Additional Information for

Reference Emissions

Setting default values to calculate reference emissions

Rationale for setting the default values to calculate reference emissions in the proposed methodology is following.

1. COP of the reference air conditioning system

Reference emissions in this methodology are partly caused by electricity consumptions of air conditioning system in the grocery store used for cooling the exhaust heat from the built-in type reference fridge-freezer showcase. Since the project fridge-freezer showcase is a separate type, it releases the exhaust heat to the outside of the store and will not cause an additional load to the air conditioning system.

Based on the surveys in Indonesia, COP values of the reference air conditioning system in the grocery stores to achieve net emission reductions have already been proposed and approved alongside with ID_AM004.

Therefore, applying the same default vales in this methodology leads to achieve net emission reductions.

2. Energy efficiency of the reference fridge-freezer showcase

2.1. Algorithm to calculate reference emissions

Reference emissions in this methodology are also caused by electricity consumptions of the built-in type reference fridge-freezer showcase itself. The following algorithm is employed to calculate such reference emissions of the reference fridge showcase. The same algorithm is also applied for the reference freezer showcase.

$$\mathbf{RE_{fridge,p}} = \sum_{\mathbf{i}} \left(\mathbf{PEC_{fridge,i,p}} \times \frac{\eta_{\mathbf{PJ,fridge,i}}}{\eta_{\mathbf{RE,fridge,i}}} \right) \times \mathbf{EF_{elec}}$$

Where;

$RE_{fridge,p}$: Reference emissions of the fridge showcase during the period *p* [tCO_2/p]

$PEC_{fridge,i,p}$: Electricity consumption of the project fridge showcase *i* during the period *p* [MWh/p]

$\eta_{PJ,fridge,i}$: Energy efficiency of the project fridge showcase *i* [L/W]

$\eta_{RE,fridge,i}$: Energy efficiency of the reference fridge showcase *i* [L/W]

EF_{elec} : CO_2 emission factor for consumed electricity [tCO_2/MWh]

i : Identification number of the fridge showcase [-]

2.2. Product specification data considering the fridge-freezer showcase market in Indonesia

2.2.1. Indonesian market

The following information regarding the fridge-freezer showcase market in Indonesia has been acquired from the interviews with the fridge-freezer showcase manufactures selling their products in Indonesia.

[Summary of interviews with fridge-freezer showcase manufactures and The Japan Refrigeration and Air Conditioning Industry Association]

Companies interviewed: Company A, Company B, Company C and Company D

- Major manufacturer names of fridge-freezer showcase especially for grocery store market in Indonesia are Company A, Company B and Company C
- Company A and Company B manufacture low-end to mid-range products, and Company C manufactures mid-range to high-end products
- Three main types of fridge-freezer showcase for grocery store in general meaning not Indonesia-specific:
  - ✓ Walk-in type : Separate type
  - ✓ Reach-in type : Both built-in type and separate type
  - ✓ Open type : Both built-in type and separate type
- Reach-in type and open type are popular in Indonesia
- Built-in type is preferred because the ambient temperature is always high in Indonesia and it will not help to improve energy efficiency of the separate type
- Walk in type is usually separate type and is not popular in Indonesia
- Company A only manufactures fridge showcases
- Company B manufactures both fridge showcases and freezer showcases, however, capacity of the showcases are relatively small (less than 500L)
- No regulations and voluntary programme or network to recover refrigerant in Indonesia

2.2.3. Survey on products data

Products data of fridge-freezer showcases from the companies with high market share has been surveyed. As described, it is found that Company A only manufactures fridge showcases, and that Company B manufactures both fridge showcases and freezer showcases, however, capacity of the showcases is relatively small (less than 500L).

As a result, appropriate data to determine the energy efficiencies of popular products in Indonesia has been collected only for two volume ranges ($z < 900$ and $900 \leqq z < 1{,}200$) of only one fridge type (Reach-in showcase).

Then, data have been collected for other manufacturers, Company C, Company D, Company E, Company F and Company G to determine the energy efficiencies of the latest products sold in the world for other volume ranges. Company D has just started their business in Indonesia, and

Company E, Company F and Company G have not started showcase business yet, but they occupy good market share in the world and are well known as manufactures of fridge-freezer showcase.

The collected data are listed in Table 1, Table 2 and Table 3.

There are some findings from the collected data.

- Energy efficiency of the Turkish Company A products show lower energy efficiency than the other manufacturers' products
- Showcases with larger capacity (greater than or equal to 900L) tend to show higher energy efficiency than smaller ones (less than 900L)

2.2.4. Conclusions

Based on the data collected and consideration, default values of the energy efficiency of the reference fridge showcase and freezer showcase have been decided with the reasoning below:

- Showcases with high sales performance in Indonesia have been selected as reference showcases, which are reach-in type fridge showcase with less than 900L from Company A and reach-in type fridge showcase with greater than or equal to 900L and less than 1,200L from Company A.
- Other than those two categories, average of energy efficiency data collected from the Japanese manufactures been selected since they are the latest model, thus, show conservative values of energy efficiency.

