EEC

SUURI-KEIKAKU CO.,LTD

NATIONAL RENEWABLE ENERGY CENTRE

JCM/BOCM scheme in Mongolia

Upgrading and Installation of High-Efficient Heat Only Boilers for Heat supply systems in Districts

31 January 2013

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1. Outline of Project

- 1.1 Key Points of Our Study
- 1.2 Outline of GHG Mitigation Activity

<Comments>
As the results of COP18, the Japanese acquisition route of the Kyoto Protocol Units (AAU, CER, etc.) was restricted remarkably in the 2nd commitment period of the Kyoto Protocol.
As a result, the importance of the JCM/BOCM and other market mechanism is increasing significantly.

1.1.1 Key Points of Our Study

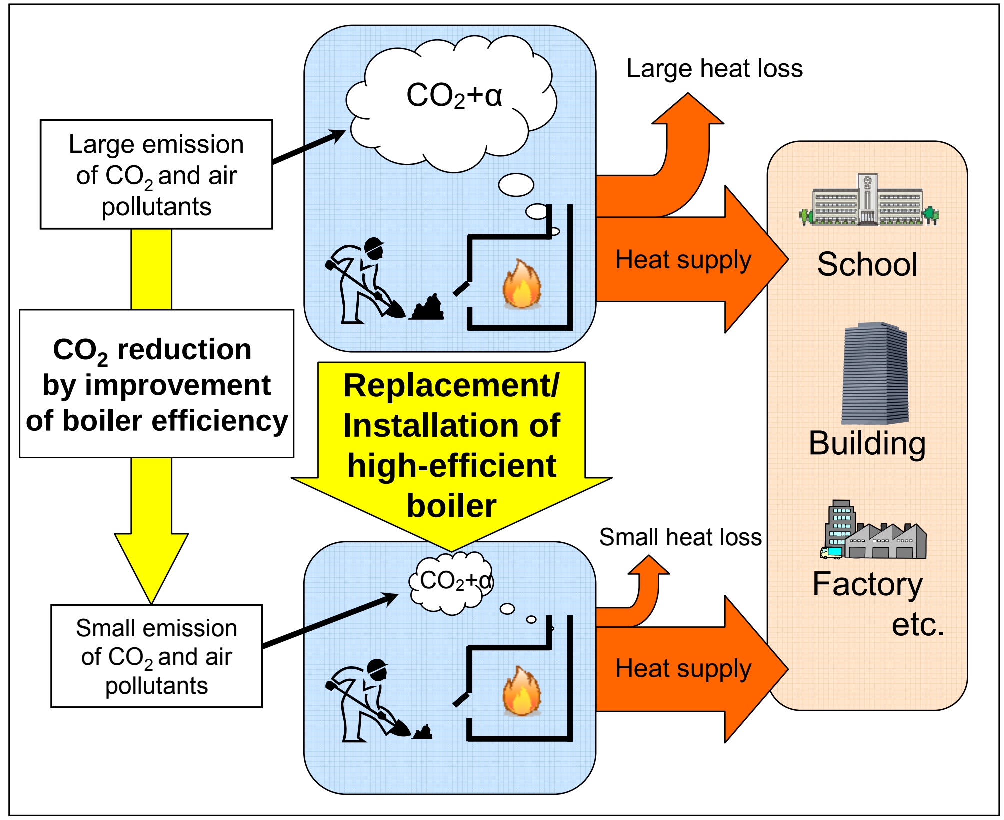
1. Japanese Team supports the development of MRV Activity which Mongolian people concerned will do the **self-directed** implementation.
2. MRV is **one set** and can not be separated.
3. Making **Monitoring Plan**, with **Verification** taken into account, is the **most Important** Process of MRV. ("Monitoring plan, with Verification take into account" means "by the monitoring plan, the **traceable evidence** can be approached".)

1.1.2 Key Points of Our Study

4. Implementing Monitoring Activities using Monitoring Equipment
5. Implementing Verification for the Monitoring Results
6. Setting “**Boiler Efficiency** of HOBs”, which is based on the **measurement survey** with **accuracy assurance**, as Default Values
7. Consider the **indirect estimation** of the amounts of heat supply (for the simplification of monitoring items)

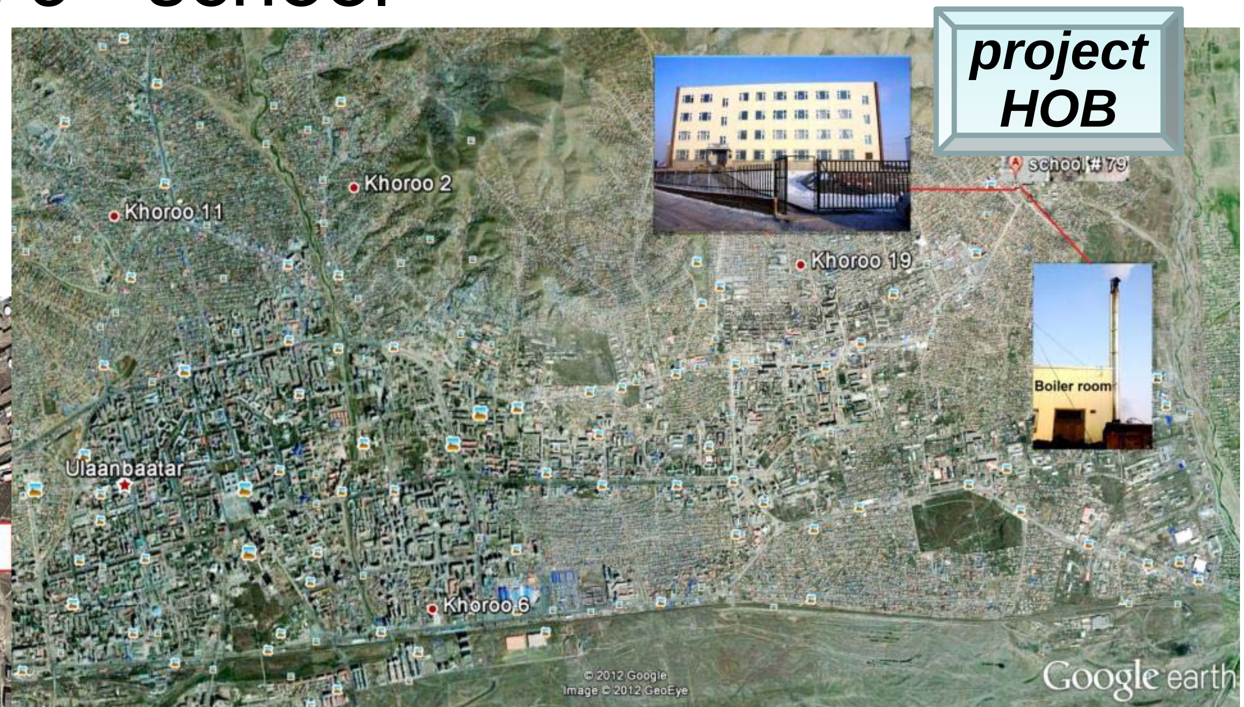
1.2 Outline of GHG Mitigation Activity

- This project/activity refers to the activity to replace low-efficient old type boilers with higher efficient boilers.
- The improvement of boiler efficiency lead to emission reductions of GHG and other air pollutants.



2. Project and Reference Scenario

- Project site: 79th school



Source: EEC Co., Ltd

Reference Scenario

- Reference scenario may be derived from the "Current Situation and Performance".
  - The result of the visiting survey against the boiler owners (available answer 14 person).
- Benchmark is "Boiler Efficiency" of Reference Boiler.
- Reference scenario should be provide the same service level as the project scenario
  - Heat Quantity is same as the Project.

3. Monitoring Plan (Most Important)

Documents for PPs

Documents for Verification Entity

Monitoring Plan

Section X.X Data and parameters to be monitored

Parameter No.1

Parameters	EGy
Description of data	Net electricity supplied to the grid
Estimated Values	10,000
Units	MWh/y
Monitoring Pattern	pattern B
Source of data	Sales and Purchase Invoices
Measurement methods and procedures	Invoices issued by the grid company
Monitoring Frequency (Monitoring, Reading, Recording frequency)	Monitoring: – Reading: Once a month Recording: Once a month
QA/QC Procedures	PP checks the data from invoices with the data monitored by backup meters. The conservative amount after the cross-check is to be used for the calculation of ERs. The backup meters are to be verified at least every three years in accordance with the national regulation.
Other Comments	NA

Monitoring Report

Section X.X Data and parameters to be monitored

Parameter No.1

Parameters	EGy
Description of data	Net electricity supplied to the grid
Monitored Values	9,800
Units	MWh/y
Monitoring Pattern	pattern B
Source of data	Sales and Purchase Invoices
Measurement methods and procedures	Invoices issued by the grid company
Monitoring Frequency (Monitoring, Reading, Recording frequency)	Monitoring: – Reading: Once a month Recording: Once a month
QA/QC Procedures	PP checks the data from invoices with the data monitored by backup meters. The conservative amount after the cross-check is to be used for the calculation of ERs. The backup meters are to be verified at least every three years in accordance with the national regulation.
Other Comments	NA
If there are any changes from the registered monitoring plan such as calibration delay, please summarized the changes.	☐ No changes ☐ Changes occurred (If changes occurred, summarize the fact and reason)

Verification Report

Section X.X Data and parameters to be monitored

Parameter No.1

Check if the information such as "Parameters", "Description of data", "Units" in the registered monitoring plan is correctly applied in the monitoring report.	☐ Yes ☐ No *(If No, summarize the fact and reason)*
Check if "Monitored Values" are correct.	☐ Yes ☐ No *(If No, summarize the fact and reason)*
Check if "Monitoring Pattern" and "Source of data" are in line with the registered monitoring plan.	☐ Yes ☐ No *(If No, summarize the fact and reason)*
Check if "Measurement methods and procedures" is in line with the registered monitoring plan and explain how the entity verified it.	☐ Yes ☐ No *(If No, summarize the fact and reason)* - how the team verified ☐DR (*evidences/measures*) ☐SV (*evidences/measures*) ☐Others (*evidences/measures*)
Check if "Monitoring Frequency (Monitoring, Reading, Recording frequency)" is line with the registered monitoring plan.	- Monitoring frequency: ☐ Yes ☐ No *(If No, summarize the fact and reason)* - Reading frequency: ☐ Yes ☐ No *(If No, summarize the fact and reason)* - Recording frequency: ☐ Yes ☐ No *(If No, summarize the fact and reason)*
Check if "QA/QC Procedures" was implemented as per the registered monitoring plan and explain how the entity verified it.	(For each QA/QC procedure) ☐ Yes ☐ No *(If No, summarize the fact and reason)* - how the team verified ☐DR (*evidences/measures*) ☐SV (*evidences/measures*) ☐Others (*evidences/measures*)
Check if there are any changes from the registered monitoring plan such as calibration delay. If the entity identifes the changes, describe how the chages have been treated.	☐ No changes ☐ Changes occurred *(If changes occurred, summarize the fact and reason)* - If changes were identified, how the team treated them. () ☐As per BOCM manual (*describe the* … *of measures*)

Monitoring Plan

Monitoring Report

The Monitoring Plan taken into account of the Verification is most important.

