Monitoring Plan Sheet (Input Sheet) [Attachment to Project Design Document]

Table 1: Parameters to be monitored *ex post*

(a) Monitoring point No.	(b) Parameters	(c) Description of data	(d) Estimated Values	(e) Units	(f) Monitoring option	(g) Source of data	(h) Measurement methods and procedures	(i) Monitoring frequency	(j) Other comments
(1)	$EC_{PJ,i,p}$	Power consumption of project chiller *i* during the period *p*	1,910	MWh/p	Option C	Monitored data	**[The case for use of measuring equipment]** 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 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. - Accuracy level: ±1.0% or better - Calibration: Every year after the installation by a qualified agency. - QA/QC: Continuous measurement and at least monthly recording from logger sysytem to PC. **[The case for auto data collection]** Data is collected automatically and sent through Internet to a server. - Specification of measuring equipments: 1) Electrical power meter is applied for measurement of electrical power consumption of project chiller. 2) Meter is certified with national/international standards on electrical power meter. - Measuring and recording: 1) Measured data is automatically sent to a server where data is recorded and stored. 2) Recorded data is checked its integrity once a month by responsible staff. - Accuracy level: ±1.0% or better - Calibration:	Continuously	
(2)	$EI_{grid,p}$	Electricity imported from the grid to the project site during the period *p*	59,813	MWh/p	Option B	Invoice from the power company	Data is collected and recorded from invoices from the power company (PT PLN).	Every month	
(3)	$h_{gen,p}$	Operating time of captive electricity generator during the period *p*	0	hours/p	Option C	Monitored data	Data is measured by meter equipped to a generator.	Continuously	In the project, there is no generator for captive electricity. Thus, this parameter is not applicable for this project.

Table 2: Project-specific parameters to be fixed *ex ante*

(a) Parameters	(b) Description of data	(c) Estimated Values	(d) Units	(e) Source of data	(f) Other comments
EF_{elec}	[For grid electricity] CO_2 emission factor for consumed electricity	0.814	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 "Emission Factors of Electricity Interconnection Systems", National Committee on Clean Development Mechanism Indonesian DNA for CDM unless otherwise instructed by the Joint Committee.	
EF_{elec}	[For captive electricity] CO_2 emission factor for consumed electricity	0.8	tCO_2/MWh	CDM approved small scale methodology: AMS-I.A	In the project, there is no generator for captive electricity.
$T_{cooling\text{-}out,i}$	Output cooling water temperature of project chiller i set under the project specific condition	36.9	degree Celsius	Specifications of project chiller i prepared for the quotation or factory acceptance test data by manufacturer	
$T_{chilled\text{-}out,i}$	Output chilled water temperature of project chiller i set under the project specific condition	14	degree Celsius	Specifications of project chiller i prepared for the quotation or factory acceptance test data by manufacturer	
$COP_{RE,i}$	COP of reference chiller i under the standardizing temperature conditions	5.59	-	Selected from the default values set in the methodology	
$COP_{PJ,i}$	COP of project chiller i under the project specific conditions	7.66	-	Specifications of project chiller i prepared for the quotation or factory acceptance test data by manufacturer	
$COP_{PJ,tc,i}$	COP of project chiller i calculated under the standardizing temperature conditions	6.01	-	Calculated with the following equation; $COP_{PJ,tc,i} = COP_{PJ,i} \times [(T_{cooling\text{-}out,i} - T_{chilled\text{-}out,i} + TD_{chilled} + TD_{cooling}) \div (37 - 7 + TD_{chilled} + TD_{cooling})]$	
RC_{gen}	Rated capacity of generator	0.0	kW	Specification of generator for captive electricity	

Table3: *Ex-ante* estimation of CO_2 emission reductions

CO_2 emission reductions	Units
117	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 equipments (Data used: commercial evidence such as invoices)
Option C	Based on the actual measurement using measuring equipments (Data used: measured values)

Monitoring Plan Sheet (Calculation Process Sheet) [Attachement to Project Design Document]