[Default values]

-Reach-in type fridge showcase

Range of volume (L)	Energy efficiency (L/W)
$z < 900$	1.18
$900 \leqq z < 1{,}200$	1.08
$1{,}200 \leqq z$	2.24

-Open type fridge showcase

Range of volume (L)	Energy efficiency (L/W)
$z < 900$	0.50
$900 \leqq z < 1{,}200$	0.65
$1{,}200 \leqq z$	0.73

-Reach-in type freezer showcase

Range of volume (L)	Energy efficiency (L/W)
z < 900	0.70
900 ≦ z < 1,200	0.70
1,200 ≦ z	1.01

Table 1. Collected data on reach-in type fridge showcases

Company A, Company B, Company C, Company D, Company E, Company F, Company G

■Reach-in type_Fridge

less than 900L			
Manufacture	Company A		
Model	A1		
Refrigerant	R134a		
Performance temperatur	2-10		
Effective capacity [L]	627		
Rated power consumptic	533	Average	
Energy efficiency [L/W]	1.18	1.18	

greater than or equal to 900L and less than 1,200L			
Manufacture	Company A		
Model	A2		
Refrigerant	R134a		
Performance temperatur	2-10		
Effective capacity [L]	936		
Rated power consumptic	876	Average	
Energy efficiency [L/W]	1.07	1.07	

greater than or equal to 1,200L				
Manufacture	Company E	Company F		
Model	E1	F1		
Refrigerant	R404a	R404a		
Performance temperatur	-1-10	-1-10		
Effective capacity [L]	1,457	1,457		
Rated power consumptic	600	710	Average	
Energy efficiency [L/W]	2.43	2.05	2.24	

Table 2. Collected data on open type fridge showcases

■Open type_Fridge

less than 900L										
Manufacture	Company G	Company G	Company G	Company D	Company D	Company D	Company F	Company F	Company F	
Model	G1	G2	G3	D1	D2	D3	F8	F9	F10	
Refrigerant	R404a	R404a	R404a	R404a	R404a	R404a	R404a	R404a	R404a	
Performance temperatur	2-10	2-10	2-10	0-22	0-22	0-22	5-20	5-20	5-20	
Effective capacity [L]	697	506	759	402	603	870	400	525	800	
Rated power consumptic	1,100	1,150	1,193	1,026	1,080	1,453	990	1,242	1,880	Average
Energy efficiency [L/W]	0.63	0.44	0.64	0.39	0.56	0.60	0.40	0.42	0.43	0.50

greater than or equal to 900L and less than 1,200L										
Manufacture	Company G	Company G	Company F							
Model	G4	G5	F11							
Refrigerant	R404a	R404a	R404a							
Performance temperatur	2-10	2-10	5-20							
Effective capacity [L]	1,046	1,012	1,040							
Rated power consumptic	1,100	2,330	1,880							Average
Energy efficiency [L/W]	0.95	0.43	0.55							0.65

greater than or equal to 1,200L										
Manufacture	Company G									
Model	G6									
Refrigerant	R404a									
Performance temperatur	2-10									
Effective capacity [L]	1,395									
Rated power consumptic	1,919									Average
Energy efficiency [L/W]	0.73									0.73

Table 3. Collected data on reach-in type freezer showcases

■Reach-in type_Freezer

less than 900L								
Manufacture	Company C	Company C	Company E	Company E	Company F	Company F	Company F	
Model	C1	C2	E2	E3	F2	F3	F4	
Refrigerant	R404a	R404a	R404a	R404a	R404a	R404a	R404a	
Performance temperatur	-20	-20	-20	-20	-20	-20	-20	
Effective capacity [L]	466	635	643	860	860	643	777	
Rated power consumptic	960	960	950	950	950	1,080	1,205	Average
Energy efficiency [L/W]	0.49	0.66	0.68	0.91	0.91	0.60	0.64	0.70

greater than or equal to 900L and less than 1,200L				
Manufacture	Company C	Company F	Company F	
Model	C3	F5	F6	
Refrigerant	R404a	R404a	R404a	
Performance temperatur	-20	-20	-20	
Effective capacity [L]	990	1,002	993	
Rated power consumptic	1,970	1,210	1,310	Average
Energy efficiency [L/W]	0.50	0.83	0.76	0.70

greater than or equal to 1,200L			
Manufacture	Company E	Company F	
Model	E4	F7	
Refrigerant	R404a	R404a	
Performance temperatur	-20	-20	
Effective capacity [L]	1,329	1,329	
Rated power consumptic	1,310	1,310	Average
Energy efficiency [L/W]	1.01	1.01	1.01