Verification Report

Example of Parameter Table 1

Parameter No.4		Monitoring Plan	Monitoring report	Verification check
Data/Parameter		**PH**	**PH**	Yes, Parameter is apllied correctly in the monitoring report
Unit		GJ/h	-----	Yes, Description of the Parameter is apllied correctly in the monitoring report
Description		Net heat quantity supplied by the Project HOB	-----	Yes, Purpose of data is correct as per monitoring plan
Purpose of data		For identification of Reference and Project emissions	-----	Type of parameter is described correctly as "measurement".

Example of Parameter Table 2

Parameter No.4		Monitoring Plan	Monitoring report	Verification check
Estimated/Monitored value(s)		389.0 MJ/h (108 kW) (Source:Passport for exploitation)	**56.29** GJ/t Max 0.37 GJ/h Min 0.18 GJ/h Hourly average 0.28 GJ/h	Yes, Monitored values are correct according "Monitoring results" data sheet , shown in Ref No.16
Measurement/ Calculation /Default	Measurement/Calculation /Default	Measurement	-----	Yes, Parameter type is described correctly as per MP.
	Required accuracy level	by MNS OIML R75-1:2007	-----	
Monitoring Pattern		-		
Source of data		Data logged by the heatmeter	-----	Yes, Source of value are in line with the MP.

Example of Parameter Table 3

Parameter No.4		Monitoring Plan	Monitoring report	Verification check
Monitoring equipment	**Specification**			
	Device name	heat meter	-----	Yes, Used Monitoring equipment was ULTRAHEAT UH50-B70C MN00-E ,it is applied correctly as per MP.
	Maker	Landis+Gyr GmbH	-----	-----
	Model/Type	ULTRAHEAT UH50-B70C MN00-E	-----	Yes, Ref No. 21
	Manufacturer's serial number:	66 923 154	-----	Yes, Ref No. 21
	Accuracy	class 2 (EN 1434) (Source: Operation instructions)	-----	Yes, Ref No. 21
	Authorized measuring range	NA	-----	
	Verification status			
	The latest date of verification	2nd of May 2012	-----	Yes, according to OA and Ref No.19
	Validity	1st of May 2017	-----	Yes , it is confirmed by OA
	Responsible person/entity	Landis+Gyr GmbH, Nuremberg/Germany	-----	Yes , it is confirmed by OA.
	No. Certificate number	Certification for Serial number 6692 3154	-----	Yes, Ref No.19

Example of Parameter Table 4

Parameter No.4		Monitoring Plan	Monitoring report	Verification check
Measuring/ Reading/ Recording frequency	**Measuring method**			Measuring method was correct as per MP.
	Measuring point	Please see T1, T2, V1	-----	Yes, it is confirmed by OA
	Measuring range	NA	-----	
	Measuring frequency	Continuously	-----	Yes according to Heat meter's Characteristics, Ref No. 21
	Recording method			Recording method was correct as per MP.
	Recording frequency	Hourly	-----	Yes according to Heat meter's Characteristics, Ref No. 21
	Recording medium	Data logged by the heat meter	-----	Yes, it is confirmed by OA
	Backup method	daily back-up in the computer and monthly back-up in the CD	-----	Yes, it is confirmed by DR and OA.

Example of Parameter Table 5

Parameter No.4		Monitoring Plan	Monitoring report	Verification check
Calculation method (if applicable)		Net heat quantity is calculated depending on flow rate and temperature differences between supply and return temperatures	-----	Yes, It is confirmed by Monitoring results -Project HOB . 04 Dec.2012, Ref No.16
Required by Industrial standard/ requirement of verification	Standard name	List of measuring equipment to validated	-----	Yes -Reference No.15
	Standard number/year	MNS 4549:2005	-----	
	Required verification frequency	5 years (Director's order of National Center for Standardization and measurement (Order #6, date-2008-01-09) (http://www.legalinfo.mn/law/details/1312)	-----	Yes
	Accepted accuracy	±5% (source: MNS OIML R75-1:2007)	-----	Yes, Ref No.20

Example of Parameter Table 6

Parameter No.4		Monitoring Plan	Monitoring report	Verification check
QA/QC procedures	**QA/QC to be performed**			
	Industrial standard/Requirement:			
	• Standard type	Director's order of Mongolian Agency for Standardization and Metrology (Order #6, date-2008-01-09) (http://www.legalinfo.mn/law/details/1312)	-----	Yes –Ref. No.15
	• Standard name	List of measuring equipment to be validated	-----	
	• Required verification validity	5 years (for heat meter)	-----	Yes, it is confirmed by Ref No.15
	• Accepted industry standards:	±5% (source: MNS OIML R75-1:2007	-----	Yes, Ref No.20
	Verification validity	5 years (before expiration). In case that the equipment which does not comply with the accepted industry standards should be replaced by a verified new one.	-----	During the monitoring period verification of the equipment was valid.

Example of Parameter Table 7

Parameter No.4		Monitoring Plan	Monitoring report	Verification check
Trouble shooting procedure of missing data	How was the completion of the missing data	Will be completed by the hourly minimum value (excluding abnormal value) of available recorded data during the monitoring period	During the monitoring period, there was no missing data. It was confirmed that recorded values was normal one, confirming rating capacity of the network pump and outdoor air temperature	During the monitoring period, there was no missing data.
Additional comment		No comments		

Final Documents of Monitoring Plan

Monitoring Plan

1. General description of the project activity

(1) Title of the project

Title: *Upgrading and Installation of High-Efficient Heat Only Boilers for Heat supply systems in Districts*

(2) Version number and date for completion of the monitoring plan

Version: 1
Date: 29 October 2012

(3) Brief description of the project activity and contribution of the project activity to sustainable development (co-benefit)

The target of the project activity is:

- Replacement of old type Heat Only Boilers (HOBs) (low energy efficiency) and
- Installation of New type HOB (high energy efficiency) financed by two steps JICA loan.

Box: Definition
HOB means Heat Only Boiler, defined as a boiler used for heat supply which has capacity of 0.10MW – 3.15MW, according to the Mongolia National Standard (MNS5043).
HOB Upgrading means replacement of existing HOB which is still workable.
HOB Installation means:

- New installation of HOB for New Heat Supply Systems in Districts;
- Replacement of existing HOB which has broken down (out of commission).

Boiler Efficiency is defined as follows:
Boiler Efficiency = Output energy from HOB / Input energy to HOB or
Boiler Efficiency = Net heat quantity supplied (to supply destination) by HOB / Net heat quantity of coal consumed by HOB) Input energy of HOB

The subject of this project is to demonstrate (implement) BOCM project activities at the new efficient project HOB located at the place named School #79 in Bayanzurkh district of Ulaanbaatar city. The project HOB belongs to school 79 (the operation of the HOB is

Monitoring Plan (Word File)

