SCALE PROJECT ACTIVITIES  
(SSC-CDM-BUNDLE)**

**SECTION A. General description of the Bundle**

**A.1. Title of the Bundle:**

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Daegu & SinanJeungdo PV(photovoltaic) Power Plant Project

**A.2. Version and Date :**

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Version : 03

Date : 30/05/2008

**A.3. Description of the Bundle and the subbundles : \_\_\_\_\_**

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**Description of the project activity**

Daegu & SinanJeungdo PV Power Plant is located at Daegu branch, Korea District Heating Corporation(KDHC) and Jeungdo, Sinangun, JeollaNamdo.

The project is a bundled project which consists of Daegu 0.1MW PV Power Plant and SinanJeungdo 0.8MW PV Power Plant. The expected annual electricity exported to the grid by this project is 1,302MWh and the expected annual emission reduction is 827 tCO<sub>2</sub>e.

The purpose of this project is to abate greenhouse gas(GHG) emissions by electricity generation of two PV Power Plants instead of using fossil fuel .

The project is developed, financed and implemented by KDHC.

KDHC has been serving customers for 18 years since it was established in November 1985 by the Korea Government, promoting energy conservation and improving living standards, through the efficient use of district heating.

**The purpose of the project activity**

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

**Contribution of the project activity to sustainable development**

The project contributes to sustainable development in the following ways:

- Generation by photovoltaic Power Plant decreases fossil use and will make nation-wide benefit.
- As one of renewable energy sources, photovoltaic power does not emit any GHG and pollutant into the air and contribute to improve local air quality
- Photovoltaic power can be utilized as an energy source for future generations, because it alternates fossil fuel and does not impact in resource exhaustion.



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- As a good practice for renewable energy use and environmental improvement, the project activity could be replicated across other district heating companies or heat suppliers in Korea.

**A.4. Project participants:**

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**SECTION B. Technical description of the Bundle:**

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**B.1. Location of the Bundle:**

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## &lt;Table 1&gt; Project participants

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

**B.1.1. Host Party(ies):**

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The Republic of Korea

**B.1.2. Region/State/Province etc.:**

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1) Daegu PV Power Plant : Daegu City