1. Calculations for emission reductions	Fuel type	Value	Units	Parameter
Emission reductions during the period p	N/A	117.00	tCO_2/p	ER_p
2. Selected default values, etc.				
COP of reference chiller i under the standardizing temperature conditions	N/A	5.59	-	$COP_{RE,i}$
3. Calculations for reference emissions				
Reference emissions during the period p	N/A	1672.09	tCO_2/p	RE_p
Reference emissions	N/A			
CO_2 emission factor for consumed electricity [grid]	Electricity	0.81	tCO_2/MWh	EF_{elec}
CO_2 emission factor for consumed electricity [captive]	Electricity	0.8	tCO_2/MWh	EF_{elec}
Proportion of grid electricity over total electricity consumed at the project site	N/A	1.00	-	-
Proportion of captive electricity over total electricity consumed at the project site	N/A	0.00	-	-
Power consumption of project chiller i	Electricity	1910.00	MWh/p	$EC_{PJ,i,p}$
COP of reference chiller i under the standardizing temperature conditions	N/A	5.59	-	$COP_{RE,i}$
COP of project chiller i calculated under the standardizing temperature conditions	N/A	6.01	-	$COP_{PJ,tc,i}$
4. Calculations of the project emissions				
Project emissions during the period p	N/A	1554.74	tCO_2/p	PE_p
Project emissions	N/A			
CO_2 emission factor for consumed electricity [grid]	Electricity	0.81	tCO_2/MWh	EF_{elec}
CO_2 emission factor for consumed electricity [captive]	Electricity	0.8	tCO_2/MWh	EF_{elec}
Proportion of grid electricity over total electricity consumed at the project site	N/A	1.00	-	-
Proportion of captive electricity over total electricity consumed at the project site	N/A	0.00	-	-
Power consumption of project chiller i	Electricity	1,910.00	MWh/p	$EC_{PJ,i,p}$

[List of Default Values]

$COP_{RE,i}$ (x<300USRt)	4.92	-
$COP_{RE,i}$ (300≦x<450USRt)	5.33	-
$COP_{RE,i}$ (450≦x<500USRt)	5.59	-
$COP_{RE,i}$ (500≦x<700USRt)	5.85	-
$COP_{RE,i}$ (700≦x<1250USRt)	5.94	-

$TD_{cooling}$	1.50	degree Celsius
$TD_{chilled}$	1.50	degree Celsius

Monitoring Structure Sheet [Attachment to Project Design Document]

Responsible personnel	Role
Plant Manager	**[The case for use of measuring equipment]** Responsible for project planning, implementation, monitoring results and reporting. **[The case for auto data collection]** Responsible for project planning, implementation, monitoring results and reporting.
Supervisor	**[The case for use of measuring equipment]** Appointed to be in charge of confirming the archived data after being checked and corrected when necessary. Also, appointed to be in charge of monitoring procedure (data collection and storage), including monitoring equipments and calibrations, and training of monitoring. **[The case for auto data collection]** Appointed to be in charge of confirming the archived data that are collected and provided by auto data collection system (the system) after being checked and corrected when necessary. Also, appointed to be in charge of monitoring procedure (data collection/storage and data sharing with manufacturer), including monitoring equipments and calibrations, and training of
Chiller Operator	**[The case for use of measuring equipment]** Appointed to be in charge of direct checking of the archived data for irregularity and lack and data collection periodically. **[The case for auto data collection]** Appointed to be in charge of direct checking of the archived data for irregularity and lack, in order for cross checking of data collected by the system.

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
2014/03/01-2015/07/31	(1)	$EC_{PJ,i,p}$	Power consumption of project chiller *i* during the period *p*	1,992.62	MWh/p	Option C	Monitored data	**[Use of measuring equipment]** 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) [Before Replacement of Meter] Meter is certified with the standards of manufacturer whose accuracy on power consumption is as good as international standards. [After Replacement of Meter] Meter is certified with International Standard (IEC) 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. - Accuracy level: [Before Replacement of Meter] ±0.48% [After Replacement of Meter] ±0.32% - Calibration: Calibration was not conducted since both meters have not been used for more than one year. - QA/QC: Continuous automatic measurement and daily manual recording at every 7 o'clock in the morning.	Continuously	Electrical power meter was replaced on 16 Dec 2014 to new meter.
2014/03/01-2015/07/31	(2)	$EI_{grid,p}$	Electricity imported from the grid to the project site during the period *p*	101,714.72	MWh/p	Option B	Invoice from the power company	Data is collected and recorded from invoices from the power company.	Every month	
2014/03/01-2015/07/31	(3)	$h_{gen,p}$	Operating time of captive electricity generator during the period *p*	0	hours/p	Option C	Monitored data	Data is measured by meter equipped to a generator.	Continuously	In the project, there is no generator for captive electricity. Thus, this parameter is not applicable for this project.

