

**MONITORING REPORT FORM (CDM-MR)****Version 01 - in effect as of: 28/09/2010****CONTENTS**

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**MONITORING REPORT****Version 01 and date 11/03/2011****Title: Korea Water Resources Corporation (KOWACO) small-scale hydroelectric power plants project****(the Andong-dam, the Seongnam, the Jangheung-dam small-scale hydroelectric)****UNFCCC Reference Number: 0584****4th Monitoring Period: 01/01/2010 – 31/12/2010****SECTION A. General description of the project activity****A.1. Brief description of the project activity: >>**

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- The purpose of the project activity :

The aim of this bundled project activity is to generate electricity and to supply it to the grid using hydro power instead of the fossil fuel, which contributes to mitigation of climate change & sustainable development.

- Measures taken to reduce greenhouse gas emissions :

Since hydro power technology can generate electricity without emitting any greenhouse gas (hereinafter GHG), this project activity contributes to the reduction of GHG by alternating at least one of fossil fuel-fired power plants which would have generated electricity with emitting GHG.

- Installed technology and equipments :

This proposed project bundled three small-scale hydroelectric power plants - the Andong-dam, the Seongnam, the Jangheung-dam small scale hydro power plant. And it consists in 2,640kW of facility capacity and power generation of 15,473MWh per year from the bundled three power plants.

Item	Andong-dam	Seongnam	Jangheung-dam
Unit	3	1	1
Generation Capacity	500 kW× 3	340 kW	800 kW
Total installed Capacity	1,500 kW	340 kW	800 kW

- Relevant dates for the project activity:

Item	Andong-dam	Seongnam	Jangheung-dam
Completion of Construction	10/10/2003	15/12/2004	18/12/2005
Starting date of operation	08/09/2003	16/12/2004	30/11/2005
Continued operation	08/09/2003- Present	16/12/2004- Present	30/11/2005- Present