2) SinanJeungdo PV Power Plant : JeollaNamdo

**B.1.3. City/Town/Community etc:**

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

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

**B.1.4. Details of physical location, including information allowing the unique identification of this Bundle:**

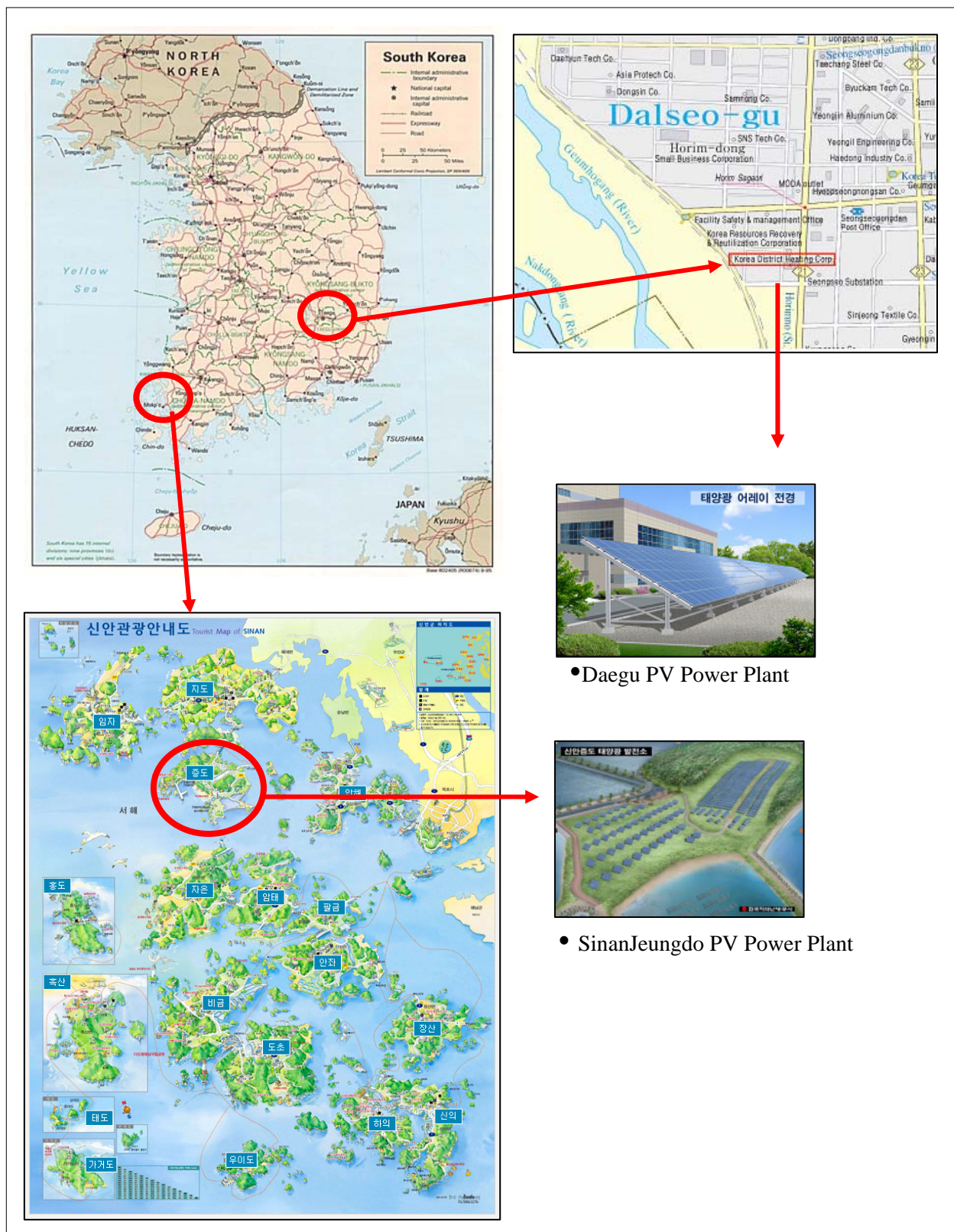
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The Daegu project site is located in the KDHC Daegu branch, which is located in the Seongseo industrial area at Daecheondong Dalseogu Daegu city .(2,442 m<sup>2</sup>) There are 'Keimyung University' and 'Keimyung University Subway station' around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

The SinanJeungdo project site is located in Jeungdo area Sinangun JeollaNamdo.(56,298 m<sup>2</sup>) The Sinan project site is the next to 'Taepyeong Saltern'.



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



<Figure 2> Daegu PV Power Plant



<Figure 3> SinanJeungdo PV Power Plant



## B.2. Type(s), category(ies) and technology/(ies)/Measure/(s) of the bundle:

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

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

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

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

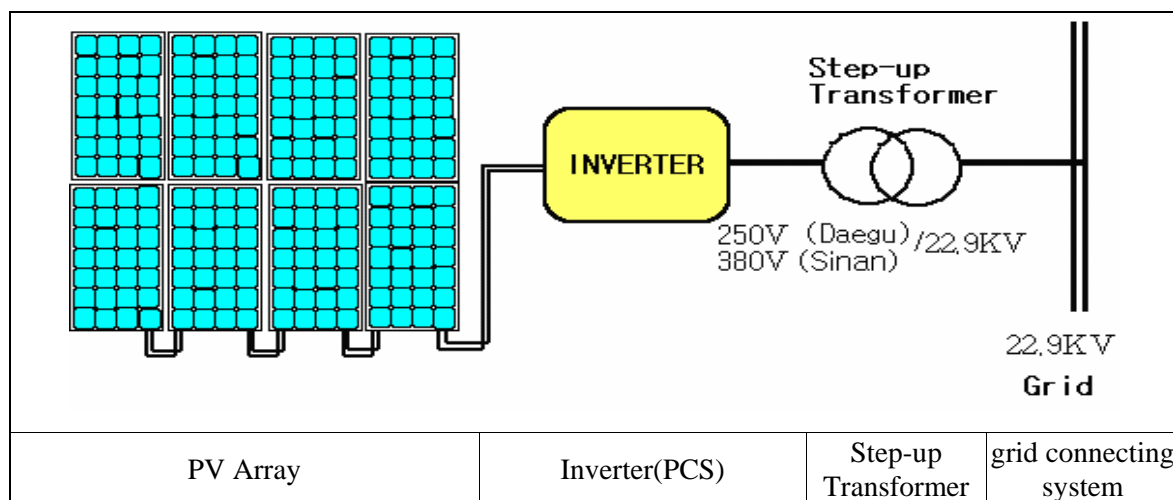
The remote operating and monitoring system of the PV Power Plant makes possible to audit and measure the data by sending electric characteristics such as power generation, voltage, electric current and frequency of photovoltaic generation of electric power to the main computer. It is also possible to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