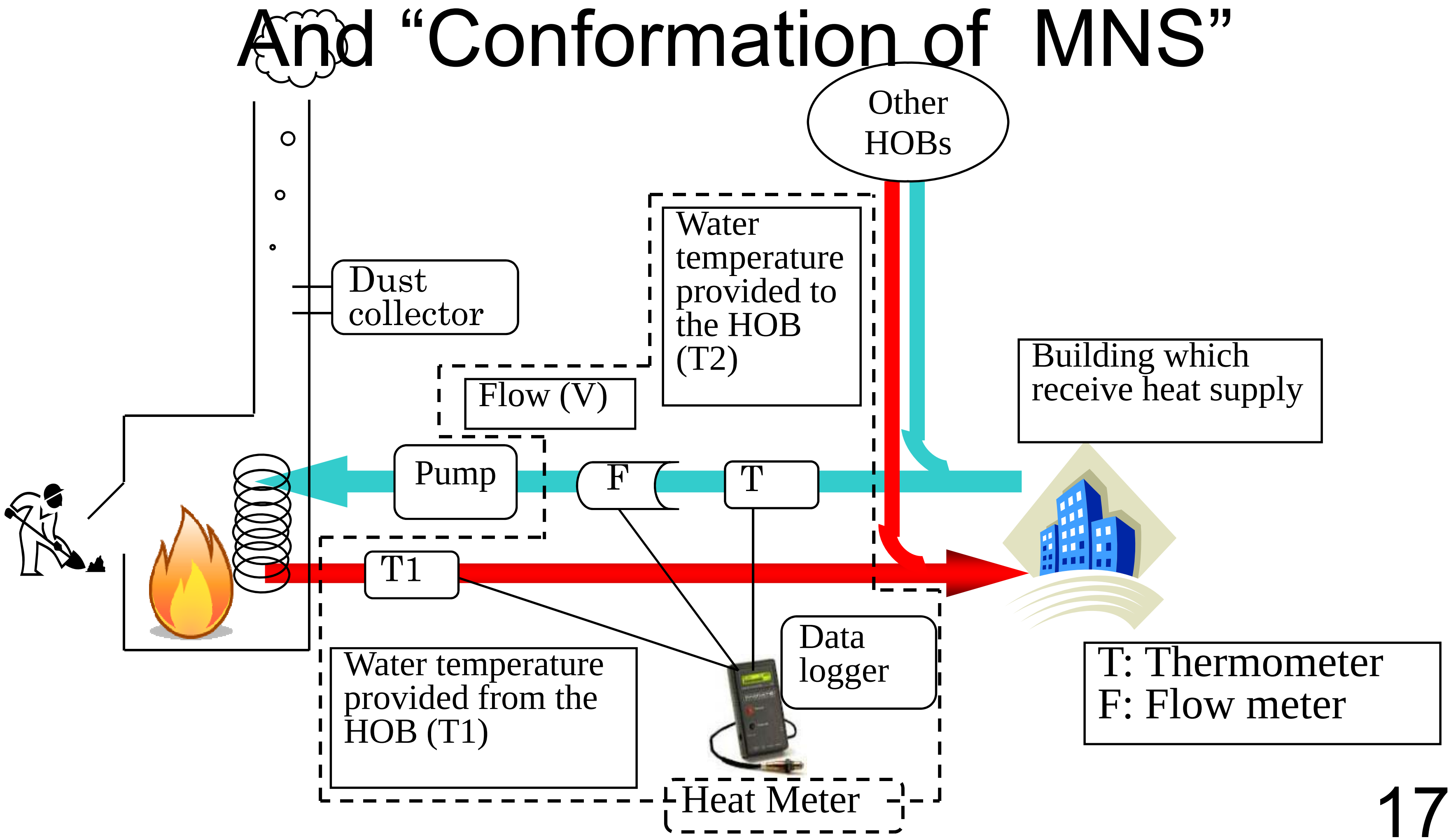
Data/Parameter		**T1**	
Unit		°C	▫ Yes
Description		Temperature of the heated water supplied by the project boiler (outlet)	▫ Yes, According to project description
Purpose of data		For identification of Heat quantity supplied by the project HOB for calculation of Reference and Project emissions.	▫ Yes
Monitored value(s)		Average **48,75** °C Maximum **56,60** °C Minimum **40,60** °C	▫ Yes
Measurement/Calculation /Default	Measurement/Calculation /Default	Measurement	▫ Yes
	Required accuracy level	by MNS OIML R75-1:2007	▫ Yes
Monitoring Pattern			
Source of data		Data logged by the temperature sensor (from heatmeter)	
Monitoring equipment	**Specification**		
	Device name	Refer to PH	▫ Yes
	Maker	Refer to PH	▫ Yes
	Model/Type	Refer to PH	▫ Yes- According to Heatmeter's specification(Reference No1)
	Manufacturer's serial number:	Refer to PH	▫ No-CAR Number is wrong according to serial number on the Heatmeter's
	Accuracy	Refer to PH	▫ Yes- According to Heatmeter's specification (Reference No1)
	Authorized measuring range	0-150) °C (Source: Operation instructions)	▫ Yes-According to Heatmeter's specification (Reference No1)
	Verfcation status		

T1 / T2 / V1 / PH / Version / Objective of the validation of

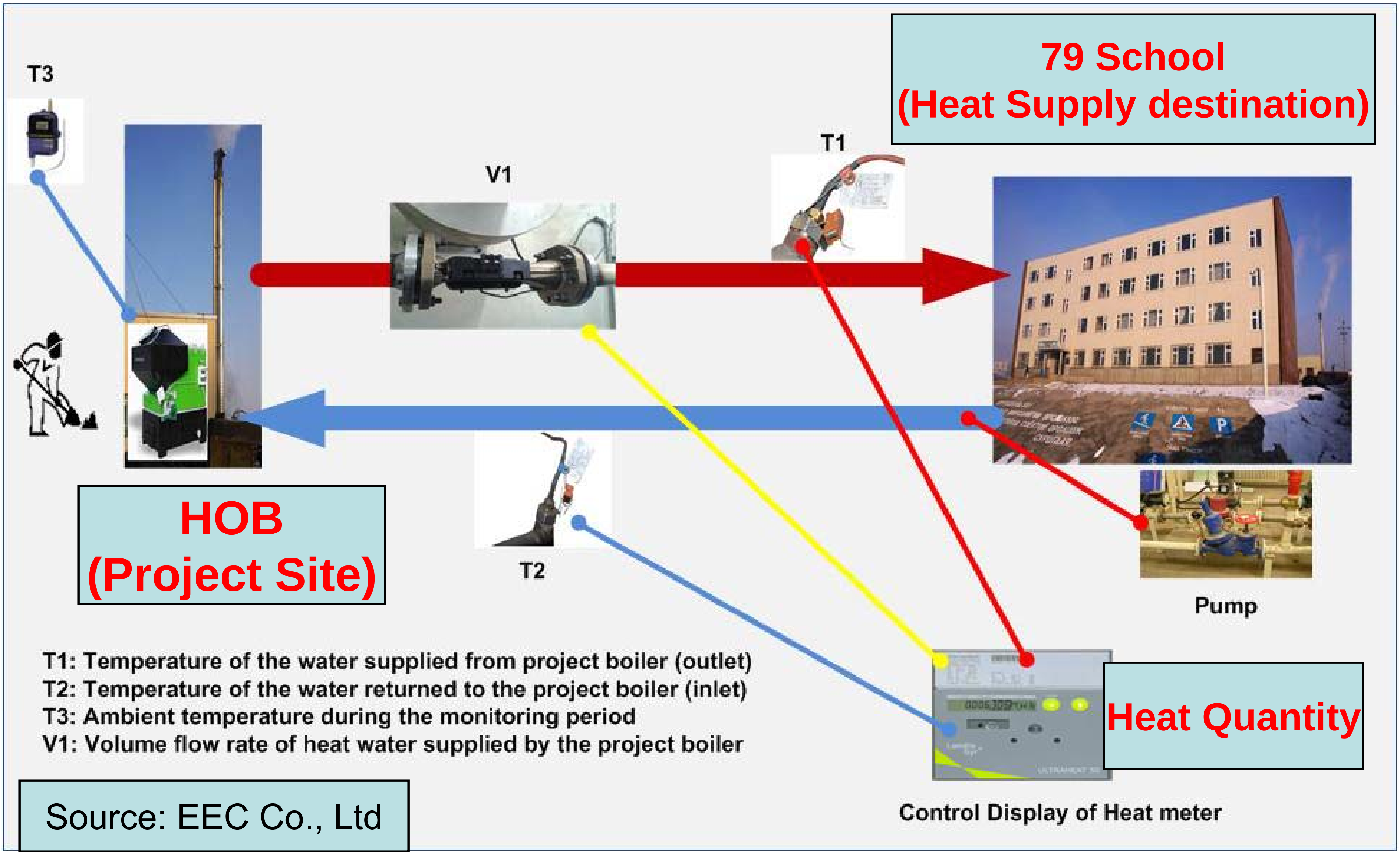
Parameter Table (Excel File)

Parameter Table is most Important,
so these information should be marshaled.

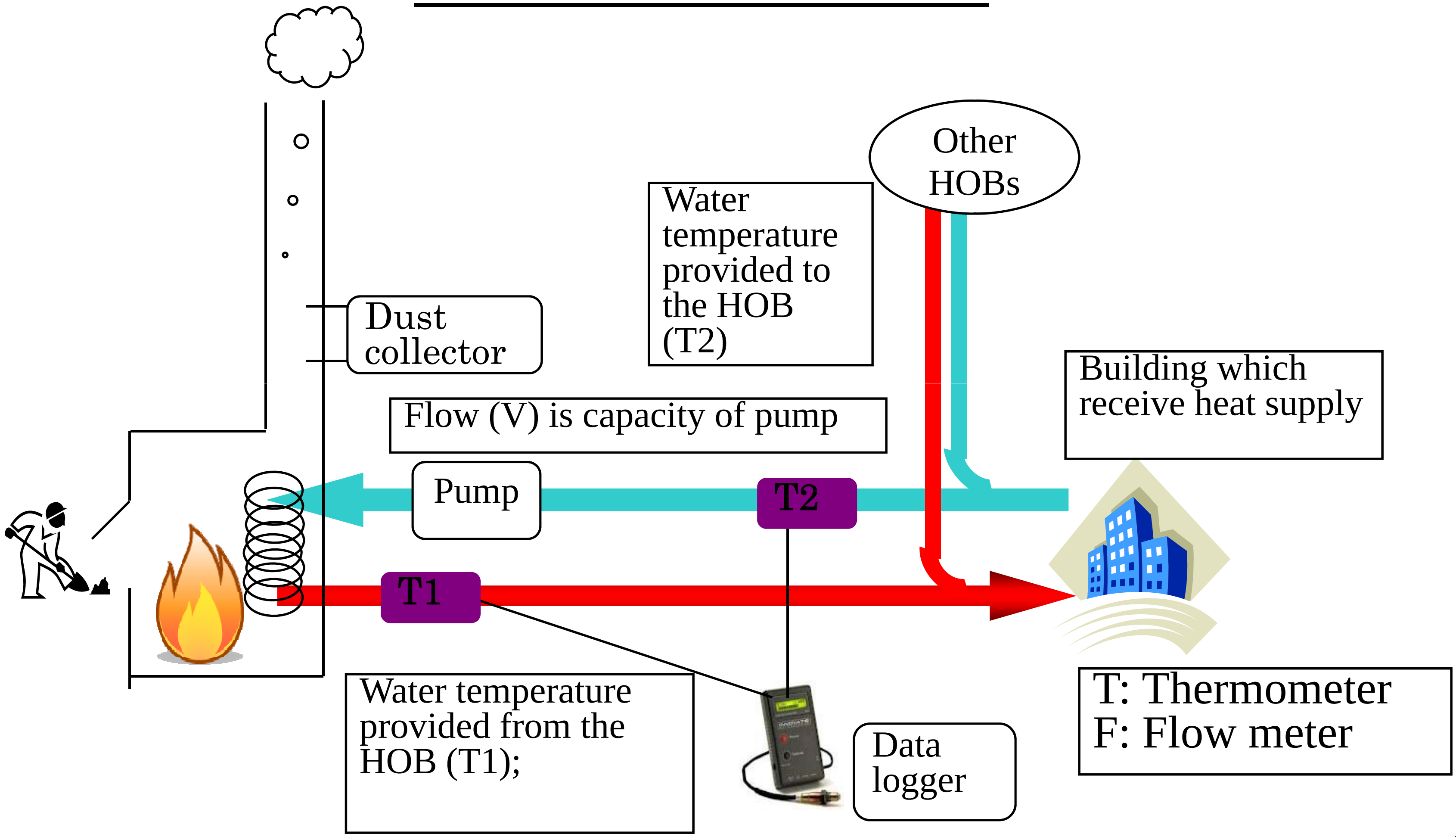
High Quality Method: Monitoring method1-1 “Actual monitoring of Project Heat” And “Conformation of MNS”



