

Monitoring Report Sheet (Input Sheet) [For Verification]

Table 1: Parameters monitored ex post

(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)
Monitoring period	Monitoring point No.	Parameters	Description of data	Monitored Values	Units	Monitoring option	Source of data	Measurement methods and procedures	Monitoring frequency	Other comments
01/04/2017 - 31/12/2017	(1)	EC _{P,J,p}	Power consumption of project chiller <i>i</i> during the period <i>p</i>	-	MWh/p	Option C	Monitored data	Data is measured by measuring equipments in the factory. - Specification of measuring equipments: 1) Electrical power meter is applied for measurement of electrical power consumption of project chiller. 2) Meter is certified in compliance with national/international standards on electrical power meter. - Measuring and recording: 1) Measured data is recorded and stored in the measuring equipments. 2) Recorded data is checked its integrity once a month by responsible staff. - Calibration: The electrical power meter is calibrated by the manufacturer at the time of factory shipment, and the performance of meter is guaranteed by the manufacturer for ten years without a calibration. - Measuring and recording: The data monitored and required for verification and issuance will be kept and archived electronically for two years after the final issuance of credits.	Continuously	Input on "MRS (input_separate)"
-	(2)	FC _{P,J,p}	The amount of fuel input for power generation during monitoring period <i>p</i>	-	mass or weight/p	-	-	Data is collected and recorded from the invoices by the fuel supply company.	-	-
-	(3)	EG _{P,J,p}	The amount of electricity generated during the monitoring period <i>p</i>	-	MWh/p	-	-	Data is measured by measuring equipment in the factory. - Specification of measuring equipment: 1) Electrical power meter is applied for measurement of electrical power consumption of project chiller. 2) Meter is certified in compliance with national/international standards on electrical power meter. - Measuring and recording: 1) Measured data is recorded and stored in the measuring equipment. 2) Recorded data is checked its integrity once a month by responsible staff. - Calibration: In case a calibration certificate issued by an entity accredited under national/international standards is not provided, such measuring equipment is required to be calibrated.	-	-

Table 2: Project-specific parameters fixed ex ante

(a)	(b)	(c)	(d)	(e)	(f)
Parameters	Description of data	Estimated Values	Units	Source of data	Other comments
EF _{elec}	[For grid electricity] CO ₂ emission factor for consumed electricity	0.566	ICO ₂ /MWh	The most recent value available at the time of validation is applied and fixed for the monitoring period thereafter. The data is sourced from "Grid Emission Factor (GEF) of Thailand", endorsed by Thailand Greenhouse Gas Management Organization unless otherwise instructed by the Joint Committee.	
EF _{elec}	[For captive electricity] CO ₂ emission factor for consumed electricity Option a	0.000	ICO ₂ /MWh	Power generation efficiency obtained from manufacturer's specification	Calculated
EF _{elec}	[For captive electricity] CO ₂ emission factor for consumed electricity Option b	0.000	ICO ₂ /MWh	The power generation efficiency calculated from monitored data of the amount of fuel input for power generation and the amount of electricity generated	Calculated
EF _{elec}	[For captive electricity] In case the captive electricity generation system meets all of the following conditions; - The system is non-renewable generation system - Electricity generation capacity of the system is less than or equal to 15 MW	-	ICO ₂ /MWh	[Captive electricity with diesel fuel] CDM approved small scale methodology: AMS-I.A. [Captive electricity with natural gas] 2006 IPCC Guidelines on National GHG Inventories for the source of EF of natural gas. CDM Methodological tool "Determining the baseline efficiency of thermal or electric energy generation systems version02.0" for the default efficiency for off-grid power plants.	
T _{cooling-out,i}	Output cooling water temperature of project chiller <i>i</i> set under the project specific condition	-	degree Celsius	Specifications of project chiller <i>i</i> prepared for the quotation or factory acceptance test data by manufacturer	Input on "MPS (input_separate)"
T _{chilled-out,i}	Output chilled water temperature of project chiller <i>i</i> set under the project specific condition	-	degree Celsius	Specifications of project chiller <i>i</i> prepared for the quotation or factory acceptance test data by manufacturer	Input on "MPS (input_separate)"
COP _{RE,i}	COP of reference chiller <i>i</i> under the standardizing temperature conditions	-	-	Selected from the default values set in the methodology	Input on "MPS (input_separate)"
COP _{PJ,i}	COP of project chiller <i>i</i> under the project specific conditions	-	-	Specifications of project chiller <i>i</i> prepared for the quotation or factory acceptance test data by manufacturer	Input on "MPS (input_separate)"
COP _{PJ,tc,i}	COP of project chiller <i>i</i> calculated under the standardizing temperature conditions	-	-	Calculated with the following equation: COP _{PJ,tc,i} = COP _{PJ,i} × [(Tcooling-out,i - Tchilled-out,i + TDchilled + TDcooling) ÷ (37 - 7 + TDchilled + TDcooling)]	
η _{elec}	Power generation efficiency	-	%	Specification of the captive power generation system provided by the manufacturer	
NCV _{fuel}	Net calorific value of consumed fuel	-	GJ/mass or weight	In order of preference: 1) values provided by the fuel supplier; 2) measurement by the project participants; 3) regional or national default values; 4) IPCC default values provided in table 1.2 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories. Lower value is applied.	
EF _{fuel}	CO ₂ emission factor of consumed fuel	-	ICO ₂ /GJ	In order of preference: 1) values provided by the fuel supplier; 2) measurement by the project participants; 3) regional or national default values; 4) IPCC default values provided in table 1.4 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories. Lower value is applied.	

