

**MONITORING REPORT FORM (F-CDM-MR)**
Version 02.0**MONITORING REPORT**

Title of the project activity	Korea South-East Power Co. (KOSEP) small-scale hydroelectric power plants project (the Samchonpo Thermal Power Plant and Younghung Thermal Power Plant small-scale hydroelectric power plants construction project)
Reference number of the project activity	788
Version number of the monitoring report	1
Completion date of the monitoring report	08/06/2012
Registration date of the project activity	23/03/2007
Monitoring period number and duration of this monitoring period	2st monitoring: 01/01/2009 ~ 31/12/2011
Project participant(s)	Korea South-East Power Co.(KOSEP)
Host Party(ies)	Republic of Korea
Sectoral scope(s) and applied methodology(ies)	Energy industries(1): AMS-I.D.(ver.9)
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	63,567 ton CO ₂
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	67,518 ton CO ₂

**SECTION A. Description of project activity****A.1. Purpose and general description of project activity**

>>

- Purpose of the project activity

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

-Brief description of the installed technology and equipments

KOSEP small-scale hydroelectric power plants project consists in six wheels, six generators, one transformer in the Samchonpo and three wheels, three generators, one transformer in the Younghung.

Item	Samchonpo	Younghung
Unit	6	3
Generator output power	1,000 KW x 6	1,000KW x 3
Total installed Capacity	6,000KW	3,000KW

- Relevant dates for the project activity

Item	Samchonpo	Younghung
Completion of construction	29/12/2006	06/04/2008
Commissioning date	23/01/2007	09/04/2008
Starting date of operation	29/12/2006	11/03/2008
1 st monitoring period	01/11/2007 ~ 31/12/2008	
2 st monitoring period	01/01/2009 ~ 31/12/2011	

Date when power transmission was firstly made is defined as starting date of commercial operation in Republic of Korea.

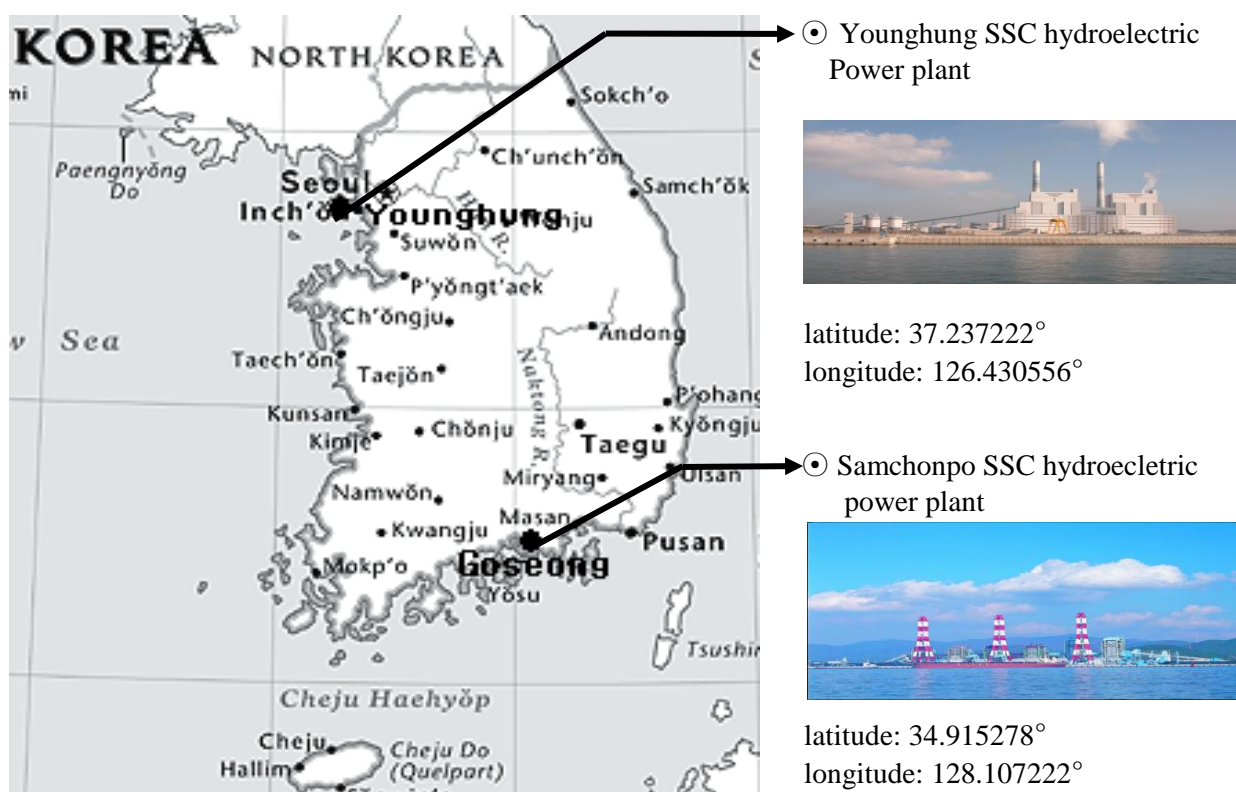
The date in Samchonpo when KPX firstly transmitted power was 29 December, 2006 and the construction was completed on 29 December, 2006. The date in Younghung when KPX firstly transmitted power at the end of construction stage was 11 March, 2008 and the construction was completed on 6 April, 2008.

