



**Monitoring report form  
(Version 05.1)**

*Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.*

**MONITORING REPORT**

<b>Title of the project activity</b>	K-water hydropower IX	
<b>UNFCCC reference number of the project activity</b>	7326	
<b>Version number of the monitoring report</b>	Version 01.0	
<b>Completion date of the monitoring report</b>	15/02/2017	
<b>Monitoring period number and duration of this monitoring period</b>	1st monitoring period, 01/12/2012 – 30/06/2016	
<b>Project participant(s)</b>	Korea Water Resources Corporation (K-water)	
<b>Host Party</b>	Republic of Korea	
<b>Sectoral scope(s)</b>	Sectoral scope : 1 : Energy industries (renewable / non-renewable sources)	
<b>Selected methodology(ies)</b>	AMS.I.D. Grid connected renewable electricity generation, version 17.0	
<b>Selected standardized baseline(s)</b>	Not Applicable	
<b>Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD</b>	189,541 tCO <sub>2</sub> e *This amount was recalculated by multiplying the day of this monitoring period over a year to the yearly estimated emission reductions in PDD, 52,892 tCO <sub>2</sub> e (52,892 tCO <sub>2</sub> e / 365 days × 1,308 days = 189,541 tCO <sub>2</sub> e)	
<b>Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period</b>	GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012	GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards
	4,750	182,741

## **SECTION A. Description of project activity**

### **A.1. Purpose and general description of project activity**

>>

#### **Purpose of project activity**

The proposed project aims at meeting the increasing demand for utilizing renewable energy resources to generate electricity and supporting the social-economic development of the local areas and the host country by means of the construction of hydropower plants. As the proposed project will displace a part of the generated electricity from fossil fuel power plants, the proposed project will lead to avoidance of CO<sub>2</sub> emission and environmental pollution caused by fossil fuel consumption.

#### **Description of project activity**

“K-water hydropower IX”(hereinafter referred to as the project activity) is performed by Korea Water Resources Corporation(hereinafter referred to as K-water). The project is a new run-of-river hydropower plant at a site there was no renewable energy power plant operating prior to implementation of the project activity. The generated electricity from a hydropower plant will be transmitted to the grid of Korea Electric Power Corporation (hereinafter referred to as the KEPCO grid) which is a company in charge of exclusively managing the grid of Republic of Korea.

#### **Brief description of installed technology and equipment**

As a bundled CDM project, the project activity consists of five hydropower plants as Dalseong, HapcheonChangnyeong, ChangnyeongHaman, Seungchon and Juksan. The installed equipment is the following;

- Dalseong hydropower plant
  - (a) Turbine Type : Horizontal Shaft Bevel-Gear Bulb
  - (b) Electricity Generation : 14,968 MWh/y
  - (c) Installed Capacity : 2,856 (kW)
  - (d) Generator voltage : 0.69 (kV)
- HapcheonChangnyeong hydropower plant
  - (a) Turbine Type : Horizontal Shaft Kaplan Tubular
  - (b) Electricity Generation : 25,357 MWh/y
  - (c) Installed capacity : 5,000 (kW)
  - (d) Generator voltage : 3.3 (kV)
- ChangnyeongHaman hydropower plant
  - (a) Turbine Type : Horizontal Shaft Kaplan Tubular
  - (b) Electricity Generation : 28,937 MWh/y
  - (c) Installed Capacity : 5,000 (kW)
  - (d) Generator voltage : 0.69 (kV)
- Seungchon hydropower plant
  - (a) Turbine Type : Horizontal Shaft Kaplan Tubular
  - (b) Electricity Generation : 4,643 MWh/y
  - (c) Installed Capacity : 800 (kW)
  - (d) Generator voltage : 0.38 (kV)

- Juksan hydropower plant
  - (a) Turbine Type : Horizontal Shaft Kaplan Tubular
  - (b) Electricity Generation : 5,692 MWh/y
  - (c) Installed Capacity : 1,220 (kW)
  - (d) Generator voltage : 0.48 (kV)

### **Relevant dates for the project activity**

The project started on 27/10/2009(Dalseong), 27/10/2009(HapcheonChangnyeong), 23/10/2009 (ChangnyeongHaman), 16/10/2009(Seungchon), 16/10/2009(Juksan) ; the Starting date of activity is the date signed on the contract of turnkey-base project for each of hydropower plants. The duration of the first crediting period is from 01/12/2012, which is the current period.

The total amount of emission reductions achieved in this monitoring period is summarized in the table below;

**Table 1 : Total amount of emission reductions**

Monitoring period	Total electricity	Total emission reductions
01/12/2012 – 30/06/2016	282,154.478 MWh	187,491 tCO <sub>2e</sub>