- Total emission reductions achieved in this monitoring period: 8,121 tCO₂

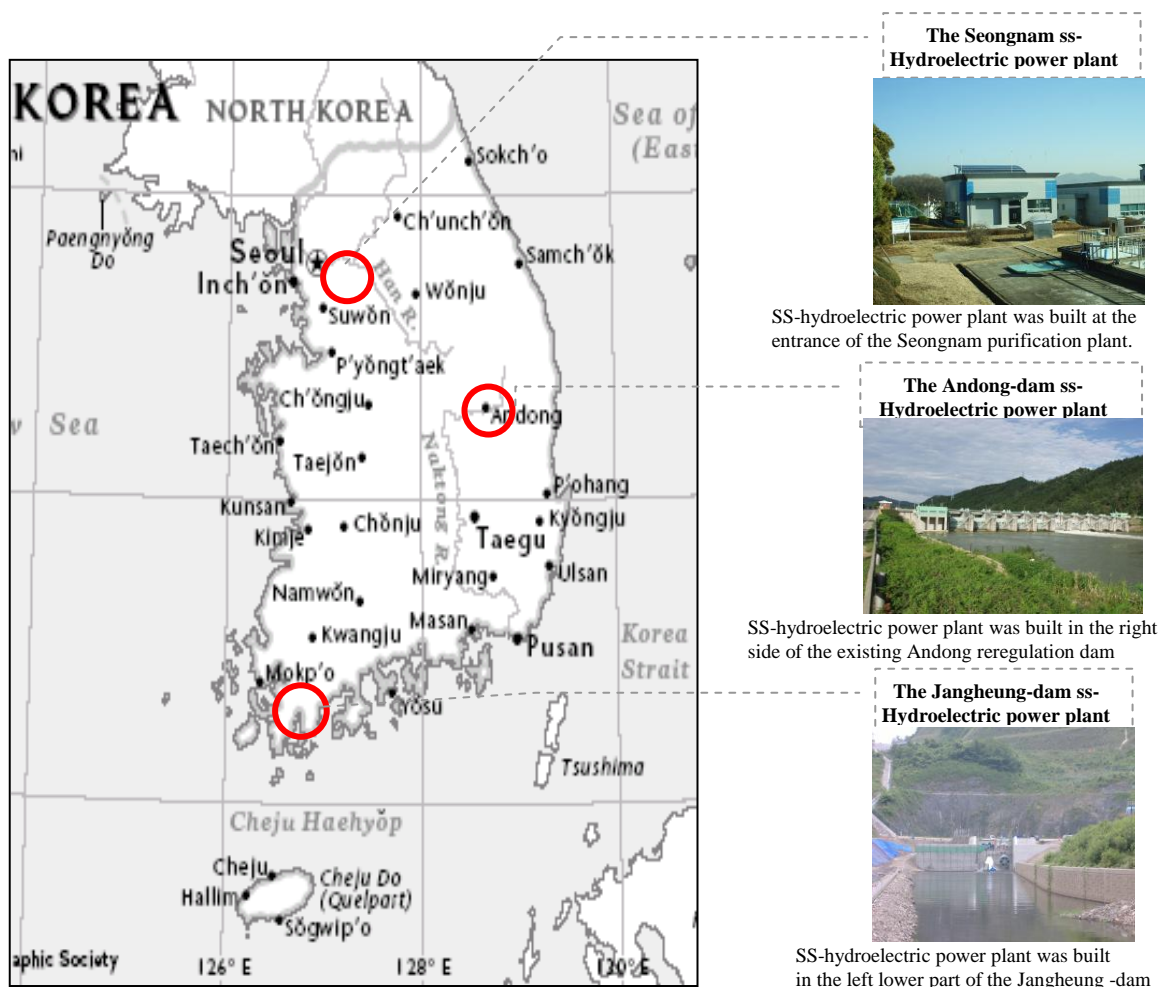
A.2. Project Participants

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Name of Party involved(*) (host) indicates a host Party)	Private and/or public entity(ies) Project participants(*) (as applicable)	Kindly indicate if the Party Involved wishes to be considered As project participant (Yes/No)
Republic of Korea (Host)	Public entity : Korea Water Resources Corporation(K-water)	No

A.3. Location of the project activity:

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The Andong-dam small-scale hydroelectric power plant:
Beopheung-dong, Andong city, Gyeongsangbuk-do, Republic of Korea
(latitude of 36°34'00"N and longitude of 128°44'55"E)

The Seongnam small-scale hydroelectric power plant:
Sasong-dong, Sujeong-gu, Seongnam city, Gyeonggi-do, Republic of Korea
(latitude of 37°24'48"N and longitude of 127°06'32"E)

The Jangheung-dam small-scale hydroelectric power plant:
Jicheon-ri, Busan-myeon, Jangheung-gun, Jeollanam-do, Republic of Korea
(latitude of 34°45'11"N and longitude of 126°53'08"E)

A.4. Technical description of the project

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1. Type and category (ies) of the project activity

Project Type: I - Renewable energy project

Project Category: D - Grid connected renewable electricity generation

2. Technology/Measure of the project activity

Bundled three small-scale hydroelectric power plants utilize potential energy of water. And this energy is converted to a kinetic energy, which generates electricity without emitting any GHG through rotating water turbines. The total installed capacity is 2,640kW. Refer to the diagrams and tables below.