- Total emission reductions achieved in this monitoring period: 67,518tCO₂**A.2. Location of project activity**

>>

The Samchonpo thermal power plant small-scale hydroelectric power plant:
(Goseong Gun, Gyeongsangnam-do, Republic of Korea)

The Younghung thermal power plant small-scale hydroelectric power plant:
(Ongjin Gun, Incheon metropolitan City, Republic of Korea)



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 if the Party involved wishes to be considered as project participant (Yes/No)
Republic of KOREA (host)	Public entity : Korea South- East Power Co. (KOSEP)	No

A.4. Reference of applied methodology

>>

The applied Methodology: AMS-I.D. Grid connected renewable electricity generation (Version 9)

Tools: “Tool to calculate emission factor for an electricity system” (Version 01.1)

A.5. Crediting period of project activity

>>

Type: Fixed

Start date of 2st monitoring: 01/01/2009

Length of the crediting period (2st monitoring): 3 years (01/01/2009 ~ 31/12/2012)

Crediting period: 01/11/2007 ~ 31/10/2017 (10years)

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

>>

1. Technical process

KOSEP small-scale hydroelectric power plants project (the Samchonpo Thermal Power Plant, Younghung Thermal Power Plant small-scale hydroelectric power plants construction project) consists in 8,695.2 kW

of facility capacity and power generation as per the PDD is expected to be 38,155MWh per year. Major project participant is KOSEP.

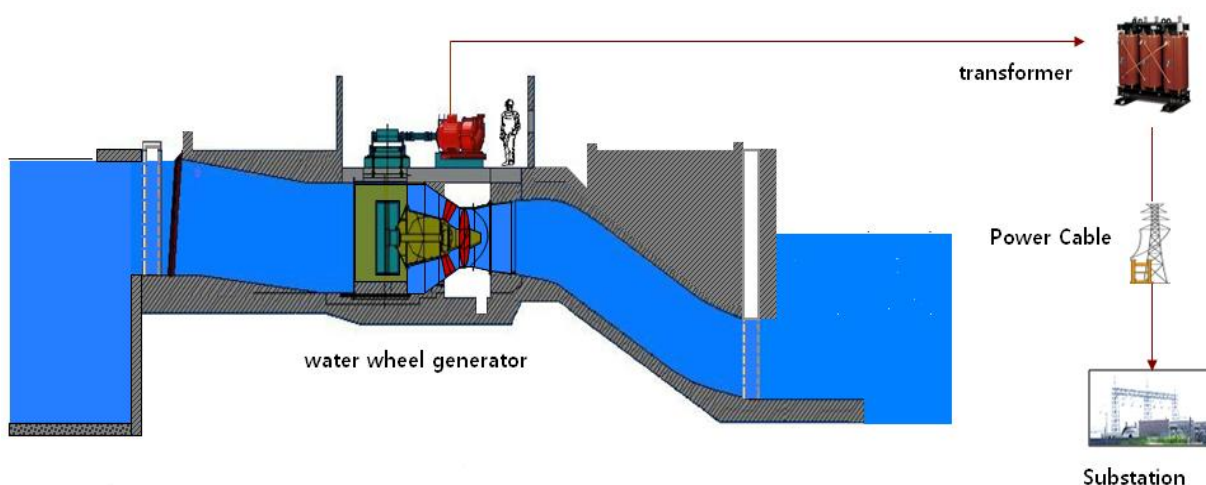
Those plants are generating rotatory force of wheels utilizing potential energy derived from net head of cooling water, and they generate electricity by generator directly connected to the wheel.