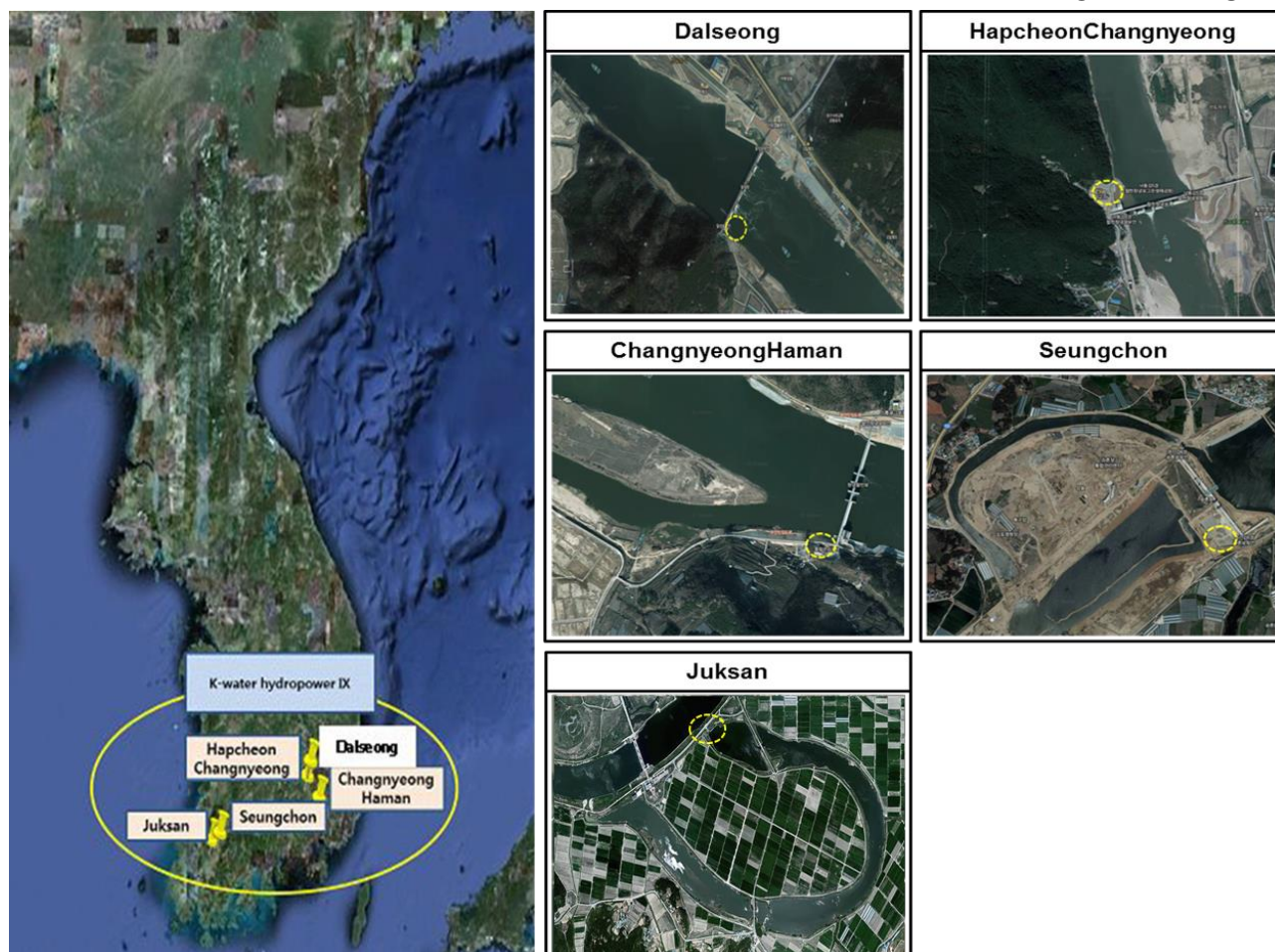
### **A.2. Location of project activity**

>>

The project activity has been being performed on Nakdong River and Youngsan River in Republic of Korea. And the host party is the Republic of Korea. The <Table 2> shows the geographic locations of the power plant of each project site. The specific address of the power plant of each project site is described as below;

**Table 2 : The address of the power plant of each project site**

Plant	Geographical location
<b>Dalseong</b>	456, Inan-ri, Gaejin-myeon, Goryeong- gun, Gyeongsangbuk-do The latitude of 35.732421N° and the longitude of 128.414966E°
<b>Hapcheon Changnyeong</b>	222-3, Samhak-ri, Cheongdeok-myeon, Hapcheon-gun, Gyeongsangnam-do The latitude of 35.590132N° and the longitude of 128.354309E°
<b>Changnyeong Haman</b>	1352, Bongchon-ri, Chilbuk- myeon, Haman- gun, Gyeongsangnam-do The latitude of 35.377410N° and the longitude of 128.551046E°
<b>Seungchon</b>	495-4, Seungchon-dong, Nam-gu, Gwangju city The latitude of 35.067305N° and the longitude of 126.763390E°
<b>Juksan</b>	1175-77, Juksan-ri, Dasi-myeon, Naju-si, Jeollanam-do The latitude of 34.973441N° and the longitude of 126.631345E°



### A.3. Parties and project participant(s)

Party involved ((host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate whether 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
Switzerland		

### A.4. Reference of applied methodology and standardized baseline

&gt;&gt;

#### Title of approved baseline and monitoring methodology

Renewable electricity generation for a grid in accordance with approved small scale methodology "AMS-I.D."

Type : 1 –Renewable Energy Projects

Sectoral Scope : 01, Energy Industries

Category I.D. : Grid connected renewable electricity generation, Version 17.0

<http://cdm.unfccc.int/methodologies/DB/RSCTZ8SKT4F7N1CFDXCSA7BDQ7FU1X>

Reference : Appendix B of the Simplified Modalities and Procedures for small-scale CDM project activities

<http://cdm.unfccc.int/Reference/COPMOP/08a01.pdf#page=52>

**Tool reference**

"Tool to calculate the emission factor for an electricity system" Version 02.2.1  
<http://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.2.1.pdf>

**Standardized baseline**

Not applicable

**A.5. Crediting period of project activity**

>>

The chosen crediting period is : 10 year, (fixed)

The start date of the crediting period : 01/12/2012

The end date of the crediting period : 30/11/2022

The period of first verification & issuance is : 01/12/12 – 30/06/2016

**A.6. Contact information of responsible persons/entities**

>>

The responsible persons/entities;

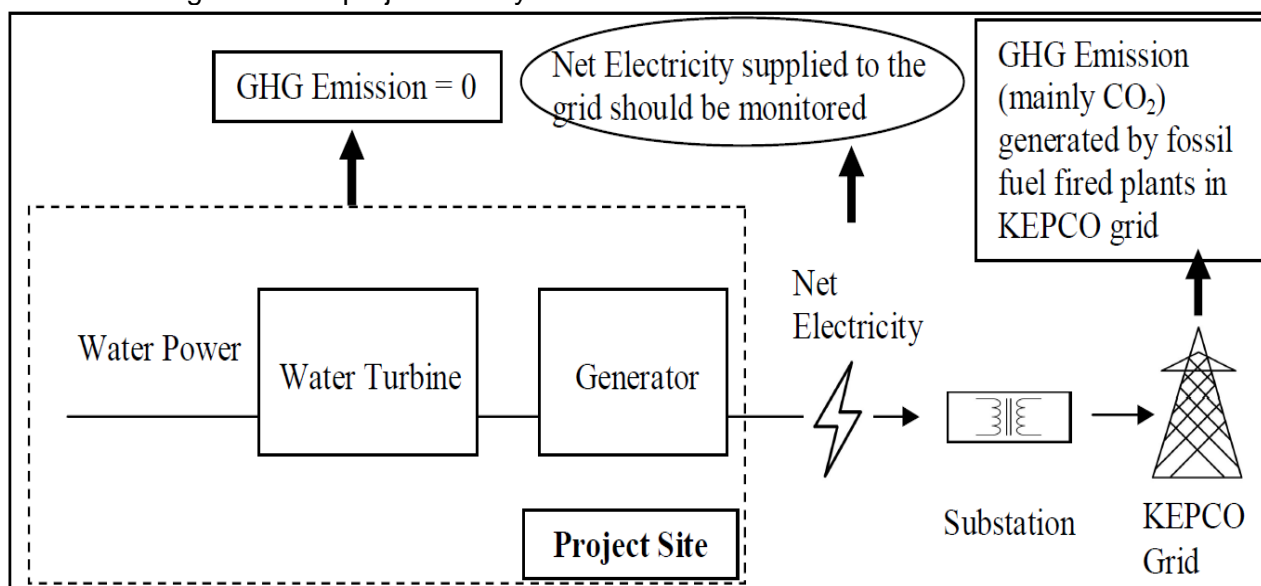
- Deog-je Kim, Principal Specialist / Korea Water Resources Corporation (K-water)  
 E-mail: kdj@kwater.or.kr, Telephone : 82-42-629-2988, Fax : 82-42-629-2999