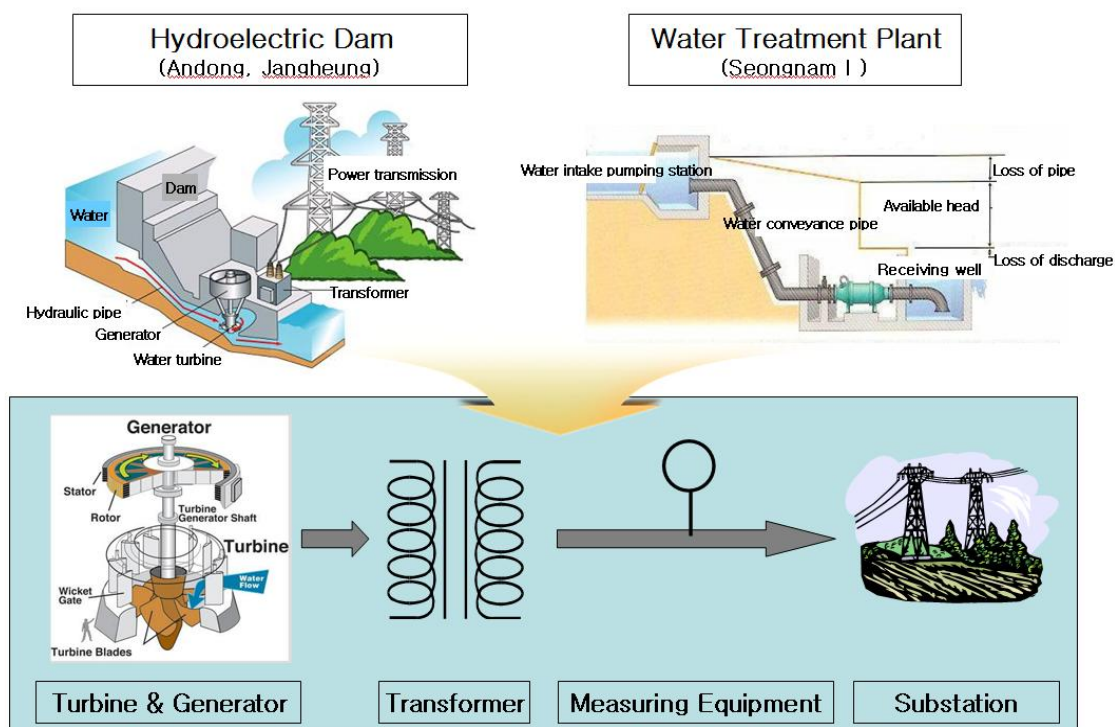


Figure 1. System Diagram of small-scale hydroelectric power plants

Classification		The Andong-dam	The Seongnam	The Jangheung-dam
Wheel	Type	Propeller (Tubular)	Vertical Francis	Horizontal Francis
	Output power	504 kW	372 kW	800 kW
	Rotation	225 RPM	450 RPM	514 RPM
	Unit	3	1	1
Generator	Type	squirrel cage induction	Three-phase induction (Vertical axis)	Three-phase induction (horizontal axis)
	Output power	500 kW	340 kW	800 kW
	Rotation	225 RPM	450 RPM	514 RPM
Transformer	Type	Mold type	Mold type	Mold type
	Capacity	2,000 kVA	500 kVA	1,000 kVA
	Volatage	3.3 kV / 22.9 kV	380 V / 22.9 kV	3.3 kV / 22.9 kV
	Connection type	Δ -Y	Δ -Y	Δ -Y
	Unit	1	1	1

Table 1. Description of technology of the small-scale hydroelectric power plants

A.5. Title, reference and version of the baseline and monitoring methodology applied to the project activity:

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The baseline and monitoring methodology of the project referred Appendix B of the simplified modalities and procedures for small-scale CDM project activities.

Approved Methodology: AMS I.D - Grid connected renewable electricity generation (Version 8)

A.6. Registration date of the project activity:

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06/10/2006

A.7. Crediting period of the project activity and related information (start date and choice of crediting period):

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Starting date of the first crediting period: 01/01/2007

Length of the total crediting period: 7 years (01/01/2007 ~ 31/12/2013)

**A.8. Name of responsible person(s)/entity(ies):**

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The name of the responsible person/entity:

- **Deog-Je, Kim/Korea Water Resources Corporation (K-water)**
Tel. +82-42-629-2962 (kdj@kwater.or.kr)
- **Jung-Suk, Jang/Korea Water Resources Corporation (K-water)**
Tel. +82-42-629-2963 (detente41@kwater.or.kr)

**SECTION B. Implementation of the project activity****B.1. Implementation status of the project activity**

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1. Relevant dates of the project activity:

Item	Andong-dam	Seongnam	Jangheung-dam
Completion of Construction	10/10/2003	15/12/2004	18/12/2005
Starting date of operation	08/09/2003	16/12/2004	30/11/2005
Continued operation	08/09/2003- Present	16/12/2004- Present	30/11/2005- Present

2. The information regarding the actual operations:

There was only an overhaul in Seongnam during the monitoring period from 01 Jan. 2010 to 31 Dec. 2010.

Item	Andong-dam	Seongnam	Jangheung-dam
Overhaul	N/A	generator I : 01/12/2010-14/12/2010	N/A
Downtimes	N/A	N/A	N/A
Exchange of equipment	N/A	N/A	N/A

3. Events or situations which may impact on the applicability of the methodology:

Even though an overhaul had been occurred in Seongnam small-scale hydroelectric power plant, there was no event may impact on the applicability of the methodology such as increases or decreases in capacity of facilities. And, the implementation of the project had been performed in good conditions generally and followed by the descriptions in the registered PDD.

