

## Explanation to the revision of Emission Factor( $EF_{grid,CM,y}$ )

1. PP used the most recently updated data to revise the EF this time. There were new publications of KEPCO "2017 Statistics of electric power in Korea('18.6)" and KPX "2017 Status of generation facility('18.7)". And the newly published data have more specific generation data compared to the statistics of last year.
2. Group energy is low-cost/must run power plants in Korea because electricity supplied to the grid by Group energy is preferentially purchased at the electricity market. ("Electric utility act" article 31).
3. PP used Option A to calculate OM factor because the data on the net electricity generation and a CO<sub>2</sub> emission factor of each power units are available in KEPCO "2017 Statistics of electric power in Korea('18.6)".
4. Since only the total power generation is available for some plants composed of plural units, the net electricity generation of the plants was allocated to the units in proportion of capacity.

### (1) Dangjin C/C plant

- Total power generation in 2017 : 7,256,526MWh
- Generation facility

Item	Capacity(MW)	Capacity in 2017(MW)	commissioning date
#1	500.75	500.75	2001.4
#2	533.00	533.00	2008.3
#3	382.00	382.00	2013.8
<b>#4</b>	<b>846.00</b>	<b>643.50</b>	<b>2017.4</b>
Total	2,261.75	<b>2,050.25</b>	

☞ Dangjin C/C #4 = 7,256,526MWh \* 643.5 / 2,050.25 = 2,245,709MWh  
(BM sheet line 49)

### (2) Gunjang energy cogeneration plant

- Total power generation in 2017 : 3,920,189MWh
- Generation facility

Item	Capacity(MW)	Capacity in 2017(MW)	commissioning date
#1	54.529	54.529	2008.1
#2	30.54	30.54	2009.11
#3	60.00	60.00	2014.10

<b>#4</b>	<b>250.00</b>	<b>250.00</b>	<b>2016.4</b>
<b>#5</b>	<b>28.50</b>	<b>21.375</b>	<b>2017.4</b>
Total	423.569	<b>416.444</b>	

- ☞ Gunjang #4 =  $3,920,189\text{MWh} \times 250.00 / 416.444 = 2,353,371\text{MWh}$   
(BM sheet line 112)
- ☞ Gunjang #5 =  $3,920,189\text{MWh} \times 21.375 / 416.444 = 201,213\text{MWh}$   
(BM sheet line 47)

(3) Gumhoyeosu cogeneration plant

- Total power generation in 2017 : 1,583,062MWh
- Generation facility

Item	Capacity(MW)	Capacity in 2017(MW)	commissioning date
#1	119.13	119.13	2009.4
<b>#2</b>	<b>144.97</b>	<b>144.97</b>	<b>2016.2</b>
Total	264.1	<b>2,281.1</b>	

- ☞ Gumhoyeosu #2 =  $1,583,062\text{MWh} \times 144.97 / 264.1 = 868,976\text{MWh}$   
(BM sheet line 119)

5. If Electricity generation(EG) in new&renewable power plants is not available(no data source), that is calculated by plant capacity and plant utilization factor of each units as follows.

- ☞ plant capacity \* 24h \* 365day \* average plant utilization factor
- plant capacity : KPX "2017 Status of generation facility('18.7)"
- plant utilization factor : KEPCO "2017 Statistics of electric power in Korea('18.6)"

For example, Electricity generation(EG) in Solar plants, which respective plant capacity is not available, is calculated as follows.

- ☞ Total annual increased capacity \* 24h \* 365day \* average utilization factor

6. If generation and fuel consumption data of each units are available, the emission factor is determined as Option A1. However, if generation and only the fuel type used each units are available, PP determined the emission factor as Option A2. The CO<sub>2</sub> emission factor of each fuel type i(EF<sub>CO<sub>2</sub>,i,y</sub>) is quoted from "Guideline for the greenhouse gas and energy target management operation(2016.12.30, Korea) attached table #22". And the parameter η(average net energy conversion efficiency) is quoted from the default values provided in Table2, Appendix of TOOL 09 ;"Determining the baseline efficiency of thermal or electric energy generation systems"

(1) Cogeneration (LNG)

Plant name	Fuel type	Technology	Capacity (MWh)	Default efficiency factors	EF	Applied EF
Dongtan #1,#2 (BM sheet line 6)	LNG	gas turbine	492,940	0.788	0.2563	<b>0.2513</b>
		steam turbine	263,820	0.835	0.2419	
		total	756,760			
Chuncheon (BM sheet line 46)	LNG	gas turbine	287,800	0.788	0.2563	<b>0.2515</b>
		steam turbine	143,400	0.835	0.2419	
		total	431,200			
Wirye (BM sheet line 48)	LNG	gas turbine	270,400	0.788	0.2563	<b>0.2513</b>
		steam turbine	142,200	0.835	0.2419	
		total	412,600			
Myeongpumosan (BM sheet line 118)	LNG	gas turbine	289,300	0.788	0.2563	<b>0.2514</b>
		steam turbine	146,800	0.835	0.2419	
		total	436,100			
Hanam (BM sheet line 129)	LNG	gas turbine	240,750	0.788	0.2563	<b>0.2514</b>
		steam turbine	123,061	0.835	0.2419	
		total	363,811			

(2) Cogeneration (Coal)

Plant name	Fuel type	Technology	Default efficiency factors	Applied EF
Gunjang #5 (BM sheet line 47)	coal	steam turbine	0.835	0.4109
Gunjang #4 (BM sheet line 112)	coal	steam turbine	0.835	0.4109
Gumhoyeosu (BM sheet line 119)	coal	steam turbine	0.835	0.4109
Saemangeum #1,#2 (BM sheet line 125)	coal	steam turbine	0.835	0.4109

(3) Combined cycle (LNG)

Plant name	Fuel type	Technology	Default efficiency factors	Applied EF
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Yeongnampower (BM sheet line 16)	LNG	Combined cycle gas turbine	0.62	0.3257
Busanjeonggwanenergy (BM sheet line 34)	LNG	Combined cycle gas turbine	0.62	0.3257
Pocheoncheonyeon (BM sheet line 55)	LNG	Combined cycle gas turbine	0.62	0.3257
Pajumunsan (BM sheet line 61)	LNG	Combined cycle gas turbine	0.62	0.3257

(4) Ultra-supercritical thermal plant (Coal)

Plant name	Fuel type	Technology	Default efficiency factors	Applied EF
Bukpyeong #2 (BM sheet line 28)	Coal	Ultra-supercritical	0.5	0.6862
Bukpyeong #1 (BM sheet line 56)	Coal	Ultra-supercritical	0.5	0.6862

(5) IGCC Plant (Coal)

Plant name	Fuel type	Technology	Default efficiency factors	Applied EF
Taeon IGCC ST #9 (BM sheet line 95)	coal	IGCC	0.5	0.6862

7. Since  $TEG_y$  is the parameter used to calculate the power density of the hydro power project activity, PP changed  $TEG_y$  to  $EG_{PJ,y}$ .  $EG_{PJ,y}$  is quantity of net electricity generation that is produced and fed into the grid as a result of the implementation of the CDM project activity in year y.  
(Please refer to Methodology ACM0002 version17.0 paragraph 43, 44)