**SECTION B. Implementation of project activity****B.1. Description of implemented registered project activity**

>>

The project activity is the generation of hydropower using running water from a weir to the powerhouse. The horizontal shaft Kaplan turbines coupled to either synchronous generators or induction generators are used to convert the flow of water to electrical energy. The generated electricity by the project activity is transmitted to the KEPCO grid and is measured continuously, respectively by each of installed watt-hour meter on site. In the absence of the project activity, equivalent amount of electricity would have been produced from other sources of energy such as fossil fuels in KEPCO grid which would have released greenhouse gases into the atmosphere.

Schematic diagram of the project activity:



<Figure B.1> Project Boundary

The capacities of the project equipments was not changed during this monitoring period and no emergency incidents occurred during this period which may change the applicability of the methodology or change the emission reductions. Further, the plant was in continuous operation during the monitoring period.

**B.2. Post-registration changes****B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline**

&gt;&gt;

Not applicable

**B.2.2. Corrections**

&gt;&gt;

- The map showing the geographic location of Juksan power plant is changed.

**B.2.3. Changes to start date of crediting period**

&gt;&gt;

Not applicable

**B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration**

&gt;&gt;

Not Applicable

**B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline**

&gt;&gt;

- The recording frequency of the electricity exported to the grid is revised to monthly from hourly. Because the recording frequency at the registration stage is not consistent with that of the actual recording of electricity data.
- The monitoring organization and responsibility is changed according to the company reorganization.
- Switzerland is involved as a party of this project activity.

**B.2.6. Changes to project design of registered project activity**

&gt;&gt;

Not Applicable

**B.2.7. Types of changes specific to afforestation or reforestation project activity**

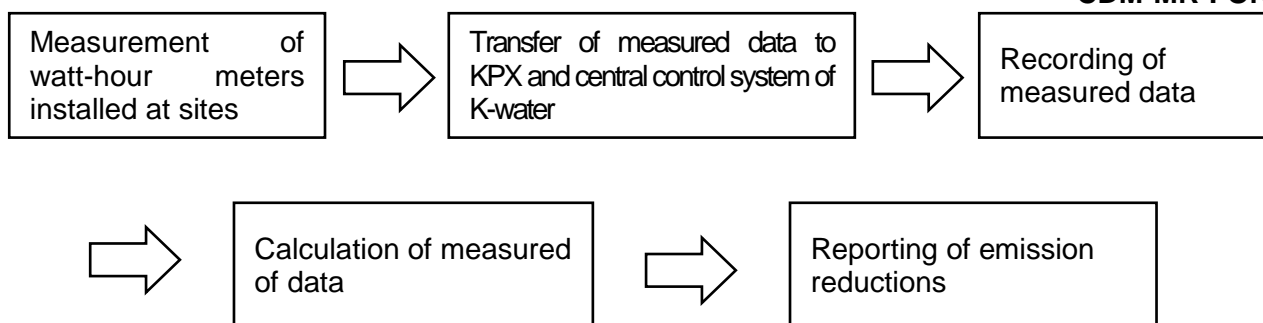
&gt;&gt;

Not Applicable

**SECTION C. Description of monitoring system**

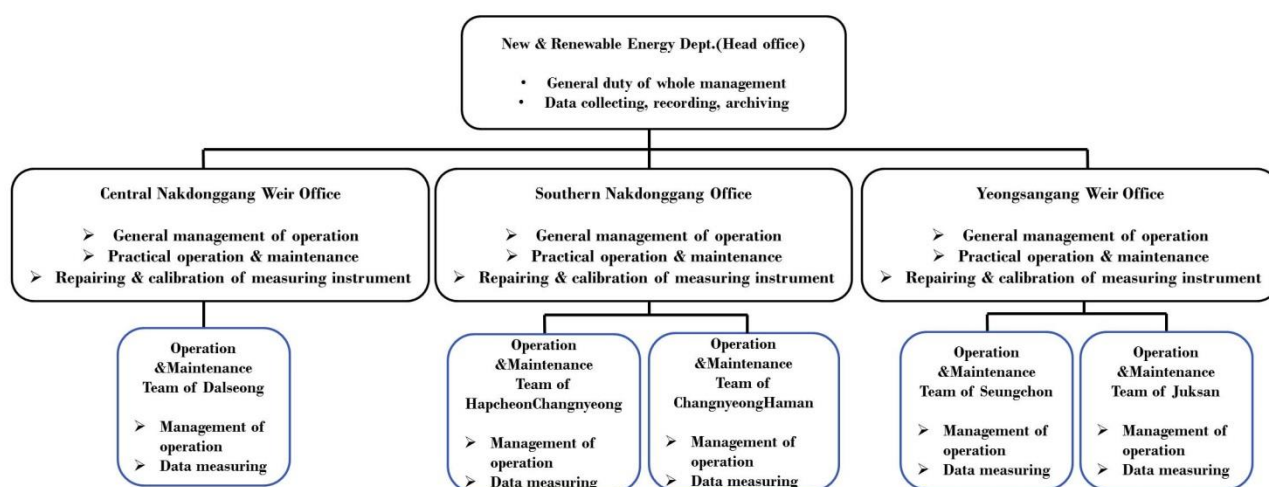
&gt;&gt;

The objective of the monitoring plan is to assure the complete, consistent, clear, and accurate monitoring and calculation of the project emission reductions during the whole crediting period.