B.2. Revision of the monitoring plan

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N/A

B.3. Request for deviation applied to this monitoring period

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N/A

B.4. Notification or request of approval of changes

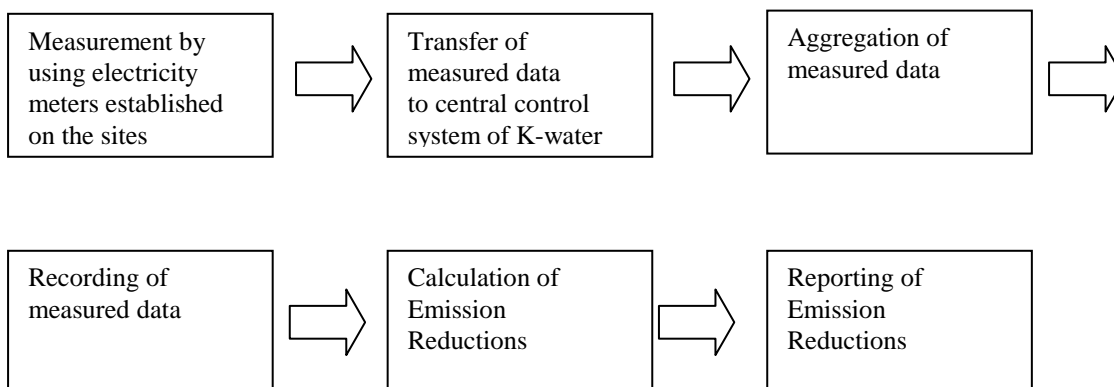
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N/A

SECTION C. Description of the monitoring system

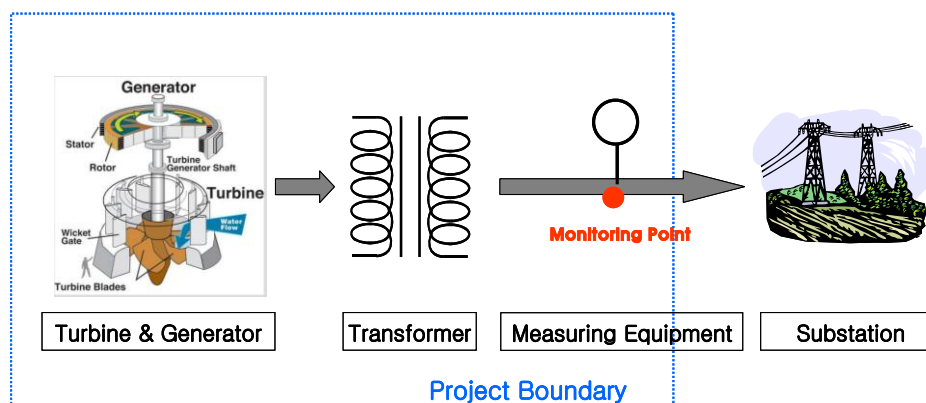
1. Data collection procedure

Data collection procedure is as follows;



Procedure	Unit	methods	Frequency	Remarks
Data Measuring	kWh	Automatic	Hourly	
Measured Data Transfer	kWh	Automatic	Daily	
Measured Data Aggregation	kWh	Automatic	Weekly	
Measured Data Recording	kWh	Automatic	Monthly	
Emission Reductions Calculation	tCO ₂	Manual	After the related monitoring periods	
Emission Reductions Reporting	tCO ₂	Manual	After the related monitoring periods	

2. Monitoring Points for the Project

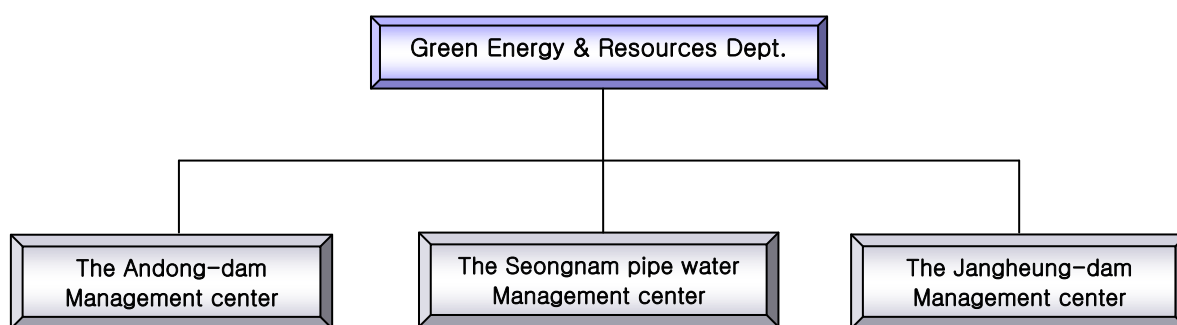


Monitoring Points are located at each places (Andong, Seongnam, Jangheung). Electricity monitored by wattmeter with accuracy range $\pm 0.5\%$ is delivered to the grid by the project.