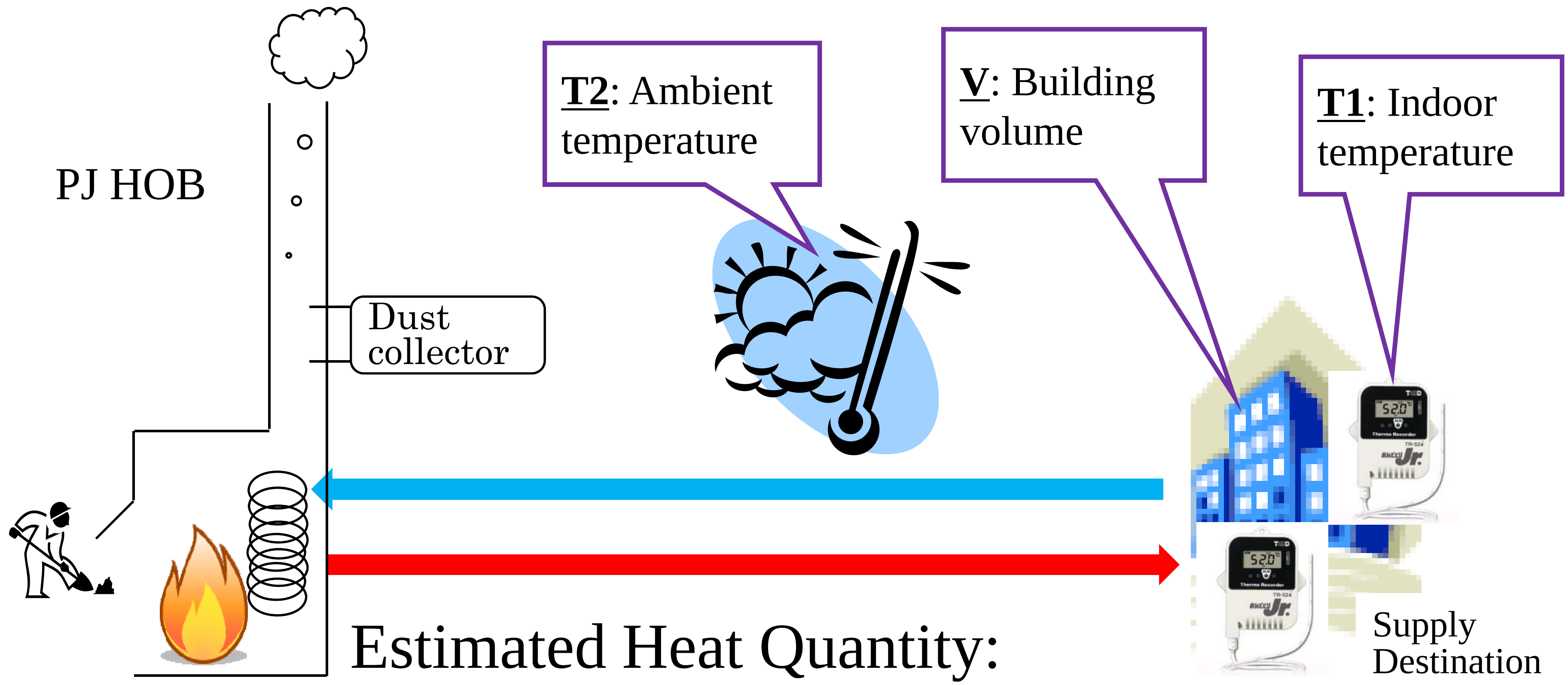
High Quality Method: Installation of Monitoring Equipment



Low Quality Method 1: Monitoring method2-2 “Actual Monitoring of Project Heat” But “Not Conformation of MNS”



Low Quality Method2: Monitoring method 3-2
In case that Net heat quantity supplied by the project HOB cannot be monitored



Estimated Heat Quantity:

$$\underline{Q = q0 \times V \times (T1 - T2)}$$

q0 is Default Value

4. MRV Method

- 4.1 Eligibility Criteria
- 4.2 Option of Estimation Method
- 4.3 Information and Data of Estimation
- 4.4 Emission Reduction of Monitoring Results
- 4.4.1 Low Quality Method
- 4.4.2 High Quality Method

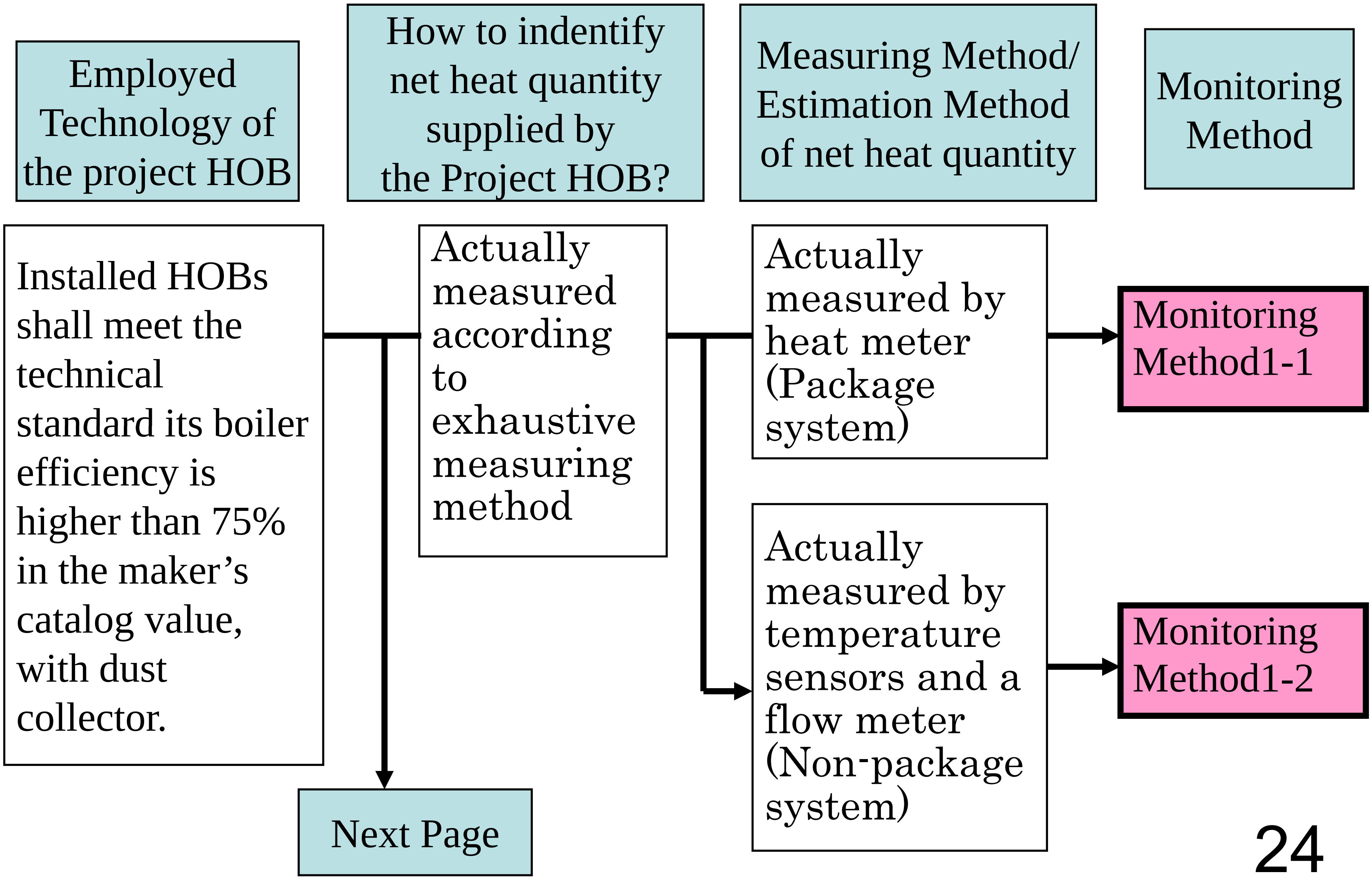
4.1 Eligibility Criteria (1)

1. HOB is a Heat Only Boiler, defined as a boiler used for heat supply which has capacity of 0.10MW – 3.15MW.
2. The project activity is
   - to switch from old type coal HOBs (of low energy efficiency) to new types ones (of high energy efficiency) in existing Heat Water Supply Systems in Districts (and/or)
   - to introduce new type ones in association with new construction of Heat Water Supply Systems in Districts.