Procedure	Unit	Methods	Frequency
Data Measuring	kWh	Electronically	Continuously
Measured Data Transfer	kWh	Electronically	Exported electricity : Hourly(KPX), Daily(K-water) Imported electricity : Monthly
Measured Data Recording	kWh	Electronically	Monthly
Emission Reductions Calculation	tCO <sub>2</sub> e	Manual	After the related monitoring periods
Emission Reductions Reporting	tCO <sub>2</sub> e	Manual	After the related monitoring periods

## 1. Monitoring Organization



**<Figure C.1> Monitoring organization and responsibility**

As shown in the figure, each Operation & Maintenance Team of the plant observes monitoring system's operation and transmission of overall data to the Central Nakdonggang Weir Office, Southern Nakdonggang Office and Yeongsangang Weir Office. And Central Nakdonggang Weir Office, Southern Nakdonggang Office and Yeongsangang Weir Office takes the responsibility for electrical engineering work and safety management including repair and calibration of the watt-hour meter. And the New & Renewable Energy Dept of Head office monitors data of electricity supplied to KEPCO grid from the power house on site and 'Power Generation Total Information System' which is the database systems owned by K-water. Title of the Dept Regional Headquarters and Team may be altered in accordance with a reorganization plan of K-water. And corresponding responsibility and authority of each division of K-water also may be altered after confirmation of consolidated operating procedures.

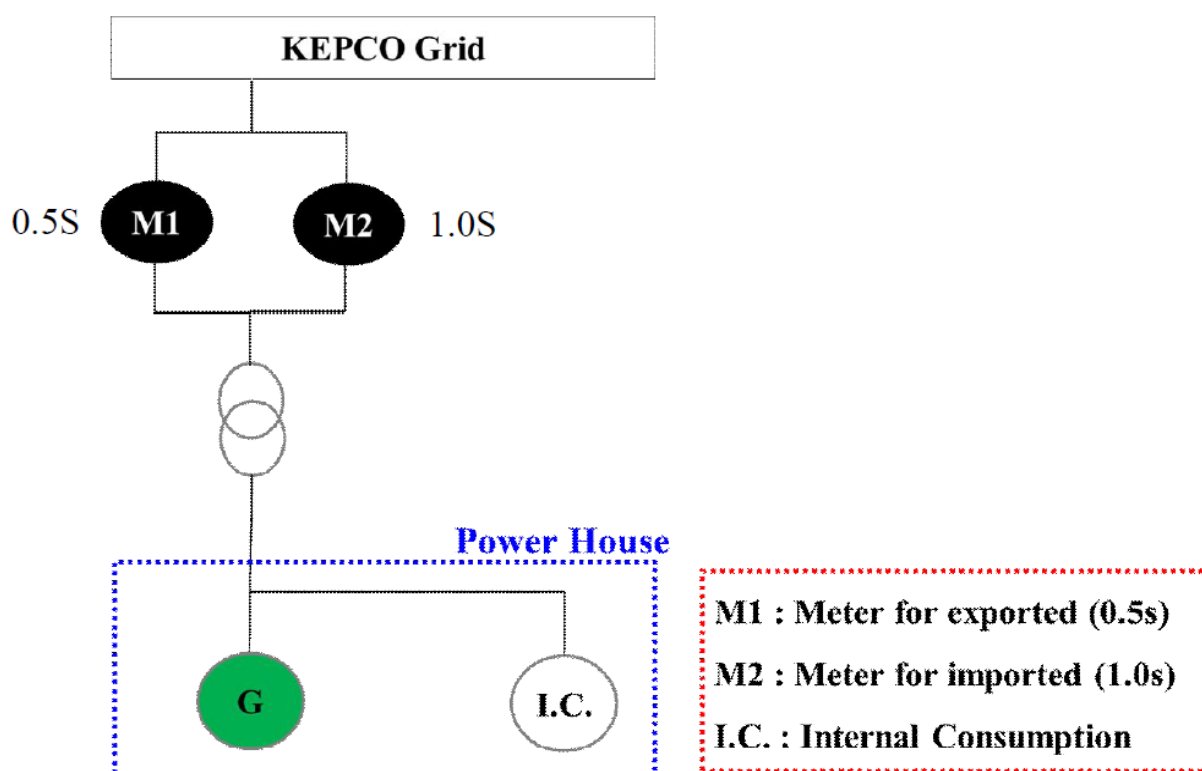


## 2. Main monitoring parameters

As the project's Emission Factor of the grid is determined ex-ante, the net electricity supplied to the grid is the main basis of the Emission Reduction calculation, therefore the monitoring plan was designed aiming at the net electricity supplied to the grid ( $EG_{\text{export},y} - EG_{\text{import},y}$ )

