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
01/01/2018 ~ 31/12/2018	(1)	$FI_{HCUR,p}$	Feed input to HCU reactor during the period *p*.	634,769.7	m3	Option C	On-site measurements.	Measured by flow meters. The project plans calibration of the flow meters at the time of turn-around.	every minute; aggregated for the period p	
01/01/2018 ~ 31/12/2018	(3)	$FC_{HCUR,gas,p}$	Consumption of natural gas during the period *p* in HCU reactor heater.	6,578.8	ton	Option C	On-site measurements.	Measured by flow meters. The project plans calibration of the flow meters at the time of turn-around.	every minute; aggregated for the period p	
01/01/2018 ~ 31/12/2018	(4)	$FC_{HCUR,diesel,p}$	Consumption of diesel oil during the period *p* in HCU reactor heater.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	Not relevant to the project	Not relevant to the project
01/01/2018 ~ 31/12/2018	(5)	$FC_{HCUR,HFO,p}$	Consumption of HFO during the period *p* in HCU reactor heater.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	Not relevant to the project	Not relevant to the project
01/01/2018 ~ 31/12/2018	(6)	$FC_{HCUR,i,p}$	Consumption of other fuel *i* during the period *p* in HCU reactor heater.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	Not relevant to the project	Not relevant to the project
01/01/2018 ~ 31/12/2018	(7)	$FI_{HCUD,p}$	Feed input to HCU debutanizer during the period *p*.	0.0	m3	Option C	On-site measurements.	Not relevant to the project	every minute; aggregated for the period p	Not relevant to the project
01/01/2018 ~ 31/12/2018	(8)	$FC_{HCUD,gas,p}$	Consumption of natural gas during the period *p* in HCU debutanizer reboiler.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	every minute; aggregated for the period p	Not relevant to the project
01/01/2018 ~ 31/12/2018	(9)	$FC_{HCUD,diesel,p}$	Consumption of diesel oil during the period *p* in HCU debutanizer reboiler.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	every minute; aggregated for the period p	Not relevant to the project
01/01/2018 ~ 31/12/2018	(10)	$FC_{HCUD,HFO,p}$	Consumption of HFO during the period *p* in HCU debutanizer reboiler.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	Not relevant to the project	Not relevant to the project
01/01/2018 ~ 31/12/2018	(11)	$FC_{HCUD,i,p}$	Consumption of other fuel *i* during the period *p* in HCU debutanizer reboiler.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	Not relevant to the project	Not relevant to the project
01/01/2018 ~ 31/12/2018	(12)	$FC_{HPU,gas,p}$	Consumption of natural gas during the period *p* in HPU.	0.0	ton	Option C	On-site measurements.	Not relevant to function A of the project	Not relevant to function A of the project	Not relevant to function A of the project
01/01/2018 ~ 31/12/2018	(13)	$FC_{HPU,diesel,p}$	Consumption of diesel oil during the period *p* in HPU.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	Not relevant to the project	Not relevant to the project
01/01/2018 ~ 31/12/2018	(14)	$FC_{HPU,HFO,p}$	Consumption of HFO during the period *p* in HPU.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	Not relevant to the project	Not relevant to the project
01/01/2018 ~ 31/12/2018	(15)	$FC_{HPU,i,p}$	Consumption of other fuel *i* during the period *p* in HPU.	0.0	ton	Option C	On-site measurements.	Not relevant to the project	Not relevant to the project	Not relevant to the project
01/01/2018 ~ 31/12/2018	(16)	$HP_{HPU,p}$	Hydrogen production during the period *p* in HPU.	0.0	Nm^3	Option C	On-site measurements.	Not relevant to function A of the project	Not relevant to function A of the project	Not relevant to function A of the project
01/01/2018 ~ 31/12/2018	(17)	$HC_{HCU,p}$	Hydrogen consumption in HCU during the period *p*.	0.0	Nm^3	Option C	On-site measurements.	Not relevant to function A of the project	Not relevant to function A of the project	Not relevant to function A of the project

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
a	Constant (specific emission factor) obtained by the regression analysis as per step A1-A2.	-1.300028	GJ/m3	Calculated according to the procedure described in section F2.	To be updated by the time of PDD registration
b	Constant (*y*-intercept) obtained by the regression analysis as per step A1-A2.	1,181,496.1	GJ	Calculated according to the procedure described in section F2.	As per Option A2 in Section F.2., hourly base value for "b" is determined then multiplied by 8760 to convert it for yearly based value To be updated by the time of PDD registration The value at the time of project registration was updated in order to adjust the parameter to be applicable for the monigoring period.
c	Constant (specific emission factor) obtained by the regression analysis as per step B1-B2.	0	GJ/mass or volume unit	Not relevant to function A of the project	Not relevant to function A of the project
d	Constant (*y*-intercept) obtained by the regression analysis as per step B1-B2.	0	GJ	Not relevant to function A of the project	Not relevant to function A of the project
e	Constant (specific energy consumption per hydrogen production) obtained by the regression analysis as per step C1-C2.	0.000000	GJ/Nm^3	Not relevant to function A of the project	Not relevant to function A of the project
f	Constant (*y*-intercept) obtained by the regression analysis as per step C1-C2.	0.0	GJ	Not relevant to function A of the project	Not relevant to function A of the project
g	Constant (specific hydrogen consumption per fresh feed input) obtained by the regression analysis as per step C1-C3.	0.0	Nm3/mass or volume unit	Not relevant to function A of the project	Not relevant to function A of the project
h	Constant (*y*-intercept) obtained by the regression analysis as per step C1-C3.	0.0	Nm^3	Not relevant to function A of the project	Not relevant to function A of the project
NCV_{gas}	Net calorific value of natural gas	46.5	GJ/t	Lower value of IPCC default values provided in the table 1.2 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories.	To be updated by the time of PDD registration
NCV_{diesel}	Net calorific value of diesel	NA	GJ/mass or volume unit	not relevant to the project	not relevant to the project
NCV_{HFO}	Net calorific value of residual oil	NA	GJ/mass or volume unit	not relevant to the project	not relevant to the project
NCV_{i}	Net calorific value of any other fuel used	NA	GJ/mass or volume unit	not relevant to the project	not relevant to the project
EF_{gas}	Emission factor of natural gas	0.0543	$t\text{-}CO_2/GJ$	Lower value of IPCC default values provided in the table 1.4 of Ch.1 Vol.2 of 2006 IPCC Guidelines on National GHG Inventories.	To be updated by the time of PDD registration
EF_{diesel}	Emission factor of diesel	NA	$t\text{-}CO_2/GJ$	not relevant to the project	not relevant to the project
EF_{HFO}	Emission factor of residual oil	NA	$t\text{-}CO_2/GJ$	not relevant to the project	not relevant to the project
EF_{i}	Emission factor of any other fuel used	NA	$t\text{-}CO_2/GJ$	not relevant to the project	not relevant to the project