Table3: Ex-post calculation of CO₂ emission reductions

Monitoring period	CO ₂ emission reductions	Units
1/April/2017 - 31/December/2017	24	ICO ₂ /p

[Monitoring option]

Option A	Based on public data which is measured by entities other than the project participants (Data used: publicly recognized data such as statistical data and specifications)
Option B	Based on the amount of transaction which is measured directly using measuring equipment (Data used: commercial evidence such as invoices)
Option C	Based on the actual measurement using measuring equipment (Data used: measured values)

Parameters	Parameters monitored ex post				Project-specific parameters fixed ex ante									Ex-post calculation of emissions					
	Chiller <i>i</i>	EC _{PJ,p}	FC _{PJ,p}	EG _{PJ,p}	EF _{elec}	EF _{elec}	EF _{elec}	EF _{elec}	T _{cooling-out,i}	T _{chilled-out,i}	COP _{RE,i}	COP _{PJ,i}	COP _{PJ,tc,i}	η _{elec}	NCV _{fuel}	EF _{fuel}	RE _{i,p}	PE _{i,p}	ER _{i,p}
Description of data	Project chiller No.	Power consumption of project chiller <i>i</i> during the period <i>p</i>	The amount of fuel input for power generation during monitoring period <i>p</i>	The amount of electricity generated during the monitoring period <i>p</i>	[For grid electricity] CO ₂ emission factor for consumed electricity	[For captive electricity] CO ₂ emission factor for consumed electricity Option a	[For captive electricity] CO ₂ emission factor for consumed electricity Option b	[For captive electricity] CO ₂ emission factor for consumed electricity	Output cooling water temperature of project chiller <i>i</i> set under the project specific condition	Output chilled water temperature of project chiller <i>i</i> set under the project specific condition	COP of reference chiller <i>i</i> under the standardizing temperature conditions	COP of project chiller <i>i</i> under the project specific conditions	COP of project chiller <i>i</i> calculated under the standardizing temperature conditions	Power generation efficiency	Net calorific value of consumed fuel	CO ₂ emission factor of consumed fuel	Reference emissions of project chiller <i>i</i> during the period <i>p</i>	Project emissions of project chiller <i>i</i> during the period <i>p</i>	Emissions reductions by the project chiller <i>i</i> during the period <i>p</i>
Units	-	MWh/p	mass or weight/p	MWh/p	tCO ₂ /MWh	tCO ₂ /MWh	tCO ₂ /MWh	tCO ₂ /MWh	degree Celsius	degree Celsius	-	-	-	%	GJ/mass or weight	tCO ₂ /GJ	tCO ₂ /p	tCO ₂ /p	tCO ₂ /p
Monitored /estimated values	1(U-R-4/1&2)	269.6	-	-	0.566	0.000	0.000	-	37.0	7.0	5.69	6.15	6.15	-	-	-	165.03	152.69	12.34
	2(U-R-5/1&2)	127.9	-	-	0.566	0.000	0.000	-	37.0	7.0	5.69	6.15	6.15	-	-	-	78.32	72.46	5.86
	3(U-R-6/1&2)	130.7	-	-	0.566	0.000	0.000	-	37.0	7.0	5.69	6.15	6.15	-	-	-	80.01	74.03	5.98
	4	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	5	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	6	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	7	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	8	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	9	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	10	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	11	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	12	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	13	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	14	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	15	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	16	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	17	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	18	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	19	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	20	-	-	-	0.566	0.000	0.000	-	0.0	0.0	0.00	0.00	0.00	-	-	-	0.00	0.00	0.00
	Total	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	323.36	299.17