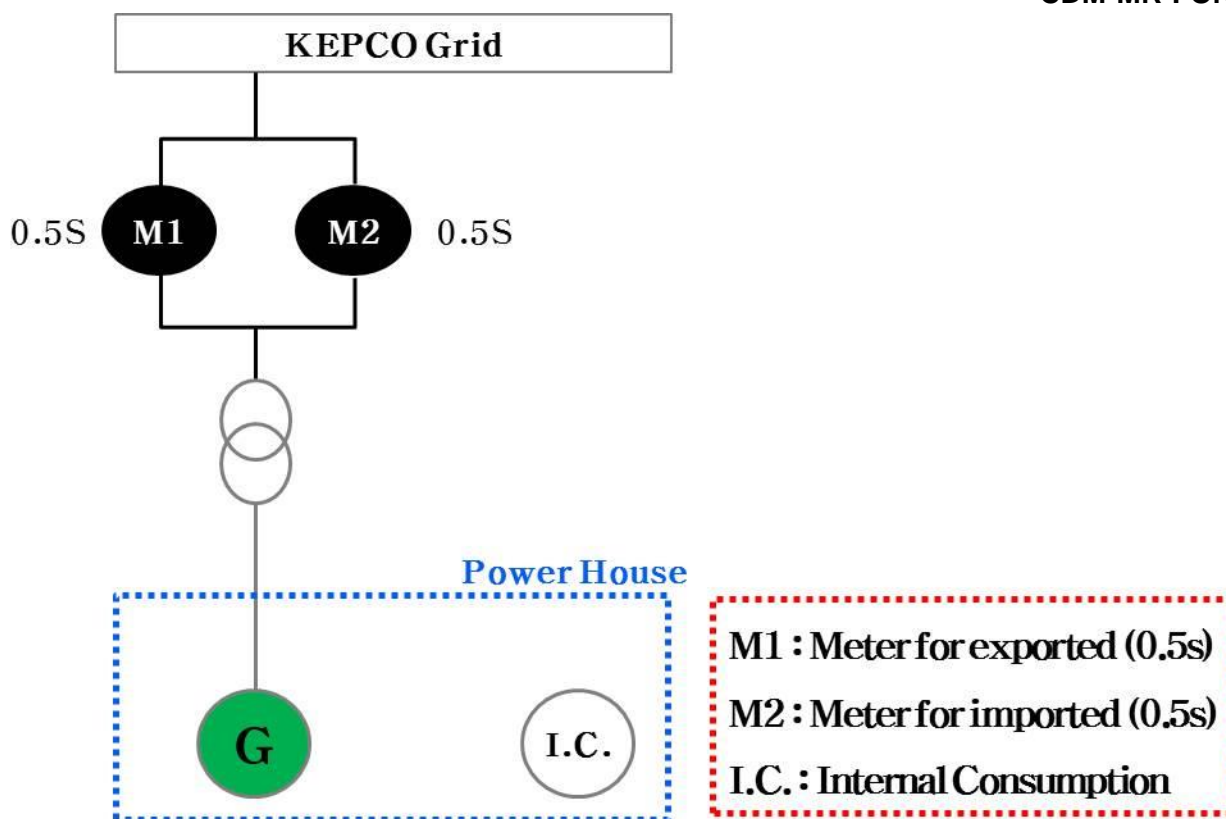
## 3. Installation of meters

In the case of all the hydropower plants, the watt-hour meters for measuring the both amount of electricity exported to the grid and imported from the grid are installed respectively. The auxiliary power consumed for the power house is supplied internally from the generated electricity during the generator's operation. Otherwise, the auxiliary power is supplied from KEPCO grid when the generator is stopped.



<Figure C.2> A single-line diagram for Dalseong, HapcheonChangnyeong, Seungchon power plants





<Figure C.3> A single-line diagram for ChangnyeongHaman, Juksan power plants

#### **4. Data Recording**

##### Electricity exported to the grid

The data were continuously measured by the watt-hour meter and monthly recorded by the person in charge of CDM in New & Renewable Energy Dept. And also, the data of electricity exported to KEPCO grid were hourly transferred on Korea Power Exchange (hereinafter referred to as KPX) and daily transferred to 'Power Generation Total Information System' of K-water from KPX.

##### Electricity imported from the grid

The data were continuously measured by the watt-hour meter and monthly recorded by the person in charge of CDM in New & Renewable Energy Dept. And also, the data of electricity imported from KEPCO grid were monthly checked by receipt of KEPCO.

#### **5. Data management**

All data collected as part of monitoring should be archived electronically and be kept at least for 2 years after the end of the crediting period. And there was an appropriate training for the person in charge of safety and monitoring on a regular basis during the crediting period after CDM registration. The training is composed of how to measure the meters, being aware of the related regulations, managing and writing data, and operating the equipment safely based on 'Electric Utility Act'.

#### **6. Disposing process of abnormality**

If any previous months, readings of the watt-hour meter are inaccurate by more than the allowable error, or otherwise functioned improperly, K-water and KEPCO, KPX will ensure informing the counterparty immediately for conducting appropriate action.

## SECTION D. Data and parameters

### D.1. Data and parameters fixed ex ante or at renewal of crediting period

<b>Data/parameter:</b>	<b>EF<sub>m,y</sub></b>
Unit	tCO <sub>2</sub> e/MWh
Description	CO <sub>2</sub> emissions factor in power unit <i>m</i> in year <i>y</i>
Source of data	Calculated
Value(s) applied)	0.6645 tCO <sub>2</sub> e/MWh
Choice of data or measurement methods and procedures	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 “2008, 2009, 2010 Statistics of Electric Power in Korea (2009, 2010, 2011)” (KEPCO) and “2010 Status of Generation Facility (2011)” (KPX).
Purpose of data	Calculation of baseline emission
Additional comments	<ul style="list-style-type: none"> <li>- This data was calculated at the time of PDD submission to the DOE for validation and will not be changed during the crediting period without updating.</li> <li>- This value is the ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period.</li> </ul>

<b>Data/parameter:</b>	<b>EF<sub>OM, y</sub></b>
Unit	tCO <sub>2</sub> e/MWh
Description	Operating Margin emission factor
Source of data	Calculated
Value(s) applied)	0.6933 tCO <sub>2</sub> e/MWh
Choice of data or measurement methods and procedures	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 “2008, 2009, 2010 Statistics of Electric Power in Korea (2009, 2010, 2011)” (KEPCO).
Purpose of data	Calculation of baseline emission
Additional comments	<ul style="list-style-type: none"> <li>- This data was calculated at the time of PDD submission to the DOE for validation and will not be changed during the crediting period without updating.</li> <li>- This value is the ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period.</li> </ul>

<b>Data/parameter:</b>	<b>EF<sub>BM, y</sub></b>
Unit	tCO <sub>2</sub> e/MWh
Description	Build Margin emission factor
Source of data	Calculated
Value(s) applied)	0.6357tCO <sub>2</sub> e/MWh
Choice of data or measurement methods and procedures	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 “2010 Statistics of Electric Power in Korea (2011)” (KEPCO) and “2010 Status of Generation Facility (2011)” (KPX).

Purpose of data	Calculation of baseline emission
Additional comments	<ul style="list-style-type: none"> <li>- This data was calculated at the time of PDD submission to the DOE for validation and will not be changed during the crediting period without updating.</li> <li>- This value is the ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period.</li> </ul>

<b>Data/parameter:</b>	<b>FC<sub>i,m,y</sub></b>
Unit	Mass: Bituminous, LNG Volume: Heavy oil, Diesel
Description	Amount of fossil fuel type <i>i</i> consumed by power plant/unit <i>m</i> in year <i>y</i> <i>i</i> : bituminous, heavy oil, diesel, LNG <i>m</i> : All power units serving the grid in year <i>y</i> except low-cost/must-run power units <i>y</i> : year
Source of data	2010 Statistics of Electric Power in Korea (2011) 2009 Statistics of Electric Power in Korea (2010) 2008 Statistics of Electric Power in Korea (2009)
Value(s) applied	See the EF calculation spreadsheet at the registration stage
Choice of data or measurement methods and procedures	The applied value was derived from "2008, 2009, 2010 Statistics of Electric Power in Korea (2009,2010,2011)" (KEPCO)
Purpose of data	Calculation of baseline emission
Additional comments	<ul style="list-style-type: none"> <li>- This data was calculated at the time of PDD submission to the DOE for validation and will not be changed during the crediting period without updating.</li> <li>- This value is the ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period.</li> </ul>

<b>Data/parameter:</b>	<b>EG<sub>m,y</sub></b>
Unit	MWh
Description	Net quantity of electricity generated and delivered to the grid by power unit <i>m</i> in year <i>y</i>
Source of data	2010 Statistics of Electric Power in Korea (2011) 2009 Statistics of Electric Power in Korea (2010) 2008 Statistics of Electric Power in Korea (2009)
Value(s) applied	See the EF calculation spreadsheet at the registration stage
Choice of data or measurement methods and procedures	The applied value was derived from "2008, 2009, 2010 Statistics of Electric Power in Korea (2009,2010,2011)" (KEPCO)
Purpose of data	Calculation of baseline emission
Additional comments	<ul style="list-style-type: none"> <li>- This data was calculated at the time of PDD submission to the DOE for validation and will not be changed during the crediting period without updating.</li> <li>- This value is the ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period.</li> </ul>