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	0.814	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 "Emission Factors of Electricity Interconnection Systems", National Committee on Clean Development Mechanism Indonesian DNA for CDM unless otherwise instructed by the Joint Committee.	
EF_{elec}	[For captive electricity] CO_2 emission factor for consumed electricity	0.8	tCO_2/MWh	CDM approved small scale methodology: AMS-I.A	In the project, there is no generator for captive electricity.
$T_{cooling-out,i}$	Output cooling water temperature of project chiller i set under the project specific condition	36.9	degree Celsius	Specifications of project chiller i prepared for the quotation or factory acceptance test data by manufacturer	
$T_{chilled-out,i}$	Output chilled water temperature of project chiller i set under the project specific condition	14	degree Celsius	Specifications of project chiller i prepared for the quotation or factory acceptance test data by manufacturer	
$COP_{RE,i}$	COP of reference chiller i under the standardizing temperature conditions	5.59	-	Selected from the default values set in the methodology	
$COP_{PJ,i}$	COP of project chiller i under the project specific conditions	7.66	-	Specifications of project chiller i prepared for the quotation or factory acceptance test data by manufacturer	
$COP_{PJ,tc,i}$	COP of project chiller i calculated under the standardizing temperature conditions	6.01	-	Calculated with the following equation; $COP_{PJ,tc,i} = COP_{PJ,i} \times [(T_{cooling-out,i} - T_{chilled-out,i} + TD_{chilled} + TD_{cooling}) \div (37 - 7 + TD_{chilled} + TD_{cooling})]$	
RC_{gen}	Rated capacity of generator	0.0	kW	Specification of generator for captive electricity	

Table3: *Ex-post* estimation of CO_2 emission reductions

Monitoring Period	CO_2 emission reductions	Units
2014/03/01-2015/07/31	122	tCO_2/p

[Monitoring option]

Option A	Based on public data which is measured by entities other than the project participants (Data used: publicly
Option B	Based on the amount of transaction which is measured directly using measuring equipments (Data used:
Option C	Based on the actual measurement using measuring equipments (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	122.00	tCO_2/p	ER_p
2. Selected default values, etc.				
COP of reference chiller i under the standardizing temperature conditions	N/A	5.59	-	$COP_{RE,i}$
3. Calculations for reference emissions				
Reference emissions during the period p	N/A	1744.42	tCO_2/p	RE_p
Reference emissions	N/A			
CO_2 emission factor for consumed electricity [grid]	Electricity	0.81	tCO_2/MWh	EF_{elec}
CO_2 emission factor for consumed electricity [captive]	Electricity	0.8	tCO_2/MWh	EF_{elec}
Proportion of grid electricity over total electricity consumed at the project site	N/A	1.00	-	-
Proportion of captive electricity over total electricity consumed at the project site	N/A	0.00	-	-
Power consumption of project chiller i	Electricity	1992.62	MWh/p	$EC_{PJ,i,p}$
COP of reference chiller i under the standardizing temperature conditions	N/A	5.59	-	$COP_{RE,i}$
COP of project chiller i calculated under the standardizing temperature conditions	N/A	6.01	-	$COP_{PJ,tc,i}$
4. Calculations of the project emissions				
Project emissions during the period p	N/A	1621.99	tCO_2/p	PE_p
Project emissions	N/A			
CO_2 emission factor for consumed electricity [grid]	Electricity	0.81	tCO_2/MWh	EF_{elec}
CO_2 emission factor for consumed electricity [captive]	Electricity	0.8	tCO_2/MWh	EF_{elec}
Proportion of grid electricity over total electricity consumed at the project site	N/A	1.00	-	-
Proportion of captive electricity over total electricity consumed at the project site	N/A	0.00	-	-
Power consumption of project chiller i	Electricity	1,992.62	MWh/p	$EC_{PJ,i,p}$

[List of Default Values]

$COP_{RE,i}$ (x<300USRt)	4.92	-
$COP_{RE,i}$ (300≦x<450USRt)	5.33	-
$COP_{RE,i}$ (450≦x<500USRt)	5.59	-
$COP_{RE,i}$ (500≦x<700USRt)	5.85	-
$COP_{RE,i}$ (700≦x<1250USRt)	5.94	-

$TD_{cooling}$	1.50	degree Celsius
$TD_{chilled}$	1.50	degree Celsius