In another words, this project adopts the system that Generator generates electricity by operating wheels before cooling water goes to the sea, and the generated electricity is going to the grid by utilizing transformer.

2. Installed technology small scale hydropower plant.

Classification		The Samchonpo small-scale hydroelectric power plant	The Younghung small-scale hydroelectric power plant
Wheel	Type	Vertical/Horizontal Kaplan	Pit/Horizontal/Kaplan
	Output power	949.2 kW	1,000 kW
	Rotation	160 RPM	187.5 RPM
	Unit	6	3
Generator	Type	Three-phase induction (horizontal axis)	Synchronous (horizontal axis)
	Output power	1,000 kW	1,000 kW
	Unit	6	3
Transformer	Type	Mold type	Mold type
	Capacity	7,000 kVA	4,000 kVA
	Volatage	3.3 kV / 22.9 kV	3.3 kV / 22.9 kV
	Connect-ion type	Δ -Y	Δ -Y
	Unit	1	1

3. System diagram



**4. Relevant dates of project activity :**

Item	Samchonpo	Younghung
Completion of construction	29/12/2006	06/04/2008
Commissioning date	23/01/2007	09/04/2008
Starting date of operation	29/12/2006	11/03/2008
1 st monitoring period	01/11/2007 ~ 31/12/2008	

5. The information regarding the actual operation :

Item	Samchonpo	Younghung
Overhaul	3 times - Calibration Of MOF(#1~#6) (20/10/2009) - Reinforcement of Transmission line (#1~#6) (02/02/2010) - Time off of distribution line (#1~#6) (07/03/2011)	3times - Disassemble/Inspection Of Lube oil cooling fan(#1~#3) (29/09/2010) - Overhaul of Hydropower plant #1 (24/10/2011) - Inspection Of Motor(#1~#3) (24/04/2012)
Downtimes	4 times - Loss of power of vibration monitoring devices(#1,#2,#4,#5,#6) (07/12/2009) - Ground connection of distribution line (#2,#3,#4,#5,#6) (01/07/2010) - Malfunction Of vibration Pick-Up (#1) (20/02/2011) - Ground connection of UPS cable(#1,#2,#3,#5,#6) (24/12/2011)	3times - Water leak of Discharge Ring Flange(#1) (02/12/2009) - Abrasion of Guide bearing(#1) (02/06/2009) - Damage of AVR card(hydropower plant) (12/02/2011)
Exchange of equipment	5 times - Exchange of Belt(#6) (18/03/2009) - Exchange of Flat Belt(#2) (23/10/2009) - Exchange of condenser(#3) (30/10/2009) - Exchange of electric motor(#5) (13/01/2010) - Exchange of condenser(#1) (19/07/2010)	4times - Exchange of all generators (there was an event of exchange of equipment in Younghung during the monitoring period due to the flooding accident in Hydraulic turbine room. As the result of it, all generators were changed with the same capacity:20/04/2009 ~ 29/05/2009) - Exchange of wheel guide Bearing/seal(#3) (09/11/2010 ~ 29/12/2010) - Exchange of wheel guide Bearing/seal (#3) (09/02/2011 ~ 14/02/2011) - Exchange of sump Pump Bearing (#3) (11/05/2011 ~ 18/05/2011)

B.2. Post registration changes

B.2.1. Temporary deviations from registered monitoring plan or applied methodology

>>

Not applicable

B.2.2. Corrections

>>

Not applicable

B.2.3. Permanent changes from registered monitoring plan or applied methodology

>>

Not applicable

B.2.4. Changes to project design of registered project activity

>> During the 2nd monitoring period, the head of dam at Samchonpo has been increased with 0.8M.

Whether if actual changes affect the additionality of project activity, Investment analysis have modified the key parameters in the original spreadsheet calculations.