<b>Data/parameter:</b>	<b>NCV<sub>i,y</sub></b>
Unit	kcal/ mass or volume unit

Description	Net calorific value of fuel <i>i</i> : bituminous, heavy oil, diesel oil, LNG <i>y</i> : year
Source of data	2010 Statistics of Electric Power in Korea (2011) 2009 Statistics of Electric Power in Korea (2010) 2008 Statistics of Electric Power in Korea (2009)
Value(s) applied	See the EF calculation spreadsheet at the registration stage
Choice of data or measurement methods and procedures	The applied value was derived from “2008, 2009, 2010 Statistics of Electric Power in Korea (2009,2010,2011)” (KEPCO)
Purpose of data	Calculation of baseline emission
Additional comments	<ul style="list-style-type: none"> <li>- This data was calculated at the time of PDD submission to the DOE for validation and will not be changed during the crediting period without updating.</li> <li>- This value is the ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period.</li> </ul>

<b>Data/parameter:</b>	<b>EF<sub>CO2,i,y</sub></b>
Unit	tCO <sub>2</sub> e/GJ
Description	CO <sub>2</sub> emission factor of fossil fuel type <i>i</i> <i>i</i> : bituminous, heavy oil, diesel oil, LNG <i>y</i> : year
Source of data	Revised 2006 IPCC Guidelines for National Greenhouse Gas Inventories
Value(s) applied	See the EF calculation spreadsheet at the registration stage
Choice of data or measurement methods and procedures	IPCC default values at the lower limit of the uncertainty at 95% confidence interval as provided in table 1.4 of Chapter 1 of Vol.2 (Energy) were used.
Purpose of data	Calculation of baseline emission
Additional comments	<ul style="list-style-type: none"> <li>- This data was calculated at the time of PDD submission to the DOE for validation and will not be changed during the crediting period without updating.</li> <li>- This value is the ex-ante value which is calculated at the time of PDD submission and will be applied during the crediting period.</li> </ul>

## D.2. Data and parameters monitored

<b>Data/parameter:</b>	<b>EG<sub>BL,y</sub></b>
Unit	MWh
Description	Quantity of net electricity supplied to the grid as a result of the implementation of the CDM project activity in year <i>y</i>
Measured/calculated/default	Calculated
Source of data	Actual data obtained from quantity of net electricity supplied to the grid in year <i>y</i> are difference between the Watt-hour meter quantities of the grid through on-site export and the import Watt-hour meter.

Value(s) of monitored parameter	<p><b>Total electricity exported = 283,623.713 MWh</b>  <b>Total electricity imported = 1,469.235 MWh</b>  <b>Total net electricity = 282,154.478 MWh</b></p> <p>- (1) <math>EG_{BL,y,Dalseong,exported}</math> 51,813.961 MWh  <math>EG_{BL,y,Dalseong,imported}</math> 21.204 MWh  <math>EG_{BL,y,Dalseong,exported} - EG_{BL,y,Dalseong,imported} = EG_{BL,y,Dalseong}</math>  <math>EG_{BL,y,Dalseong} = 51,813.961 - 21.204 = 51,792.757</math> MWh</p> <p>- (2) <math>EG_{BL,y,HapcheonChangnyeong,exported}</math> 93,553.311 MWh  <math>EG_{BL,y,HapcheonChangnyeong,imported}</math> 1,358.748 MWh  <math>EG_{BL,y,HapcheonChangnyeong,exported} - EG_{BL,y,HapcheonChangnyeong,imported} = EG_{BL,y,HapcheonChangnyeong}</math>  <math>EG_{BL,y,HapcheonChangnyeong} = 93,553.311 - 1,358.748 = 92,194.563</math> MWh</p> <p>- (3) <math>EG_{BL,y,ChangnyeongHaman,exported}</math> 104,062.008 MWh  <math>EG_{BL,y,ChangnyeongHaman,imported}</math> 9.984 MWh  <math>EG_{BL,y,ChangnyeongHaman,exported} - EG_{BL,y,ChangnyeongHaman,imported} = EG_{BL,y,ChangnyeongHaman}</math>  <math>EG_{BL,y,ChangnyeongHaman} = 104,062.008 - 9.984 = 104,052.024</math> MWh</p> <p>- (4) <math>EG_{BL,y,Seungchon,exported}</math> 13,686.940 MWh  <math>EG_{BL,y,Seungchon,imported}</math> 23.307 MWh  <math>EG_{BL,y,Seungchon,exported} - EG_{BL,y,Seungchon,imported} = EG_{BL,y,Seungchon}</math>  <math>EG_{BL,y,Seungchon} = 13,686.940 - 23.307 = 13,663.633</math> MWh</p> <p>- (5) <math>EG_{BL,y,Juksan,exported}</math> 20,507.493 MWh  <math>EG_{BL,y,Juksan,imported}</math> 55.992 MWh  <math>EG_{BL,y,Juksan,exported} - EG_{BL,y,Juksan,imported} = EG_{BL,y,Juksan}</math>  <math>EG_{BL,y,Juksan} = 20,507.493 - 55.992 = 20,451.501</math> MWh</p> <p>According to the calculation above, baseline total net electricity is 282,154.478 MWh  <math>(EG_{BL,y,Dalseong} + EG_{BL,y,HapcheonChangnyeong} + EG_{BL,y,ChangnyeongHaman} + EG_{BL,y,Seungchon} + EG_{BL,y,Juksan})</math>.</p>
Monitoring equipment	Value has been calculated from Energy export and import values, which were recorded in the export and import Watt-hour meter each.
Measuring/reading/recording frequency:	N/A
Calculation method (if applicable):	Calculated monthly with on-site monitored data of $EG_{export,y}$ and $EG_{import,y}$ using the formula $EG_{BL,y} = EG_{export,y} - EG_{import,y}$
QA/QC procedures:	More detailed QA/QC procedures are described in the monitoring system in the "Section C. Description of monitoring system".
Purpose of data:	Calculation of baseline emission
Additional comments:	-

<b>Data/parameter:</b>	<b><math>EG_{export,y}</math></b>
Unit	MWh
Description	Electricity supplied to the grid by the proposed project in year y
Measured/calculated/default	Measured