The project is the electricity generation system using Solar Cells which generate a photoelectric effect in the presence of sunlight. Kyungdong Solar (Daegu Project) and Unison (SinanJeongdo Project) supply Solar Cells which are manufactured by Solar World in Germany. This project used an innovative new module, SW 165(Daegu)/175(SinanJeongdo) mono from SolarWorld.

(See B.6.3 Module Brochure)

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

**<Figure 4> The organization of the PV generation**





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&lt;Table 2&gt; Technology description

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

**B.3 Estimated amount of emission reductions over the chosen crediting period:**

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Total emission reductions from the electricity exported to grid by the project is estimated as 8,270 tCO<sub>2</sub>e Over years (crediting period), which means an average annual emission reduction of 827. For details, please refer to Section E.

&lt;Table 3&gt; Annual estimation of emission reduction

| Years  | Annual estimation of emission reductions<br>(tonnes of CO <sub>2</sub> e) |
|--|---|
| August 2008 – July 2009                                  | 827   |
| August 2009 – July 2010                                  | 827   |
| August 2010 – July 2011                                  | 827   |
| August 2011 – July 2012                                  | 827   |
| August 2012 – July 2013                                  | 827   |
| August 2013 – July 2014                                  | 827   |
| August 2014 – July 2015                                  | 827   |
| August 2015 – July 2016                                  | 827   |
| August 2016 – July 2017                                  | 827   |
| August 2017 – July 2018                                  | 827   |
| Total estimated reductions (tonnes of CO <sub>2</sub> e) | 8,270   |
| Total number of crediting years                          | 10 years  |
| Annual average (tonnes of CO <sub>2</sub> e)             | 827   |

**SECTION C. Duration of the project activity / Crediting period:****C.1. Duration of the Bundle**

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**C.1.1. Starting date of the Bundle:**

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13/12/2005

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

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**C.2.1. Renewable crediting period:**

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

&gt;&gt;

Not applicable

**B.2.1.2. Length of the first crediting period:**

&gt;&gt;

Not applicable

**C.2.2. Fixed crediting period:**

&gt;&gt;

**C.2.2.1. Starting date:**

&gt;&gt;

01/08/2008

**C.2.2.2. Length:**

&gt;&gt;

10 years

**SECTION D. Application of a monitoring methodology:**

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**A. Application of a monitoring methodology**

Project category : I.D Grid connected renewable electricity generation

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

Reference : Appendix B of the simplified modalities and procedures for small scale CDM project activities

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

According to AMS I.D version 12, “Indicative simplified baseline and monitoring methodologies for selected small-scale CDM project activity categories”, the category comprises renewable, such as photovoltaic, hydro, tidal/wave, geothermal and biomass, that supply electricity to an electricity distribution system that is or would have been applied by at least one fossil fuel or non-renewable biomass fired generating unit”. The Daegu & SinanJeungdo PV Power Plant Project falls into this activity category.