3. QA/QC procedures

- Electricity measuring meters were set up transparently in accordance with “Law regarding measurement” and “Act on operation of electricity market” then sealed after affirmation of Korea Power Exchange.
- The meters were calibrated when they were installed, and re-calibrated every three years after installation.
- The amount of electricity transmitted to the grid is measured automatically by established meters. The measured data are simultaneously transferred to central control system of K-water and Korea Power Exchange.
- The collected data of K-water was double checked with those of Korea Power Exchange.

4. Monitoring organization structure, roles and responsibilities



Department in charge of monitoring for the project and responsible department are as follows:

- Department in charge of monitoring (including Operation & Maintenance of facilities. etc.)
: the Andong-dam management center, Seongnam management center, the Jangheung-dam management center.
- Responsible department (project management, Emission Reductions calculation and reporting)
: CDM Business Team

5. Emergency procedure:

- In case unexpected accident which affects Emission Reductions is occurred, the person in charge of monitoring should report to the responsible department(CDM Business Team) and act according to the internal manual in emergency.
- In case meters are improperly operated or the transfer of data is in error, internal investigation and correction procedure shall be followed and be certified by the final decision-maker and Korea Power exchange.

**SECTION D. Data and parameters****D.1 Data and parameters determined at registration and not monitored during the monitoring period, including default values and factors**

Data / Parameter:	EF _{OM}
Data unit:	tCO ₂ /MWh
Description:	operating margin emission factor
Source of data used:	calculated
Value(s) :	0.7807
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	- This value was calculated according to <i>Tool to calculate the emission factor for an electricity system</i> . Applied value was calculated by referring Statistics of Electric Power in KOREA (2003, 2004, 2005) (KEPCO). - This value is used for CO ₂ emissions factor of grid (EF).
Additional comment:	This value is supposed to be calculated once at the time of PDD submission.

Data / Parameter:	EF _{BM}
Data unit:	tCO ₂ /MWh
Description:	build margin emission factor
Source of data used:	calculated
Value:	0.4718
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	- This value was calculated according to <i>Tool to calculate the emission factor for an electricity system</i> . Applied value was calculated by referring Statistics of Electric Power in KOREA (2003, 2004, 2005) (KEPCO). - This value is used for CO ₂ emissions factor of grid (EF).
Additional comment:	This value is supposed to be calculated once at the time of PDD submission.

Data / Parameter:	EF
Data unit:	tCO ₂ /MWh
Description:	CO ₂ emissions factor of grid
Source of data used:	calculated
Value(s) :	0.6262
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	- This value was calculated according to <i>Tool to calculate the emission factor for an electricity system</i> . Applied value was calculated by referring Statistics of Electric Power in KOREA (2003, 2004, 2005) (KEPCO). - This value is used for baseline emission calculations.
Additional comment:	This value is supposed to be calculated once at the time of PDD submission.

D.2. Data and parameters monitored



▪ Andong-dam

Data / Parameter:	EG _{1,y}
Data unit:	MWh
Description:	Net electricity supplied to the grid from Andong small-scale power plant
Measured /Calculated/Default:	Measured
Source of data:	Monthly records
Value(s) of monitored parameter:	Net electricity supplied to the grid is 6,182.987MWh.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This value is used for Baseline emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Measurement equipment: Watt-hour meter Accuracy: Allowable error range $\pm 0.5\%$ Serial number: 4349736 Calibration information - Number of meters: 1 meter - Calibration Frequency: within 3 years - Date of last calibration: 12/05/2010 (*previous : 14/11/2007) - Validity period: 12/05/2010 – 11/05/2013
Measuring/ Reading/ Recording frequency:	Measuring/Reading: hourly Recording: monthly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	The amount of electricity transmitted to the grid was automatically measured and transferred to Korea Power Exchange (KPX) and K-water, so it was double checked by both entities.