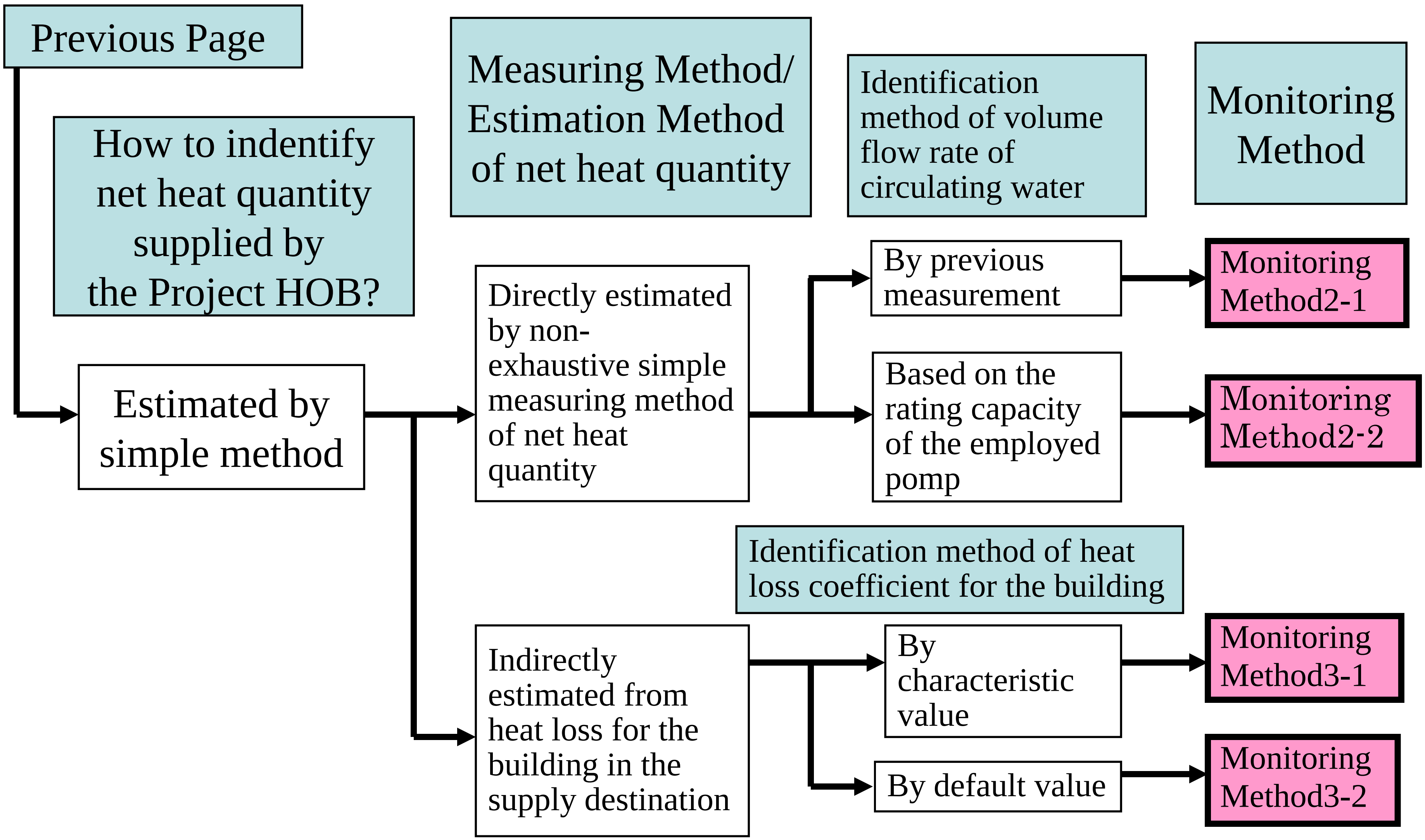
4.1 Eligibility Criteria (2)

3. Objective HOBs (Heat Only Boilers) shall be coal fired boilers for hot water supply.
4. Installed HOBs shall meet the technical standard its boiler efficiency is higher than 75% in the maker’s catalog value.
5. Dust collector shall be additionally installed with the installed HOB for pollution-abatement measure.

4.2 Option of Monitoring Method



4.2 Option of Monitoring Method



4.3 Information and Data of GHG Emission Reduction Calculation

1. Calculation Formula of CO2 Emission Reduction
2. Default Values (Boiler Efficiency)
3. Default Values (CO_2 Emission Factor)
4. Default Values (q0 values)

4.3.1 Calculation Formula of CO2 Emission Reduction

The emission reduction is calculated as follows:

$$ER_y = PH_y \times (1/\eta_{RE\ HOB} - 1/\eta_{PJ\ HOB}) \times EF_{CO2,f}$$

In this project, this is measured actually by heat meter in accordance with MNS(Mongolia National Standard) for the purpose of securing accurate measurement

ER_y	Emission reduction by the project activity (tCO_2/y)
PH_y	**Net heat quantity supplied by the Project HOB (GJ/y)**
$\eta_{RE\ HOB}$	Boiler efficiency of the reference HOB (–)
$\eta_{PJ\ HOB}$	Boiler efficiency of the project HOB (–)
$EF_{CO2,f}$	CO_2 emission factor of the coal (tCO_2/GJ)

Default values provided by the Methodology

Net Heat Quantity

- Monitoring Item is only “Net Heat Quantity” supplied by the Project HOB.
- Key Point of this methodology is “How is Heat Quantity calculated? “.

High Quality Method	Monitoring Equipment: Heat meter Direct Measurement
Low Quality Method	Monitoring Equipment: Thermometer Indirect Measurement (Estimated method)

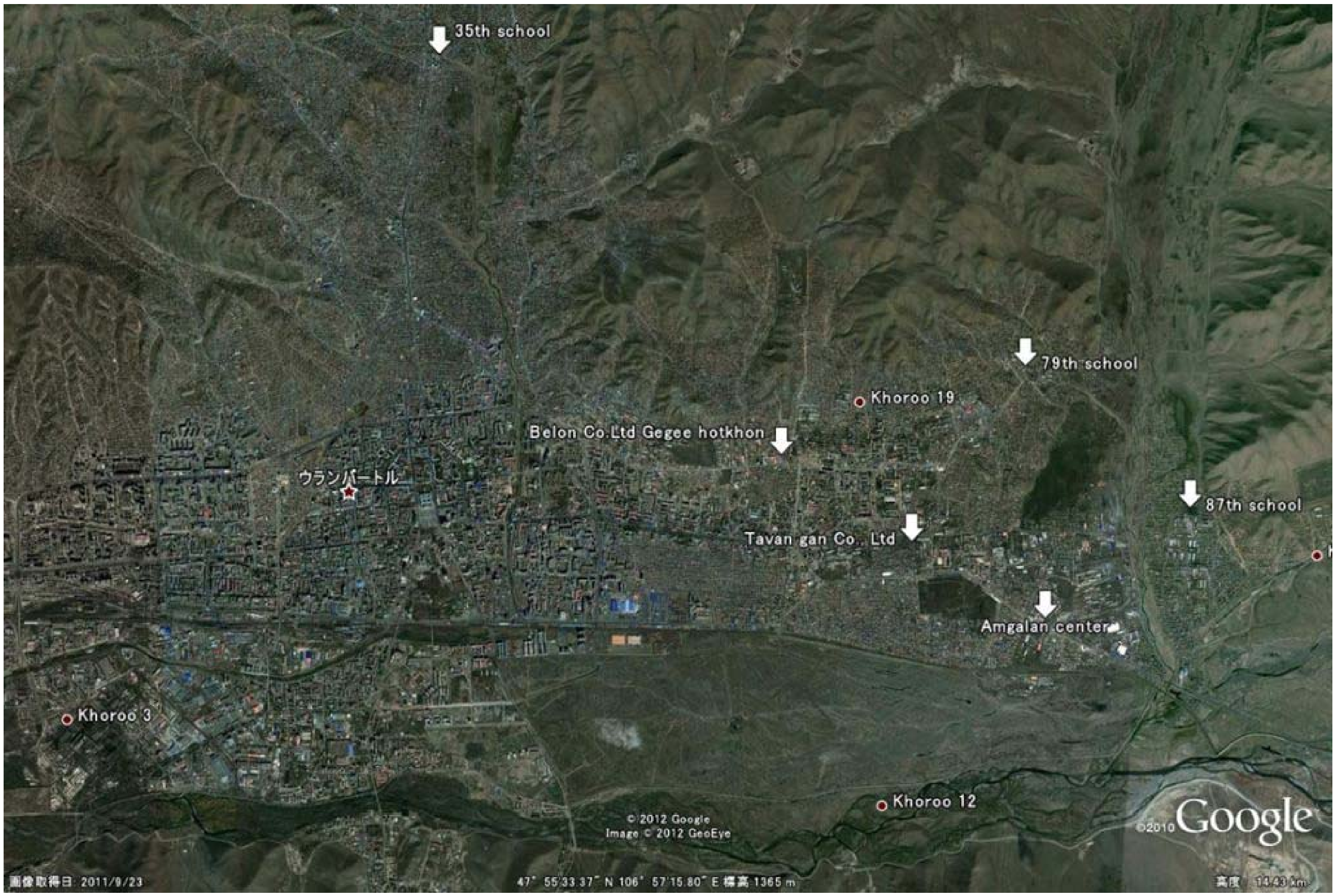
4.3.2 Default Values (Boiler Efficiency)

Project Boilers		Reference Boilers	
Location	Type	Location	Type
79 School	Carborobot300	SEN-1 Residential Area	HP32
35 School	Carborobot300	79 School	Unknown Domestic Boiler
		87 School	HP54

Project Boilers		Reference Boilers	
Location	Type	Location	Type
Ikh Zasag Univ.	DZL	87 School	HP
62 School	MUHT	Tavan gan Food Factory	Unknown Domestic Boiler
		Amgalan Center	HP

4.3.2 Boiler Efficiency Investigation

- Boiler Location



4.3.2 Boiler Efficiency Investigation

- Instruments

Heat meter (only at 79 School & Tavan gan)