- Registered PDD <table-1>

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

- Changed PDD <table-2>

Plant Name	Total Expenses (unit: one million won)	Operation & Maintenance Cost including tax (unit: one million won /year)	Unit Cost of Purchase (unit: won/KWh)	Purchased Electricity (unit :MWh)	NPV (unit : one million won)
The Samchonpo small scale hydroelectric power plant	15,995	566	55.79	26,921	-3,067
The Younghung small scale hydroelectric power plant	11,880	192	55.79	15,426	-3,492

- * Crediting period is for 10 years except construction period.
- * The discount rate of Samchonpo project is 6.00 and the discount rate of Younghung is 7.00
- * Discount rate and other variables are adopted from the execution design report of individual plant.
- * Raw data (Excel sheet) for economical analysis is submitted to DOE (KEMCO).

As a head of dam has been increased, Construction cost and O&M cost is increased.

Purchased electricity is also increased because of increasing power production

As a result, O&M cost is changed from 539 million won to 566 million won, power generation value is changed from 22,728 to 26,921.

Therefore NPV value is changed from -5,097 to -3,067. This value is smaller than 0.

It clearly demonstrated that does not effect on additionality.

According to Annex 4, EB65, 2nd monitoring is proceed without prior approval from EB because actual changes of project activity not effect on additionality

Relevant documents submitted to DOE.

B.2.5. Chnges to start date of crediting period

>>

Not applicable

B.2.6. Types of changes specific to afforestation or reforestation project activity

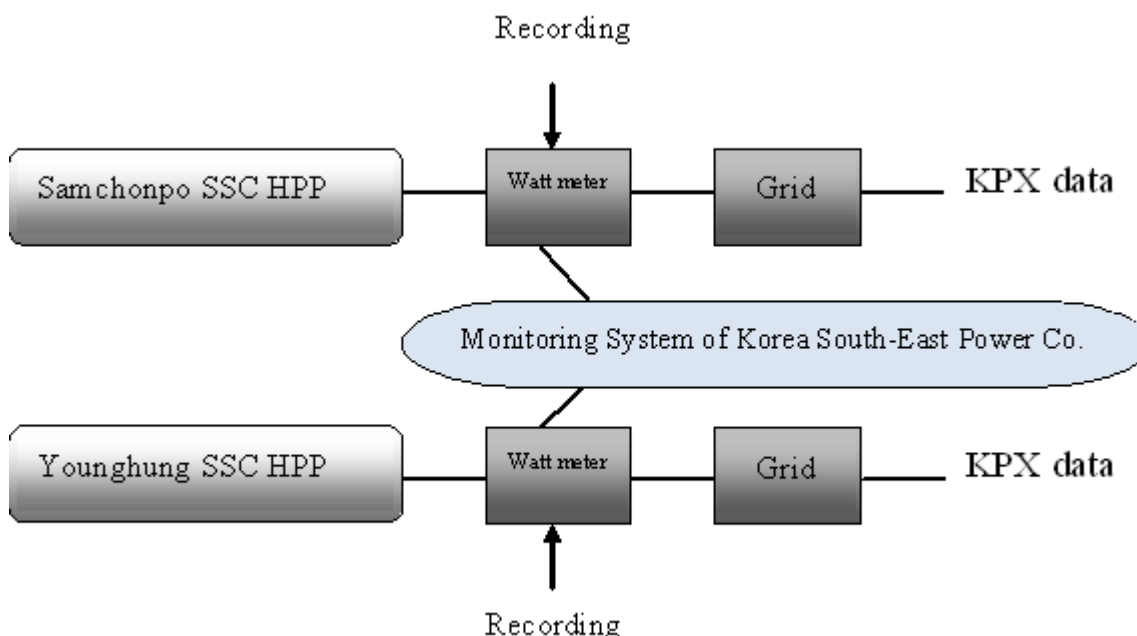
>>

Not applicable

SECTION C. Description of monitoring system

>>

- Data collection procedures & diagram:



KOSEP data

- 1) Measurement of electricity meters established on site
 - responsible person: equipment manager
- 2) Transfer measured data to central control system