▪ Seongnam

Data / Parameter:	EG _{2,y}
Data unit:	MWh
Description:	Net electricity supplied to the grid from Seongnam small-scale power plant
Measured /Calculated/Default:	Measured
Source of data:	Monthly records
Value(s) of monitored parameter:	Net electricity supplied to the grid is 1,106.365MWh.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This value is used for Baseline emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Measurement equipment: Watt-hour meter Accuracy: Allowable error range $\pm 0.5\%$ Serial number: 4349738 Calibration information - Number of meters: 1 meter - Calibration Frequency: within 3 years - Date of last calibration: 03/12/2010 (*previous : 02/05/2008) - Validity period: 03/12/2010 – 02/12/2013
Measuring/ Reading/ Recording frequency:	Measuring/Reading: hourly Recording: monthly



Calculation method (if applicable):	N/A
QA/QC procedures applied:	The amount of electricity transmitted to the grid was automatically measured and transferred to Korea Power Exchange (KPX) and K-water, so it was double checked by both entities.

▪ Jangheung-dam

Data / Parameter:	EG _{3,y}
Data unit:	MWh
Description:	Net electricity supplied to the grid from Jangheung small-scale power plant
Measured /Calculated/Default:	Measured
Source of data:	Monthly records
Value(s) of monitored parameter:	Net electricity supplied to the grid is 5,680.396 MWh.
Indicate what the data are used for (Baseline/ Project/ Leakage emission calculations)	This value is used for Baseline emission calculations.
Monitoring equipment (type, accuracy class, serial number, calibration frequency, date of last calibration, validity)	Measurement equipment: Watt-hour meter Accuracy: Allowable error range $\pm 0.5\%$ Serial number: 4349723 Calibration information - Number of meters: 1 meter - Calibration Frequency: within 3 years - Date of last calibration: 08/04/2009 - Validity period: 08/04/2009 – 07/04/2012
Measuring/ Reading/ Recording frequency:	Measuring/Reading: hourly Recording: monthly
Calculation method (if applicable):	N/A
QA/QC procedures applied:	The amount of electricity transmitted to the grid was automatically measured and transferred to Korea Power Exchange (KPX) and K-water, so it was double checked by both entities.

**SECTION E. Emission reductions calculation****E.1. Baseline emissions calculation**

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According to the formula below, baseline emissions for this project is 8,121 tCO₂.

$$BE = EG \times EF$$

BE	=	Baseline emissions(tCO₂)
EG	=	Net electricity transferred to a grid(MWh)
EF	=	Baseline emission factor(tCO₂/MWh)

Section	Andong-dam	Seongnam	Jangheung-dam	SubTotal	Baseline Emission Factor (tCO ₂ /MWh)	Baseline Emissions (tCO ₂)
	Electricity (kWh)	Electricity (kWh)	Electricity (kWh)	Electricity (kWh)		
Net Electricity	6,182,987	1,106,365	5,680,396	12,969,748	0.6262	8,121.6

E.2. Project emissions calculation

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GHG emissions due to the project activity are not occurred.

Project emission is zero;

PE = 0.

E.3. Leakage calculation

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Leakage due to the project activity is not occurred.

Project leakage is zero;

LE = 0.

E.4. Emission reductions calculation / table

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$$ER(\text{Emission reductions}) = BE - PE - LE = 8,121.6 - 0 - 0 = 8,121.6 \approx 8,121$$

(unit : tCO₂)

Period	Baseline Emissions	Project Emissions	Leakage	Emission Reductions
1 st Jan. 2010 ~ 31 st Dec. 2010	8,121.6	0	0	8,121.6

∴ According to the table above, total emission reductions are 8,121tCO₂.

**E.5. Comparison of actual emission reductions with estimates in the CDM-PDD**

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Item	Values applied in ex-ante calculation of the registered CDM-PDD	Actual values reached during the monitoring period
Emission reductions (tCO ₂)	9,689	8,121

This project was estimated to reduce 9,689 tCO₂e according to the registered CDM-PDD. But during the 4th monitoring period from 1st January 2010 to 31st December 2010, the net electricity supplied to the grid was 12,969,748 kWh, which resulted in reducing of 8,121 tCO₂e. Therefore, the actual value was lower by 1,568 tCO₂e than the estimated value in CDM-PDD.

E.6. Remarks on difference from estimated value in the PDD

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The emission reductions totally depend on the electricity generation in this project and the amount of electricity generation was increased compared to those of the previous monitoring period but a little lower than the estimates in CDM-PDD because of the typical seasonal gap of the amount of precipitation in Korea.

Therefore, the actual emission reductions are lower than the estimated value in the PDD and we confirm there is no significant increase during this monitoring period.