4.3.2 Boiler Efficiency Investigation

- Instruments

Ultrasonic Flow Meter

Thermocouples

Data Logger

4.3.2 Boiler Efficiency Investigation

- Measurement of Heat Supply

Project Boiler at 79 school

Reference Boiler at 87 school

4.3.2 Boiler Efficiency Investigation

- Measurement of Coal Consumption

4.3.2 Boiler Efficiency Investigation (1)

Note: "interim"

Project Boiler at 79 School (Type: **Carborobot**)

Time				Heat Meter		Thermocouples + Ultrasonic flowmeter				
	Coal Consumption	Coal Calorific Value	Input Calorific Value	Calorific Value	Boiler Efficiency	Flow Rate	Inlet Water Temperature	Outlet Water Temperature	Accumulated Calorific Value	Boiler Efficiency
	kg	kcal/kg	GJ	GJ	%	m3/h	℃	℃	GJ	%
10:00～	24.1	3,844	0.388	0.23	59.3	14.0	40.8	44.5	0.215	55.3
11:00～	23.6	3,844	0.380	0.18	47.4	14.1	40.6	44.0	0.197	51.9
12:00～	19.3	3,844	0.311	0.17	54.7	14.0	38.5	41.3	0.163	52.5
13:00～	18.5	3,844	0.298	0.18	60.5	14.1	37.8	40.7	0.171	57.3
14:00～	12.7	3,844	0.204	0.19	93.3	14.1	38.2	41.1	0.174	85.5
15:00～	20.5	3,844	0.330	0.21	63.6	13.9	38.9	42.1	0.184	55.9
Total	118.7		1.910	1.16	60.7				1.104	57.8

Low Load Operation Season (Autumn) **60.7%**

4.3.2 Boiler Efficiency Investigation (2)

Note: “interim”

<u>Project Boiler</u> at 79 School (Type: **<u>Carborobot</u>**)

Time				Heat Meter		Thermocouples + Ultrasonic flowmeter				
	Coal Consumption	Coal Calorific Value	Input Calorific Value	Calorific Value	Boiler Efficiency	Flow Rate	Inlet Water Temperature	Outlet Water Temperature	Accumulated Calorific Value	Boiler Efficiency
	kg	kcal/kg	GJ	GJ	%	m3/h	℃	℃	GJ	%
	kg	kcal/kg	GJ	GJ	%	m3/h	℃	℃	GJ	%
16:00~	82.32	3631	1.251	1.093	87.3	12.8	48.4	55	1.052	84
19:00~	85.4	3631	1.298	1.053	81.1	12.8	49.2	55.5	1.009	77.8
22:00~	86.81	3631	1.32	0.99	75	12.8	48.1	54.1	0.972	73.6
1:00~	99.03	3631	1.505	1.047	69.6	12.9	48.2	54.6	1.022	67.9
4:00~	104.85	3631	1.594	0.995	62.4	12.9	49	55.1	0.981	61.5
7:00~	73.63	3631	1.119	0.859	76.8	12.8	47.5	53.7	0.832	74.3
9:30~	52.45	3631	0.797	0.215	27	12.8	48.6	56.3	0.207	26
10:00~	51.94	3631	0.79	0.401	50.8	12.8	48.9	56.3	0.399	50.5
11:00~	60.55	3631	0.92	0.378	41.1	12.8	48.5	55.4	0.376	40.8
12:00~	39.71	3631	0.604	0.42	69.7	12.8	48.5	56.1	0.405	67
13:00~	38.31	3631	0.582	0.409	70.2	12.8	48.7	55.9	0.391	67.2
14:00~	36.73	3631	0.558	0.4	71.7	12.8	47.9	55.3	0.399	71.5
15:00~	31.91	3631	0.485	0.398	82	12.8	48.8	56.2	0.396	81.7
Total	843.64		12.825	8.66	67.5				8.441	65.8

High Load Operation Season (Winter) **<u>67.5%</u>**

4.3.2 Boiler Efficiency Investigation (3)

Note: “interim”

<u>Reference Boiler</u> at Taban Food Factory (Type: CLSG) (11.1 ~ 11.2)

Time	Flow Rate	Inlet Water Temperature	Outlet Water Temperature	Accumulated Calorific Value	Coal Consumption	Boiler Efficiency
1st Nov.	m3/h	℃	℃	GJ	Kg	%
10:01～	25.1	58.6	64.2	0.249	51.7	29.3
10:26～	25	60.5	63.8	0.314	36.5	52.3
11:20～	24.9	56	59.7	0.491	93.1	32.1
12:36～	24.9	57.8	60.9	0.656	66.7	59.9
14:40～	24.9	49.8	55	0.44	78.4	34.2
Total				2.15	326.4	40.1
2nd Nov.	m3/h	℃	℃	GJ	Kg	%
9:38～	24.5	57.2	61.2	0.721	91.3	48
11:25～	24.6	58.1	62.2	0.68	97.8	42.3
13:02～	24.6	57.2	61.8	0.432	85.5	30.7
Total				1.832	274.6	40.6

Coal Calorific Value：3927kcal/kg（Lower Heating Value）

4.3.2 Boiler Efficiency Investigation (4)

Note: "interim"

Reference Boiler at 87 school (Type: HP) (Winter)

Time	Flow Rate	Inlet Water Temperature	Outlet Water Temperature	Accumulated Calorific Value	Coal Consumption	Boiler Efficiency
	m3/h	℃	℃	GJ	Kg	%
10:44~	69.3	49	54.1	4.953	698.5	47.2
14:02~	69.8	48.1	54.9	5.001	638.3	52.2
Total				9.954	1336.8	49.6

Coal Calorific Value：3585kcal/kg（Lower Heating Value）

Project Boiler at 35 school (Type: **Carborobot**) (Winter)

Time	Flow Rate	Inlet Water Temperature	Outlet Water Temperature	Accumulated Calorific Value	Coal Consumption	Boiler Efficiency
Unit	m3/h	℃	℃	GJ	kg	%
10:05~	13.3	69.1	79.6	0.531	51.3	60.3
11:00~	13.3	68.7	80.8	0.675	60.7	64.8
12:00~	13.4	69.5	81.2	0.657	62.2	61.5
13:00~	13.5	72.2	82.6	0.582	52.9	64.1
14:00~	13.4	72.5	83.7	0.629	51.1	71.7
15:00~	13.6	70.9	82.2	0.641	57.2	65.2
Total				3.715	335.4	64.5

Coal Calorific Value：4101kcal/kg（Lower Heating Value）

4.3.4 CO2 Emission Factor (1)

	Total Moisture	Gross Calorific Value	Net Calorific Value	Air-Dried Basis Carbon Analysis	CO2 EF
Unit	(%)	cal/g	cal/g	(%)	tCO_2/GJ
10/30 79 school	23.47	4142	3844	54.57	0.0951
10/31 79 school	22.84	4104	3811	52.72	0.0935
12/6 79 school	27.49	3964	3653	55.35	0.0962
12/7 79 school	26.52	3935	3631	54.48	0.0966
10/30 Amg (HP)	10.99	4,469	4,241	51.32	0.0943
10/31 Amg (HP)	9.23	4,566	4,354	50.54	0.0923
11/1 Taban (CLSG)	23.37	4,231	3,927	54.78	0.0936
SEN-1	36.48	3,657	3,308	58.31	0.0981
87 school	29.00	3,899	3,585	55.18	0.0957
79 school (HP)	25.52	4,101	3,796	55.51	0.0954

4.3.4 CO2 Emission Factor (2)

	Total Moisture	Gross Calorific Value	Net Calorific Value	Air-Dried Basis Carbon Analysis	CO2 EF
Unit	(%)	cal/g	cal/g	(%)	tCO_2/GJ
12/7 Taban	24.44	3,293	3,019	45.04	0.0987
35 school	25.47	4,415	4,101	59.21	0.0942
Tavan-Gan	23.41	3,256	2,986	42.98	0.0965
41 school	38.46	3,473	3,124	56.57	0.0976
Amgalan	43.61	2,924	2,565	51.30	0.0988
Ikh-Zasag	26.30	3,932	3,626	53.02	0.0944
Mon-Turk	29.55	3,634	3,322	51.28	0.0952
				Average	**0.0957**

CO_2 Emission Factor “Other Bituminous Coal”= **0.0946** (tCO2/TJ)

CO_2 Emission Factor “Sub-Bituminous”= **0.0961** (tCO2/TJ)

CO_2 Emission Factor “Lignite”= **0.1010** (tCO_2/TJ)