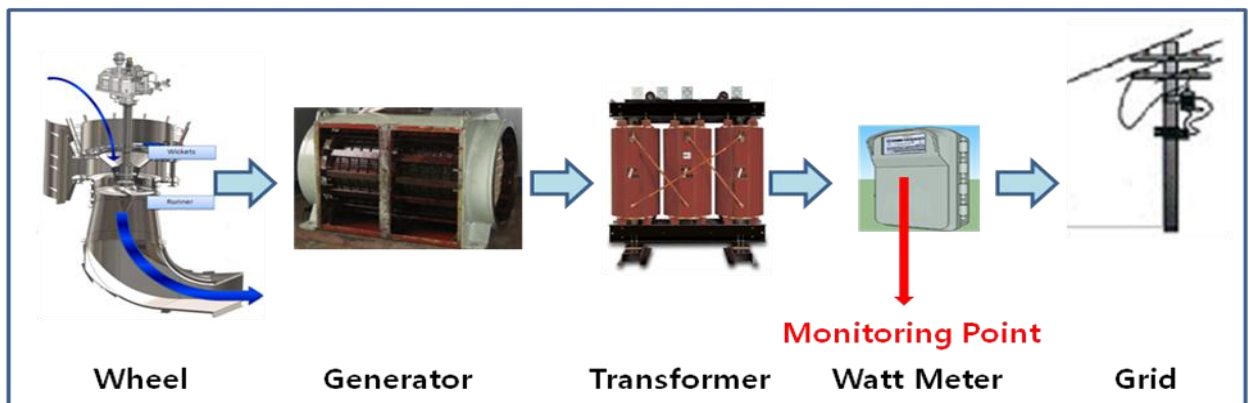
- responsible person: equipment manager
- 3) Aggregation of measured data
 - responsible person: equipment manager
- 4) Recording of measured data
 - responsible person: Management Center
- 5) Calculation of emission reduction after the comparison between KOSEP data and KPX data
 - responsible person: Power trading team
- 6) Reporting of emission reductions
 - responsible person: Climate & Environment Team (Head Office)

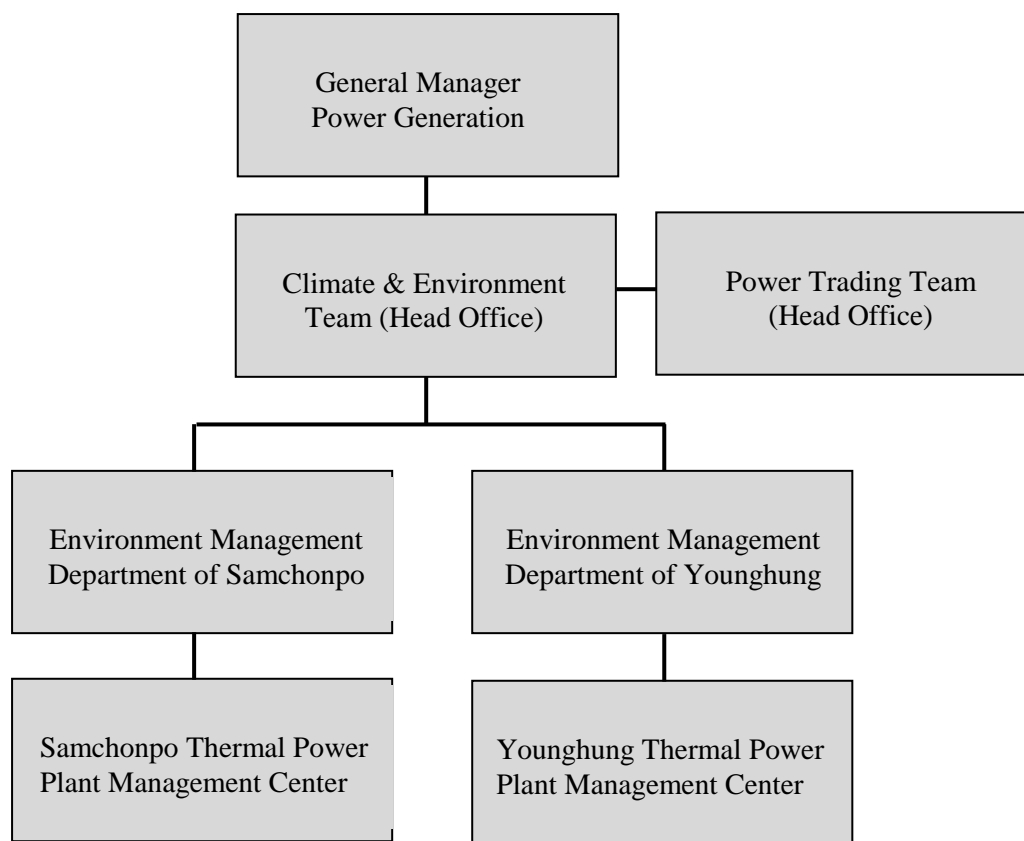
KPX data

- Aggregation of daily data by watt hour meter
- Values transferred to KPX shall be recorded everyday
- KPX data is automatically noticed to PP

Two data is double checked by PP

- After comparison between data of KPX and data of KOSEP, more conservative value will be utilized for calculations

- Monitoring Point for the project:**- Operational and management structure:**

**Management Center**

Responsibilities: Be responsible for collecting and documentation of the net electricity data supplied to the grid and check and review the collected monitoring data

Environment Management Department

Responsibilities: Be responsible for operation & maintenance of monitoring equipment, recording and collecting of monitoring data.