Monitoring Report Sheet (Calculation Process Sheet) [For Verification]

1. Calculations for emission reductions	Fuel type	Value	Units	Parameter
Emission reductions during the period p	N/A	24.19	tCO ₂ /p	ER _p
2. Calculations for reference emissions				
Reference emissions during the period p	N/A	323.36	tCO ₂ /p	RE _p
Reference emissions during the period p	N/A	323.36	tCO ₂ /p	RE _p
3. Calculations of the project emissions				
Project emissions during the period p	N/A	299.17	tCO ₂ /p	PE _p
Project emissions during the period p	N/A	299.17	tCO ₂ /p	PE _p

[List of Default Values]

COP_{RE,i} for inverter type

COP _{RE,i} (300≤x<450USRt)	5.59	-
COP _{RE,i} (450≤x<550USRt)	5.69	-
COP _{RE,i} (550≤x<825USRt)	5.85	-
COP _{RE,i} (825≤x≤1,500USRt)	6.06	-

TD _{cooling}	1.5	degree Celsius
TD _{chilled}	1.5	degree Celsius

Monitoring Report Sheet (Input Sheet) [For Verification]

Table 1: Parameters monitored ex post

(a) Monitoring period	(b) Monitoring point No.	(c) Parameters	(d) Description of data	(e) Monitored Values	(f) Units	(g) Monitoring option	(h) Source of data	(i) Measurement methods and procedures	(j) Monitoring frequency	(k) Other comments
01/04/2017 - 31/12/2017	(1)	EC _{FDV,j,k,p}	The amount of power consumption by the project displacement ventilation air conditioning unit <i>i</i> in cleanroom <i>j</i> of the project factory <i>k</i> during the period <i>p</i>	-	MWh/p	Option C	Monitored data	On-site measurement by measuring equipments. - Specification of measuring equipments: 1) Electrical power meter is applied for measurement. 2) Meter is certified in compliance with national/international standards on electrical power meter. - Measuring and recording: 1) Measured data is recorded and stored in the measuring equipments. 2) Recorded data is checked its integrity once a month by responsible staff. - Calibration: The electrical power meter is calibrated by the manufacturer at the time of factory shipment, and the performance of meter is guaranteed by the manufacturer for ten years without a calibration. - Measuring and recording: The data monitored and required for verification and issuance will be kept and archived electronically for two years after the final issuance of credits.	Continuously	Input on "MRS (input_separate)"
-	(2)	FC _{p,j,p}	The amount of fuel input for power generation during monitoring period <i>p</i>	-	mass or weight/p	-	-	Data is collected and recorded from the invoices by the fuel supply company.	-	-
-	(3)	EG _{p,j,p}	The amount of electricity generated during the monitoring period <i>p</i>	-	MWh/p	-	-	On-site measurement by measuring equipments. - Specification of measuring equipments: 1) Electrical power meter is applied for measurement. 2) Meter is certified in compliance with national/international standards on electrical power meter. - Measuring and recording: 1) Measured data is recorded and stored in the measuring equipments. 2) Recorded data is checked its integrity once a month by responsible staff. - Calibration: The electrical power meter is replaced or calibrated at an interval following the regulations in the country in which the electricity meter is commonly used or according to the manufacturer's recommendation, unless a type approval, manufacturer's specification, or certification issued by an entity accredited under international/national standards for the electrical power meter has been prepared by the time of installation.	-	-