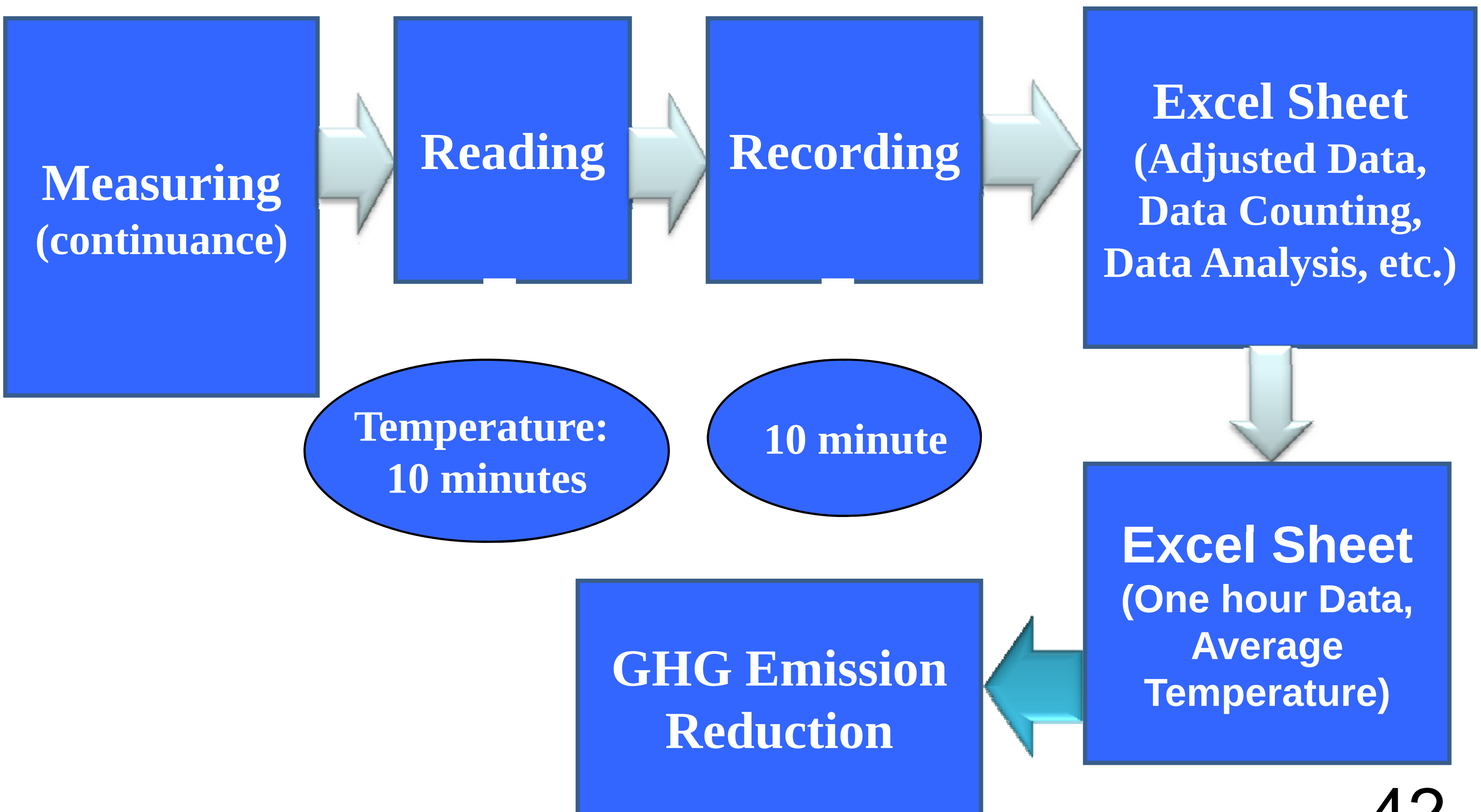
Source: ”2006 IPCC Guidelines for National Greenhouse Gas Inventories”

4.3.4 Default Values (q0 values)

- Heat Quantity: Q = q0 x V x (T1 – T2)
  - V : Building volume (m^3) (Monitoring Item)
  - T1: Indoor temperature (deg C) (Monitoring Item)
  - T2: Ambient temperature (deg C) (Monitoring Item)
  - q0: coefficient (kcal/(hour m^3 deg C)) (**Default Values**)

q0	Contents
0.32~0.45	General value in Mongolia
0.26	Designed values in 79 school
0.20	Draft Default Values ← "Tentative"
20%	Discount Rate (conservative)

4.4.1 Data Collection Flow in Low Quality Method



4.4.2 Data Collection Flow in High Quality Method

Measuring (continuance) → **Reading** → **Recording** → **Excel Sheet (Adjusted Data, Data Counting, Data Analysis, etc.)** → **GHG Emission Reduction**

Flow Rate: 2 second
Temperature: 30 second

1 minute
1 hour
1 day
1 week
1 month

Source: EEC Co., Ltd

4.4.2 Draft Results of GHG Emission Reduction

- <u>High Quality Method</u>

1. Emission Reduction	Fuel Type	Value	Unit	Parameter
Emission Reduction		3.506	tCO_2/t	ER_y
2. Selected Default Values				
Coal: Net Calorific Value #1				$NCV_{i,y}$
Coal: CO2 Emission Factor #1				$EF_{CO2,f}$
3. Reference Emission				
Reference Emission		11.97	tCO2/t	RE_y
Reference Emission (Coal consumption)		11.97	tCO2/t	
Project HOB Amount of Heat Supply		56.29	GJ/t	PH_y
Reference HOB: Boiler Efficiency		45	%	η_{REHOB}
Coal: CO2 Emission Factor of Coal		0.0957	tCO2/GJ	$EF_{CO2,y}$
4. Project Emission				
Project Emission		8.46	tCO_2/t	PE_y
Project Emission (Coal consumption)		8.29	tCO_2/t	
Project HOB: Amount of Heat Supply		56.29	GJ/t	PH_y
Project HOB: Boiler Efficiency (Coal)		65	%	η_{RJHOB}
Coal: CO2 Emission Factor of Coal		0.0957	tCO2/GJ	$EF_{CO2,f}$
Project Emission (Electricity consumption)		0.18	tCO_2/t	
Project HOB: Required electric performance maximum		800	W	EPM_{PJHOB}
Total hours during the monitoring period		201	hours/t	HMP_y
Project HOB: Electricity consumption		0.161	MWh/t	EC_y
Electricity: CO2 Emission Factor of grid		1.103	tCO2/MWh	$EF_{CO2,grid}$

ER=**<u>3.506</u>** (tCO2/t)
Because
Monitoring time
is only 201 (hour)

Note: “interim”

Boiler Efficiency is
analyzing now.
(This value is catalog value)

Project: around 60~75%
Reference around 40～50%

[Default Values]

Coal: Net Calorific Value	NCV_y	
Lignite (IPCC 2006 default value)	11.9	GJ/t
ナライハ (National standard value)		GJ/t
バガノール (National standard value)		GJ/t
		GJ/t
		GJ/t

Coal: CO2 Emission Factor	$EF_{CO2,f}$	
Coal (Lignite) acc. IPCC 2006 default	0.0957	tCO_2/GJ

Reference HOB: Boiler Efficiency by Fuel Types	η_{RB}	
Coal	45	%

Project HOB: Boiler Efficiency by Fuel Types	η_{PB}	
Coal	65	%

5. Comments of MRV Method

1. MRV is **one set** and can not be separated.
2. Making **Monitoring Plan**, with **Verification** taken into account, is the **most Important** Process of MRV. (“Monitoring plan, with Verification take into account” means “by the monitoring plan, the **traceable evidence** can be approached”.)

5.1 Achievements of Our MRV-DS

EEC Achievements

- BOCM/MRV Training course

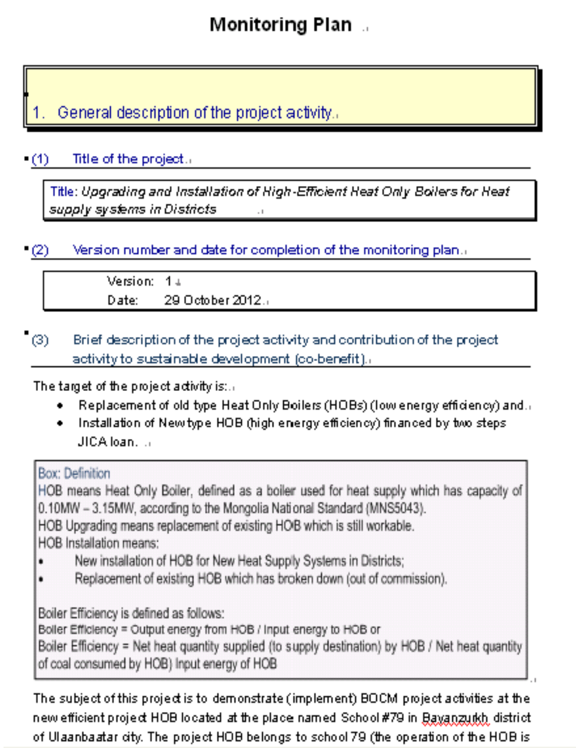
The content of the training course

- Issues of CDM, requirement of building the framework of BOCM;
- Concept of BOCM and our project, scope of monitoring activity with verification taken into account;
- How to prepare Reference and Project scenarios;
- Specific description of data and parameters to be monitored
- Contents of monitoring plan and monitoring report

5.2 Achievements of Our MRV-DS

EEC Achievements

- Preparation of Monitoring plan
- Preparation of Monitoring report



Monitoring Plan

1. General description of the project activity

(1) Title of the project

Title: *Upgrading and Installation of High-Efficient Heat Only Boilers for Heat supply systems in Districts*

(2) Version number and date for completion of the monitoring plan

Version: 1
Date: 29 October 2012

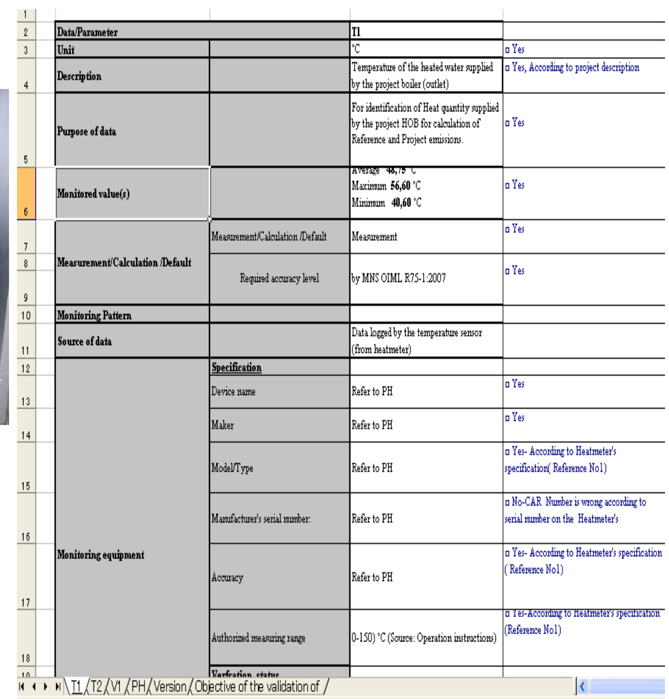
(3) Brief description of the project activity and contribution of the project activity to sustainable development (co-benefit)

The target of the project activity is:
- Replacement of old type Heat Only Boilers (HOBs) (low energy efficiency) and
- Installation of New type HOB (high energy efficiency) financed by two steps JICA loan.