Climate & Environment Team (Head Office)

Responsibilities: Take charge of the implementation and management of the monitoring plan overall; check and supervise the activities such as recording, collecting and archiving of the monitoring data.

Power Trading Team (Head Office)

Responsibilities: Comparison between data of KPX and amount of electricity recorded in internal server.

General Manager Power Generation

Responsibilities: Be responsible for final approval on a monitoring report.

- QA/QC procedures**1. Monitoring equipment and the amount of electricity monitoring**

1-1. 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.

1-2. The meters were tested when they were installed, and are re-calibrated every three years after installation.

- 1-3. The amount of electricity transmitted to the grid is measured automatically by established meters.
1-4. The measured data was simultaneously transferred to central control system of Small-Scale hydroelectric Power Plant and Korea Power Exchange.

2. Emergency procedure

- 2-1. In case unexpected accident which affects Emission Reductions is occurred, the person in charge of monitoring should report to the responsible department(Climates & Environment Team) and act according to the internal manual in emergency.
2-2. 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 fixed ex ante or at renewal of crediting period

Data/Parameter	EF _y
Unit	tCO ₂ /MWh
Description	The combined margin emission factor in the Republic of Korea grid
Source of data	The registered PDD
Value(s) applied	0.5554 tCO ₂ /MWh (Ex-ante value)
Purpose of data	<ul style="list-style-type: none">- This value is used for baseline emission calculations.- This value was calculated according to “A combined margin(CM) , consisting of the combination of operating margin(OM) and build margin(BM) according to the procedures prescribed in the approved methodology ACM0002” Applied value was calculated by referring Statistics of Electric Power in KOREA (2004, 2005, 2006) (KEPCO)
Additional comment	This parameter was calculated ex-ante as 0.5554tCO _{2e} /MWh in the registered PDD and will be fixed during the first crediting period.

**D.2. Data and parameters monitored****Samchonpo**

Data/Parameter	EG _{1,y}
Unit	MWh
Description	Electricity supplied to the grid by the project
Measured/Calculated /Default	Directly measured
Source of data	Measured by meter installed at the project site
Value(s) of monitored parameter	89,580.422MWh
Monitoring equipment	Measurement equipment: Watt-hour meter Accuracy : Allowable error range $\pm 0.5\%$. Serial number: 5561356 Calibration information - Number of meter: 1 meter - Calibration frequency : within 3years - Date of initial/previous calibration: 02/05/2006 - Date of latest calibration: 20/10/2009 - Validity period: 20/10/2009 ~ 19/10/2012
Measuring/Reading/ Recording frequency	Measuring: every 5minutes Recording: daily KOSEP practically measures supplied electricity every five minutes in order to increase its accuracy though PDD only represents that electricity shall be measured every hour. More precise monitoring than PDD description(Measuring: Hourly/ Recording: Monthly)
Calculation method (if applicable)	Not applicable
QA/QC procedures	- The amount of electricity transmitted to the grid was automatically measured and transferred to Korea Power Exchange (KPX) and, so it was double checked by receipt of sales
Purpose of data	This value is used for Baseline emission calculations
Additional comment	

Younghung

Data/Parameter	EG _{2,y}
Unit	MWh
Description	Electricity supplied to the grid by the project
Measured/Calculated/Default	Directly measured
Source of data	Measured by meter installed at the project site
Value(s) of monitored parameter	32,646.007MWh
Monitoring equipment	Measurement equipment: Watt-hour meter Accuracy : Allowable error range $\pm 0.5\%$. Serial number: 6063914 Calibration information - Number of meter: 1 meter - Calibration frequency : within 3years - Date of initial/previous calibration: 18/07/2007 - Date of latest calibration: 16/12/2010 - Validity period: 16/12/2010~ 15/12/2013
Measuring/Reading/Recording frequency	Measuring: every 5minutes Recording: daily KOSEP practically measures supplied electricity every five minutes in order to increase its accuracy though PDD only represents that electricity shall be measured every hour. More precise monitoring than PDD description(Measuring: Hourly/Recording: Monthly)
Calculation method (if applicable)	Not applicable
QA/QC procedures	- The amount of electricity transmitted to the grid was automatically measured and transferred to Korea Power Exchange (KPX) and, so it was double checked by receipt of sales
Purpose of data	This value is used for Baseline emission calculations
Additional comment	