Table 2: Project-specific parameters fixed ex ante

(a) Parameters	(b) Description of data	(c) Estimated Values	(d) Units	(e) Source of data	(f) Other comments
EF _{elec,k}	[For grid electricity] CO ₂ emission factor for consumed electricity	0.566	tCO ₂ /MWh	The most recent value available at the time of validation is applied and fixed for the monitoring period thereafter. The data is sourced from "Grid Emission Factor (GEF) of Thailand", endorsed by Thailand Greenhouse Gas Management Organization unless otherwise instructed by the Joint Committee.	
EF _{ebc}	[For captive electricity] CO ₂ emission factor for consumed electricity Option a	0.000	tCO ₂ /MWh	Power generation efficiency obtained from manufacturer's specification	Calculated
EF _{ebc}	[For captive electricity] CO ₂ emission factor for consumed electricity Option b	0.000	tCO ₂ /MWh	The power generation efficiency calculated from monitored data of the amount of fuel input for power generation and the amount of electricity generated.	Calculated
EF _{ebc}	[For captive electricity] in case the captive electricity generation system meets all of the following conditions: - The system is non-renewable generation system - Electricity generation capacity of the system is less than or equal to 15 MW	-	tCO ₂ /MWh	[Captive electricity with diesel fuel] CDM approved small scale methodology: AMS-I.A. [Captive electricity with natural gas] 2006 IPCC Guidelines on National GHG Inventories for the source of EF of natural gas. CDM Methodological tool "Determining the baseline efficiency of thermal or electric energy generation systems version02.0" for the default efficiency for off-grid power plants.	
AFR _{RE,j,k}	Airflow rate of reference mixing ventilation air conditioning unit(s) supplying air to cleanroom <i>j</i> in the project factory <i>k</i>	-	m ³ /s	Design document of the cleanroom.	Calculated
AFR _{FDV,j,k}	Airflow rate of project displacement ventilation air conditioning unit(s) supplying air to cleanroom <i>j</i> in the project factory <i>k</i>	-	m ³ /s	Design document or specification document of the displacement ventilation air conditioning unit.	Input on "MPS (input_separate)"
P _{dRE,j,k}	Discharge pressure of reference mixing ventilation air conditioning unit(s) supplying air to cleanroom <i>j</i> in the project factory <i>k</i>	1,200.00	Pa	Hearing survey with manufacturer of mixing ventilation air conditioning unit.	Default value
P _{dFDV,j,k}	Discharge pressure of project displacement ventilation air conditioning unit(s) supplying air to cleanroom <i>j</i> in the project factory <i>k</i>	-	Pa	Design document or specification document of the displacement ventilation air conditioning unit.	Input on "MPS (input_separate)"
V _{cr,j,k}	Volume of the cleanroom <i>j</i> in the project factory <i>k</i>	-	m ³	Design document of the cleanroom.	Input on "MPS (input_separate)"
T _{vent,j,k}	Number of times of ventilation required for the cleanroom <i>j</i> in the project factory <i>k</i>	-	times/h	Multiple documents published on the web. The default value is determined from the table corresponding to the airborne particulate cleanliness class required for the cleanroom.	Input on "MPS (input_separate)" Select from default values
η _{ebc}	Power generation efficiency	-	%	Specification of the captive power generation system provided by the manufacturer	
NCV _{fuel}	Net calorific value of consumed fuel	-	GJ/mass or weight	In order of preference: 1) values provided by the fuel supplier; 2) measurement by the project participants; 3) regional or national default values; 4) IPCC default values provided in table 1.2 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories. Lower value is applied.	
EF _{fuel}	CO ₂ emission factor of consumed fuel	-	tCO ₂ /GJ	In order of preference: 1) values provided by the fuel supplier; 2) measurement by the project participants; 3) regional or national default values; 4) IPCC default values provided in table 1.4 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories. Lower value is applied.	

Table 3: Ex-post calculation of CO₂ emission reductions

Monitoring Period	CO ₂ emission reductions	Units
1/April/2017 - 31/December/2017	2,380	tCO ₂ /p

[Monitoring option]

Option A	Based on public data which is measured by entities other than the project participants (Data used: publicly recognized data such as statistical data and specifications)
Option B	Based on the amount of transaction which is measured directly using measuring equipment (Data used: commercial evidence such as invoices)
Option C	Based on the actual measurement using measuring equipment (Data used: measured values)

Monitoring Report Sheet (Calculation Process Sheet) [For Verification]

1. Calculations for emission reductions	Fuel type	Value	Units	Parameter
Emission reductions during the period p	N/A	2,380.84	tCO ₂ /p	ER _p
2. Calculations for reference emissions				
Reference emissions during the period p	N/A	2,681.20	tCO ₂ /p	RE _p
Reference emissions during the period p	N/A	2,681.20	tCO ₂ /p	RE _p
3. Calculations of the project emissions				
Project emissions during the period p	N/A	300.36	tCO ₂ /p	PE _p
Project emissions during the period p	N/A	300.36	tCO ₂ /p	PE _p

[List of Default Values]

Number of times of ventilation required for the cleanroom	ISO 14644-1:2015	FED-STD-209E	T _{vent,j,k}
	Class 6	1,000	80
	Class 7	10,000	40

Discharge pressure of reference mixing ventilation air conditioning unit	1,200	Pa
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