Source of data	Electricity export values were monitored and recorded on-site through export Watt-hour meter.
Value(s) of monitored parameter	<p>The total electricity supplied to the grid read from the Watt-hour meter is total 283,623.713 MWh</p> <p>(1) Dalseong Power plant - <math>EG_{\text{export,y,Dalseong}}</math> : 51,813.961 MWh</p> <p>(2) HapcheonChangnyeong Power plant - <math>EG_{\text{export,y,HapcheonChangnyeong}}</math> : 93,553.311 MWh</p> <p>(3) ChangnyeongHaman Power plant - <math>EG_{\text{export,y,ChangnyeongHaman}}</math> : 104,062.008 MWh</p> <p>(4) Seungchon Power plant - <math>EG_{\text{export,y,Seungchon}}</math> : 13,686.940 MWh</p> <p>(5) Juksan Power plant - <math>EG_{\text{export,y,Juksan}}</math> : 20,507.493 MWh</p>

Monitoring equipment	<p>(1) Dalseong Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 0.5</math> %  Serial number : 53127545  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 4 years</li> <li>- Date of last calibration : 10/11/2015 (*previous : 31/12/2011)</li> <li>- Validity period : 10/11/2015 – 09/11/2019</li> </ul> <p>(2) HapcheonChangnyeong Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 0.5</math> %  Serial number : 53127546  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 4 years</li> <li>- Date of last calibration : 18/11/2015 (*previous : 31/12/2011)</li> <li>- Validity period : 18/11/2015 – 17/11/2019</li> </ul> <p>(3) ChangnyeongHaman Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 0.5</math> %  Serial number : 53127555  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 4 years</li> <li>- Date of last calibration : 18/11/2015 (*previous : 31/12/2011)</li> <li>- Validity period : 18/11/2015 – 17/11/2019</li> </ul> <p>(4) Seungchon Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 0.5</math> %  Serial number : 53086971  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 4 years</li> <li>- Date of last calibration : 19/03/2015 (*previous : 30/04/2011)</li> <li>- Validity period : 19/03/2015 – 18/03/2019</li> </ul> <p>(5) Juksan Power plant  Measurement equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 0.5</math> %  Serial number : 53101543  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 4 years</li> <li>- Date of last calibration : 16/06/2015 (*previous : 31/07/2011)</li> <li>- Validity period : 16/06/2015 – 15/06/2019</li> </ul>
Measuring/reading/recording frequency:	Measuring : Continuously Reading : Daily Recording : Monthly
Calculation method (if applicable):	N/A



QA/QC procedures:	<ul style="list-style-type: none"> <li>- The amount of electricity transmitted to the grid was electronically measured and transferred to KPX and K-water, so it was double checked by both entities.</li> <li>- The watt-hour meter was set up transparently in accordance with 'Measures act' and 'Rules on the operation of the electricity market'.</li> <li>- The watt-hour meter was calibrated regularly in accordance with 'Measures act', 'Rules on the operation of the electricity market' and 'General guidelines to SSC CDM methodologies'.</li> </ul>
Purpose of data:	Calculation of baseline emission
Additional comments:	N/A

<b>Data/parameter:</b>	<b>EG<sub>import,y</sub></b>
Unit	MWh
Description	Electricity imported from the grid by the proposed project in year y
Measured/calculated/default	Measured
Source of data	Electricity import values were monitored and recorded on-site through import Watt-hour meter.
Value(s) of monitored Watt-hour meter	<p>Consumed electricity in the plant read from the Watt-hour meter is total 1,469.235 MWh</p> <p>(1) Dalseong Power plant - EG<sub>import,y,Dalseong</sub>: 21.204 MWh</p> <p>(2) HapcheonChangnyeong Power plant - EG<sub>import,y,HapcheonChangnyeong</sub> : 1,358.748 MWh</p> <p>(3) ChangnyeongHaman Power plant - EG<sub>import,y,ChangnyeongHaman</sub>: 9.984 MWh</p> <p>(4) Seungchon Power plant - EG<sub>import,y,Seungchon</sub> : 23.307 MWh</p> <p>(5) Juksan Power plant - EG<sub>import,y,Juksan</sub>: 55.992 MWh</p>

Monitoring equipment	<p>(1) Dalseong Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 1.0</math> %  Serial number : 25101001068  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 7 years</li> <li>- Date of last calibration : 30/06/2010</li> <li>- Validity period : 30/06/2010 – 29/06/2017</li> </ul> <p>(2) HapcheonChangnyeong Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 1.0</math> %  Serial number : 08101007098  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 7 years</li> <li>- Date of last calibration : 31/10/2010</li> <li>- Validity period : 31/10/2010 – 30/10/2017</li> </ul> <p>(3) ChangnyeongHaman Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 0.5</math> %  Serial number : 08112005946  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 7 years</li> <li>- Date of last calibration : 31/10/2011</li> <li>- Validity period : 31/10/2011 – 30/10/2018</li> </ul> <p>(4) Seungchon Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 1.0</math> %  Serial number : 08101008979  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 7 years</li> <li>- Date of last calibration : 31/12/2010</li> <li>- Validity period : 31/12/2010 – 30/12/2017</li> </ul> <p>(5) Juksan Power plant  Measuring equipment : Watt-hour meter  Accuracy : Allowable error range <math>\pm 0.5</math> %  Serial number : 25112004232  Calibration information</p> <ul style="list-style-type: none"> <li>- Calibration Frequency : within 7 years</li> <li>- Date of last calibration : 31/05/2011</li> <li>- Validity period : 31/05/2011 – 30/05/2018</li> </ul>
Measuring/reading/recording frequency:	Measuring : Continuously Reading : Monthly Recording : Monthly
Calculation method (if applicable):	N/A

QA/QC procedures:	<ul style="list-style-type: none"> <li>- The amount of electricity imported from the grid was checked by receipt of KEPCO.</li> <li>- The Watt-hour meter was set up transparently in accordance with 'Measures act'.</li> <li>- The Watt-hour meter was calibrated regularly in accordance with 'Measures act' and 'General guidelines to SSC CDM methodologies'.</li> </ul>
Purpose of data:	Calculation of baseline emission
Additional comments:	N/A

### D.3. Implementation of sampling plan

&gt;&gt;

Not Applicable

## SECTION E. Calculation of emission reductions or GHG removals by sinks

### E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

&gt;&gt;

The baseline emissions are the product of electrical energy baseline  $EG_{BL,y}$  expressed in MWh of electricity produced by the renewable generating unit by the grid emission factor.

$$BE_y = EG_{BL,y} \times EF_{CO_2,grid,y}$$

Where:

$BE_y$  = Baseline emissions in year y (tCO<sub>2</sub>e/MWh)