**B. The monitoring plan is as follows:**

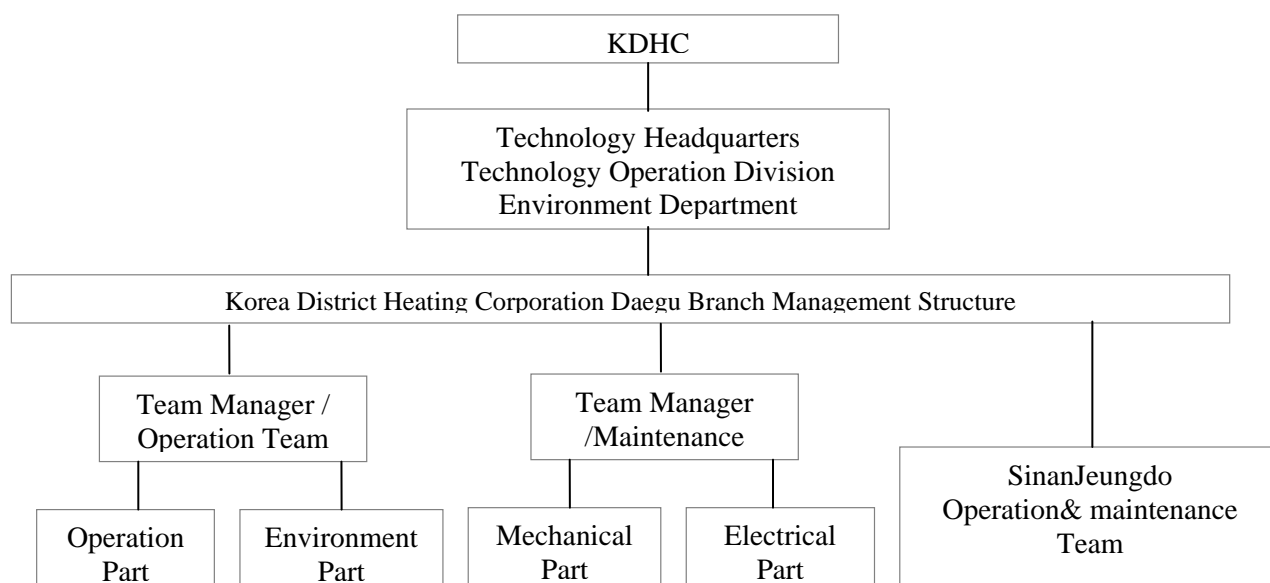
|  |   |
|--|---|
| <b>Data / Parameter:</b>   | Total electricity exported to grid by this project activity   |
| Data unit:   | MWh   |
| Description:   | Electricity exported to grid by PV Power Plant  |
| Source of data to be used:                                       | KDHC  |
| Value of data 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



**The operational and management structure for monitoring**

The remote operating and monitoring system of the PV Power Plant makes possible to audit and measure the data by sending electric characteristics such as power generation, voltage, electric current and frequency of photovoltaic generation of electric current and frequency of photovoltaic generation of electric power to the main computer. It is also possible to audit and measure the data at a distant place by a LAN or a modem.

Daegu & SinanJeungdo PV Plant will be operated and monitored at KDHC Daegu branch's operation team through the remote operating and monitoring system. Deagu branch's operation team is as follows.



Name of person for datas storage is as follow.

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

**Data collection and storage**

- Data collection and storage method

The amount of electricity supplied to the grid is measured automatically by the meter. The measured electricity amount is collected and stored hourly, also these are managed data as reports. The data is saved on PV management system PC permanently. Electricity is supplied to the grid directly. The supplied amount is confirmed monthly by KEPCO through the meter.

- Data modification method

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

**Training**

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

SinanJeungdo PV Power Plant operation team will be trained for PV Power Plant operation and management from manufacturing company in November 2007 and also will be trained for operation management education once per every quarter by KDHC Daegu branch.

**Quality Assurance and Quality Control**

Korea District Heating Corporation Daegu branch office obtained ISO14001 certification in December 2002 and is operating continuous and systematic Environment management system.

Korea District Heating Corporation Daegu branch obtained monitoring and QA/AC process for all parameters related to proposed project activity monitoring through ISO 14001 certification.

Monitoring plan of this project activity will be managed in integration and continuation with Environment management system through ISO 14001.

**Monitoring equipment and facility management procedures**

The remote operating and monitoring system of the PV Power Plant makes possible to audit and measure the data at a distant place by a LAN or a modem and so a part which breaks down will be captured and managed quickly at a distant place, in case that there is something wrong with the equipment.

In case that there is something wrong with the equipment like these, KDHC Daegu branch will resolve the problem by the procedure connected with ISO 14001.