Box: Definition
HOB means Heat Only Boiler, defined as a boiler used for heat supply which has capacity of 0.10MW – 3.15MW, according to the Mongolia National Standard (MNS5043).
HOB Upgrading means replacement of existing HOB which is still workable.
HOB Installation means:
- New installation of HOB for New Heat Supply Systems in Districts;
- Replacement of existing HOB which has broken down (out of commission).

Boiler Efficiency is defined as follows:
Boiler Efficiency = Output energy from HOB / Input energy to HOB or
Boiler Efficiency = Net heat quantity supplied (to supply destination) by HOB / Net heat quantity of coal consumed by HOB) Input energy of HOB

The subject of this project is to demonstrate (implement) BOCM project activities at the new efficient project HOB located at the place named School #79 in Bayanzurkh district of Ulaanbaatar city. The project HOB belongs to school 79 (the operation of the HOB is



1				
2	**Data/Parameter**		**T1**	
3	**Unit**		°C	▫ Yes
4	**Description**		Temperature of the heated water supplied by the project boiler (outlet)	▫ Yes, According to project description
5	**Purpose of data**		For identification of Heat quantity supplied by the project HOB for calculation of Reference and Project emissions.	▫ Yes
6	**Monitored value(s)**		Average **48,75** °C Maximum **56,60** °C Minimum **40,60** °C	▫ Yes
7	**Measurement/Calculation /Default**	Measurement/Calculation /Default	Measurement	▫ Yes
8–9		Required accuracy level	by MNS OIML R75-1:2007	▫ Yes
10	**Monitoring Pattern**			
11	**Source of data**		Data logged by the temperature sensor (from heatmeter)	
12	**Monitoring equipment**	**Specification**		
13		Device name	Refer to PH	▫ Yes
14		Maker	Refer to PH	▫ Yes
15		Model/Type	Refer to PH	▫ Yes- According to Heatmeter's specification(Reference No1)
16		Manufacturer's serial number:	Refer to PH	▫ No-CAR Number is wrong according to serial number on the Heatmeter's
17		Accuracy	Refer to PH	▫ Yes- According to Heatmeter's specification (Reference No1)
18		Authorized measuring range	0-150) °C (Source: Operation instructions)	▫ Yes-According to Heatmeter's specification (Reference No1)
19		Verfcation status		

T1 / T2 / V1 / PH / Version / Objective of the validation of

EEC Achievement

Problems during the monitoring period and its decision and lessons for future projects

Problem	Decision	Suggestion
In technical document for the heat meter delivered by Ultrasonic Co.ltd no serial number of the meter and it is difficult to believe the document can be as a technical passport of this heat meter.	We request Ultrasonic company to deliver technical document with their serial numbers for each heat meter.	Before insrallation of meter, better test in UB District heating company heat meter testing laboratory and to validate.
Heat meter time installed in the 79th school boiler house was hot accordingly with time of Mongolia i.e. 7 hours difference from UB time.	After installation in cooperation with Ultrasonic company managed the calibration of time. But there spent several days.	Time should be calibrated before installation by the delivering company

Source: EEC Co., Ltd

Heat meter was delivered without recorder of the information and we had only one possibility to collect information manually for every 10-30 minutes or hourly.	We unlegally asked UB District heating company and use 4 times theyr “optical head” for transferring the dates from meter to computer.	To purchase the meter with the optical head in complete.
Heat meter was delivered with modul whuch is for collection of dates and information through internet, but the supplyer company has no specialists who could assist for its use.	EEC Co.ltd managed it by own specvialist activity and now we received the data information using the module. Now it is our “know-how”.	In the future the compamies and individuals could work in cooperation with us in collection of information through internet using the modul from heat meter.

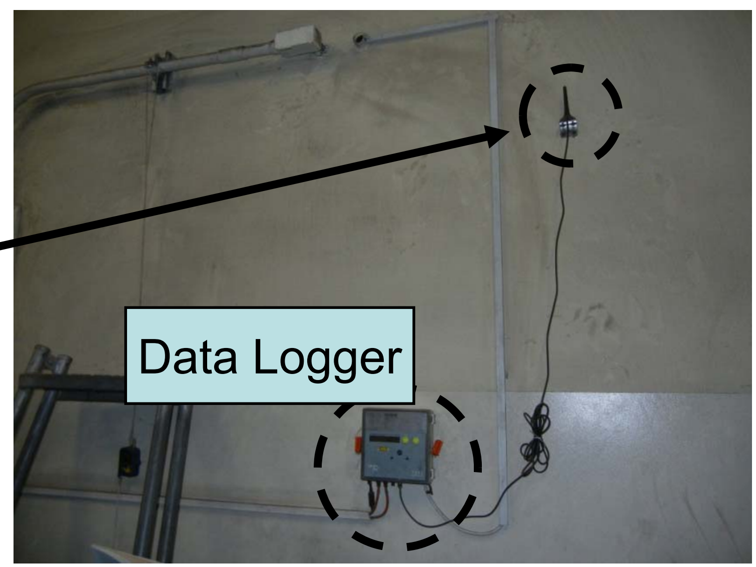
Source: EEC Co., Ltd

5.1 Achievements of Our MRV-DS

- EEC Achievement
  - "The First Construction" of the one minute data collection system of the heat meter in Mongolia.

#serial-number	created	energy,J,inst-value,0,0,0	volume,m3,inst-value,0,0,0	power,W,inst-value,0,0,0	volume-flow,m3/h,inst-value,0,0,0	flow-temp,−C,inst-value,0,0,0	return-temp,−C,inst-value,0,0,0	diff-temp,K,inst-value,0,0,0
1.2E+07	2012/12/18 0:01	3.1946E+11	22316.4	63100	14.31	52.2	48.4	3.8
1.2E+07	2012/12/18 0:02	3.1946E+11	22316.6	67200	14.35	52.5	48.4	4.1
1.2E+07	2012/12/18 0:03	3.1947E+11	22316.8	67900	14.34	52.7	48.6	4.1
1.2E+07	2012/12/18 0:04	3.1947E+11	22317.1	75900	14.49	53.3	48.7	4.6
1.2E+07	2012/12/18 0:05	3.1948E+11	22317.3	82400	14.34	53.9	48.9	5
1.2E+07	2012/12/18 0:06	3.1948E+11	22317.6	89100	14.22	54.4	48.9	5.5
1.2E+07	2012/12/18 0:07	3.1949E+11	22317.8	99600	14.3	55.1	49	6.1
1.2E+07	2012/12/18 0:08	3.1949E+11	22318	112200	14.46	55.8	49	6.8

  - "The First Construction" of the data collection system of the heat meter using the mobile telephone system in Mongolia.



5.2 Achievement of Our MRV-DS

- <u>NREC Achievement</u>
  - The First Implementation of the verification in Mongolia.
  - The First Verification Report in Mongolia
  - The First Implementation of the Government meeting of ISO14065 in Mongolia

Conclusion of NREC

Key points our Verification

- To meet Requirements necessary for Verification body,

- Assessment, validation of MP (MP considering traceable evidence),

  Assessment on accuracy of measurement, measuring equipment and QA/QC,

- Assessment of Monitoring Report

Source: NREC (National Renewable Energy Centre)

Summary of Verification

- Conducted training for MRV methodology and Demonstration project of Verification with the support of Japanese team, have established the background for creating the Verification activity in Mongolia,
- Conducting Verification with supporting Monitoring (Working together with monitoring team, on making of MP) ;
  - saves time
  - makes easy MRV operation
- Keeping the ”checklist for each Parameter” is most effective method for MRV.

- Monitoring period was short – 201 hrs,
- Some default values need to define accurately - value (reference boiler efficiency,.
- Shortage of Evidences :
  - Certification of the Ultrasonic heat meter which is supplied by Ultrasonic Co.ltd,.
  - Acceptance report for commissioning of the Project HOB from ANU service Co.ltd, to School No79

Source: NREC (National Renewable Energy Centre)

Suggestions

- Need of National standards for Monitoring and Verification activities - to introduce International standards for quantification , reporting, validation and verification of GHG emission, in Mongolia,

- Adjusting or conditioning Verification requirements of MRV to reality –
  - Requirement for manufacturer's verification certificate of measuring equipments,
  - Some evidences.

Source: NREC (National Renewable Energy Centre)

Greenhouse gas management related standards

GHG related standards , approved as MNS:

- ISO 14064-1:2006 - Specification with guidance at the organization level for quantification and reporting of GHG emissions and removals ,
- ISO 14064-2:2006 - Specification with guidance at the project level for quantification and reporting of GHG emissions and removals ,

GHG related standard, planned to be approved as MNS:

- ISO 14065 :2007 -Requirements for GHG Validation and verification bodies for use in accreditation or other forms of recognition

Other GHG related standards,

- ISO 14064-3:2006 - Specification with guidance for the validation and verification of GHG assertions
- ISO 14066 :2011 - Competence requirements for GHG Validation terms and verification teams.

Source: NREC (National Renewable Energy Centre)

5.3 Achievement of Our MRV-DS

- **Japanese Team Achievement**
  - Support EEC and NREC, and Default Values of the Boiler Efficiency, etc.

5.4.1 Comparative Evaluation
(Low Quality Method VS High Quality Method)

Low Quality Method	High Quality Method
Monitoring Equipment needs more than one.	Monitoring Equipment is simple.
Indirect measurement	Direct measurement
Quite conservative estimation is indispensable. (uncomprehened boiler activity, indirect measurement, etc.)	Real monitoring item is only “Heat quantity”.

5.4.2 Comparative Evaluation

(Low Quality Method VS High Quality Method)

Low Quality Method	High Quality Method
Recording of Monitoring data is not easy. (data collection activity needs on-site visit.)	Recording of Monitoring data is very easy. (because of the "module" which is developed by EEC)
The installation cost is low.	The installation cost is high.
The operation cost is not low.	The operation cost is low.

Thank you !

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