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

$EF_{CO_2,grid,y}$  = CO<sub>2</sub> emission factor of the grid in year y (tCO<sub>2</sub>e/MWh)

**Quantity of the electricity supplied to the grid as a result of the implementation of the CDM project activity in year y ( $EG_{BL,y}$ ) = Total Electricity Exported to the grid ( $EG_{export}$ ) – Total Electricity Imported from the grid ( $EG_{import}$ ).**

$$\text{Thus, } EG_{BL,y} = EG_{export} - EG_{import}$$

(1)  $EG_{BL,y,Dalseong,exported}$  : 51,813.961 MWh

$EG_{BL,y,Dalseong,imported}$  : 21.204 MWh

(2)  $EG_{BL,y,HapcheonChangnyeong,exported}$  : 93,553.311 MWh

$EG_{BL,y,HapcheonChangnyeong,imported}$  : 1,358.748 MWh

(3)  $EG_{BL,y,ChangnyeongHaman,exported}$  : 104,062.008 MWh

$EG_{BL,y,ChangnyeongHaman,imported}$  : 9.984 MWh

(4)  $EG_{BL,y,Seungchon,exported}$  : 13,686.940 MWh

$EG_{BL,y,Seungchon,imported}$  : 23.307 MWh

(5)  $EG_{BL,y,Juksan,exported}$  : 20,507.493 MWh

$EG_{BL,y,Juksan,imported}$  : 55.992 MWh

According to the above,

$$\begin{aligned}
 EG_{\text{exported}} &= 51,813.961 + 93,553.311 + 104,062.008 + 13,686.940 + 20,507.493 \text{ MWh} \\
 &= \mathbf{283,623.713 \text{ MWh}} \\
 EG_{\text{imported}} &= 21.204 + 1,358.748 + 9.984 + 23.307 + 55.992 \text{ MWh} \\
 &= \mathbf{1,469.235 \text{ MWh}}
 \end{aligned}$$

$$\begin{aligned}
 \text{Thus, } EG_{\text{BL},y} &= EG_{\text{export}} - EG_{\text{import}} \\
 &= (283,623.713 - 1,469.235) \text{ MWh} \\
 &= \mathbf{282,154.478 \text{ MWh}}
 \end{aligned}$$

Therefore,

$$\begin{aligned}
 BE_y &= EG_{\text{BL},y} \times EF_{\text{CO}_2, \text{grid}, y} \\
 &= 282,154.478 \times 0.6645 \\
 &= \mathbf{187,491 \text{ tCO}_2\text{e (Rounded down conservatively)}}
 \end{aligned}$$

## E.2. Calculation of project emissions or actual net GHG removals by sinks

>>

Since no fossil fuel used at the project site due to project activity during the monitoring period the project emissions are zero.

$$\text{Thus, } PE_y = 0 \text{ tCO}_2\text{e}$$

## E.3. Calculation of leakage

>>

There is no leakage in the project activity.

$$LE_y = 0 \text{ tCO}_2\text{e}$$

## E.4. Summary of calculation of emission reductions or net GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (t CO <sub>2</sub> e)	Project emissions or actual net GHG removals by sinks (t CO <sub>2</sub> e)	Leakage (t CO <sub>2</sub> e)	GHG emission reductions or net GHG removals by sinks (t CO <sub>2</sub> e) achieved in the monitoring period		
				Up to 31/12/2012	From 01/01/2013	Total amount
2012	4,750.221	0	0	4,750.221	0	4,750.221
2013	56,197.542	0	0	0	56,197.542	56,197.542
2014	51,359.689	0	0	0	51,359.689	51,359.689
2015	51,159.588	0	0	0	51,159.588	51,159.588
2016	24,024.609	0	0	0	24,024.609	24,024.609
<b>Total</b>	187,491.649	0	0	4,750.221	182,741.428	187,491.649

**E.5. Comparison of actual emission reductions or net GHG removals by sinks with estimates in registered PDD**

Item	Values estimated in ex ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e)	189,541	187,491

**E.6. Remarks on difference from estimated value in registered PDD**

&gt;&gt;

This project was estimated to reduce 189,541 tCO<sub>2</sub>e according to the registered PDD for the current monitoring period. However, actual reduction is 187,491 tCO<sub>2</sub>e and this shows that the actual value was lower by 2,050 tCO<sub>2</sub>e than the estimated value in the PDD. It is due to the pause of power generation facilities in repair works, the increased inflow of floating materials and the decrease of effective head in rainy season for each power plant. Additionally, the generators were stopped because of reconstruction of the decrepit transverse culvert (owned by Iksan Regional Construction and Management Administration) for Juksan power plant.

## Appendix 1. Contact information of project participants and responsible persons/entities

<b>Project participant and/or responsible person/ entity</b>	<input checked="" type="checkbox"/> Project participant <input checked="" type="checkbox"/> Person/entity responsible for completing the CDM-MR-FORM
<b>Organization name</b>	Korea Water Resources Corporation (K-water)
<b>Street/P.O. Box</b>	200, Sintanjin-Ro, Daedeok-Gu
<b>Building</b>	K-water
<b>City</b>	Daejeon City
<b>State/region</b>	
<b>Postcode</b>	34350
<b>Country</b>	Republic of Korea
<b>Telephone</b>	+82-42-629-3114
<b>Fax</b>	+82-42-629-2999
<b>E-mail</b>	<a href="mailto:kdj@kwater.or.kr">kdj@kwater.or.kr</a>
<b>Website</b>	<a href="http://english.kwater.or.kr">http://english.kwater.or.kr</a>
<b>Contact person</b>	Kim, Deog-je
<b>Title</b>	Principal Specialist
<b>Salutation</b>	Mr.
<b>Last name</b>	Kim
<b>Middle name</b>	
<b>First name</b>	Deog-je
<b>Department</b>	New & Renewable Energy Dept.
<b>Mobile</b>	
<b>Direct fax</b>	+82-42-629-2999
<b>Direct tel.</b>	+82-42-629-2988
<b>Personal e-mail</b>	kdj@kwater.or.kr

- - - - -

**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
05.1	4 May 2015	Editorial revision to correct version numbering.
05.0	1 April 2015	Revisions to: <ul style="list-style-type: none"> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to the Host Party;</li> <li>• Remove reference to programme of activities;</li> <li>• Overall editorial improvement.</li> </ul>
04.0	25 June 2014	Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul>
03.2	5 November 2013	Editorial revision to correct table in page 1.
03.1	2 January 2013	Editorial revision to correct table in section E.5.
03.0	3 December 2012	Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).
02.0	13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	28 May 2010	EB 54, Annex 34. Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance Keywords: monitoring report		