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

Monitoring Period	CO_2 emission reductions	Units
01/01/2018 ~ 31/12/2018	2,734	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 Report Sheet (Calculation Process Sheet) [For Verification]

1. Calculations for emission reductions	Fuel type	Value	Units	Parameter
Emission reductions during the period *p*		2,734.8	tCO_2/p	ER_p
2. Selected default values, etc.				
Net calorific value of natural gas	natural gas	46.5	GJ/t	NCV_{gas}
Net calorific value of diesel oil	diesel oil	NA	GJ/mass or volume unit	NCV_{diesel}
Net calorific value of residual oil	residual oil	NA	GJ/mass or volume unit	NCV_{HFO}
Net calorific value of any other fuel	any other fuel	NA	GJ/mass or volume unit	NCV_i
Emission factor of natural gas	natural gas	0.0543	tCO_2/GJ	EF_{gas}
Emission factor of diesel oil	diesel oil	NA	tCO_2/GJ	EF_{diesel}
Emission factor of residual oil	residual oil	NA	tCO_2/GJ	EF_{HFO}
Emission factor of any other fuel	any other fuel	NA	tCO_2/GJ	EF_i
Weighted average CO_2 emission factor of fossil fuel consumed in HCU reactor heater during the period *p*.	N/A	0.0543	tCO_2/GJ	$EF_{HCUR,p}$
Weighted average CO_2 emission factor of fossil fuel consumed in HCU debutanizer reboiler during the period *p*.	N/A	0.0543	tCO_2/GJ	$EF_{HCUD,p}$
Weighted average CO_2 emission factor of fossil fuel consumed in HPU during the period *p*.	N/A	0.0543	tCO_2/GJ	$EF_{HPU,p}$
3. Calculations for reference emissions				
Reference emissions during the period *p*		19,345.9	tCO_2/p	RE_p
Reference emissions to calculate emission reductions in HCU as a result of reduction in fuel consumption due to increased column temperature during the period *p*.	All fuels	19,345.9	tCO_2/p	$RE_{HCU1,p}$
Reference emissions to calculate emission reductions in HCU as a result of reduction in reboiler fuel consumption in debutanizers due to reduced variability of column top pressure and lower the pressure during the period *p*.	All fuels	0.0	tCO_2/p	$RE_{HCU2,p}$
Reference emissions to calculate emission reductions in HPU as a result of reduction in hydrogen demand in HCU during the period *p*.	All fuels	0.0	tCO_2/p	$RE_{HPU1,p}$
Reference emissions to calculate emission reductions in HPU as a result of improved efficiency of hydrogen production during the period *p*.	All fuels	0.0	tCO_2/p	$RE_{HPU2,p}$
4. Calculations of the project emissions				
Project emissions during the period *p*		16,611.0	tCO_2/p	PE_p
Project emissions to calculate emission reductions in HCU as a result of reduction in fuel consumption due to increased column temperature during the period *p*.	All fuels	16,611.0	tCO_2/p	$PE_{HCU1,p}$
Project emissions to calculate emission reductions in HCU as a result of reduction in reboiler fuel consumption in debutanizers due to reduced variability of column top pressure and lower the pressure during the period *p*.	All fuels	0.0	tCO_2/p	$PE_{HCU2,p}$
Project emissions to calculate emission reductions in HPU as a result of reduction in hydrogen demand in HCU during the period *p*.	All fuels	0.0	tCO_2/p	$PE_{HPU1,p}$
Project emissions to calculate emission reductions in HPU as a result of improved efficiency of hydrogen production during the period *p*.	All fuels	0.0	tCO_2/p	$PE_{HPU2,p}$

[List of Default Values]

Net calorific value of fossil fuel		
Default net calorific value of natural gas	46.5	GJ/t
Default net calorific value of diesel oil	41.4	GJ/t
Default net calorific value of residual oil	39.8	GJ/t
Default net calorific value of any other fuel	39.8	GJ/t

CO_2 emisson factor of fossil fuel		
Default emission factor of natural gas	0.0543	t-CO_2/GJ
Default emission factor of diesel oil	0.0726	t-CO_2/GJ
Default emission factor of residual oil	0.0755	t-CO_2/GJ
Default emission factor of any other fuel	0.0755	t-CO_2/GJ