D.3. Implementation of sampling plan

>>

Not applicable

SECTION E. Emission reductions calculation

E.1. Baseline emissions calculation

>>

$$BE_y = EG_y \times EF_y$$

- Samchonpo SSC HPP: 89,580.422MWh
- Younghung SSC HPP: 32,646.007MWh
- Total Electricity Generated, EG_y: 122,226.429MWh

$$BE_y = 122,226.429 \times 0.5554 \text{ tCO}_{2e}/\text{MWh} = 67,884.56 \text{ tCO}_{2e}$$

E.2. Project emissions calculation

>>

Electricity generated from this project is utilized for its own operation of small scale hydro power plant and the rest amount of electricity is going to KPX in order.

Samchonpo hydropower plant is utilized in internal meter that is imported electricity from the Water treatment facility.

Internal meter was installed on 20/10/2009 after 1st verification has been finished.

During this monitoring period, imported electricity is 520.32MWh which is accumulated.

In case of Younghung hydropower plant, imported electricity has calculated two methods as below;

- measurement of electricity supplied from KEPCO (meter1),
- calculation of imported electricity from the thermal power plant #3,#4.

Imported electricity from the KEPCO(meter1) is measured in real time, recording monthly basis.

During this monitoring period, imported electricity from the KEPCO is 104MWh.

The below EI_y calculation is for value of emergency electricity when electricity producing from small scale hydropower plant is not occurred, and it is calculated by multiplication between maximum auxiliary electricity and operation stop time of small scale hydro power plant.

Internal measuring system at KOSEP; which measures every five minutes, is identifies the hours that the small scale hydro power plant was stopped through electricity generation data.

Namely, the hours that the small scale hydro power plant was stopped are to the equal hours that auxiliary electricity was replaced.

The formula is as follows:

$EI_y = \text{Shut-down time (min)} * \text{Maximum electricity load of the facility (kW)}$

*shut down time (min): calculated based on the record (every 5 minutes measurement) of 'Electricity Transaction measuring system' of KOSEP

* Maximum electricity load of the facility (kW): obtained from the technical specification of the plant

EI_y

- Younghung SSC HPP: 35.512MWh
 $35.512\text{MWh} = 18,720(\text{min}) \times 1(\text{h}) / 60(\text{min}) \times 113.82\text{kW} \times 1\text{MW}/1000\text{kW}$

18,720(min)	This value is collected by recording system (in case of no electricity generating)
113.82kW	Maximum auxiliary electricity when all equipment is operating

All relevant data is submitted to the DOE

➤ Total Electricity imported, $EG_{IMP,y}$: 104MWh + 35.512MWh= 139.192MWh

$$PE_y = EI_y \times EF_y$$

$$PE_y = (520.32 \text{ MWh} + 139.192 \text{ MWh}) \times 0.5554 \text{ tCO}_2\text{e/MWh} = 366.29 \text{ tCO}_2\text{e}$$

D.4. Calculation of leakage

>>

Not applicable

D.5. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Time Period	Baseline emissions or baseline net GHG removals by sinks (tCO ₂ e)	Project emissions or actual net GHG removals by sinks (tCO ₂ e)	Leakage (tCO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO ₂ e)
Total	67,885	367	0	67,518

D.6. Comparison of actual emission reductions or net anthropogenic 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 (tCO₂e)	21,189	22,506

D.7. Remarks on difference from estimated value in registered PDD

>>

The re-calculated value for 12 months from the total 36 month-value is 22,506 tCO₂e and this value equals to 106.2% of 21,189 tCO₂e mentioned in the PDD. The reason why generating efficiency compared to the PDD is higher than the estimation in the PDD belongs to head of dam at Samchonpo has been increased with 0.8M. Afterward, the estimated emission reduction was increased than the expected emission reduction stated in the PDD.



History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance		