Additional Information for Reference Emissions

Establishment of reference emission

In the JCM, net emission reductions have to be ensured by setting reference emissions below BaU or setting project emissions higher than real project emissions by implementing the project.

For establishing such reference emission reductions market, share of the chillers in Indonesia was surveyed through interviews and the published report from BSRIA[1]. Based on the survey, it is found that the chillers of Company A, Company B and Company C, who operate worldwide, have a high market share in Indonesia.

Table 1 : Chiller Market in Indonesia (published report)

Source	Information on Market Share
BSRIA report	The top share manufacturers of chillers above the size of 100USRt in Indonesian market are (1st) Company A, (2nd) Company B and (3rd) Company C. Though Company B is losing its share these years, these three still dominate the chiller market in Indonesia.

Source：Report on Chillers Indonesia, BSRIA, March 2012
Note: Information in 2011. Not only centrifugal chillers, all other kinds of chillers are included in the market share information.

Table 2 : Chiller Market in Indonesia (interview)

Source	Information on Market Share
PT. Ebara	Top 3 manufactures, or Company A, C and B together have 80% of the market share.
PT. Bayutama [Hitachi distributor]	Top 3 manufactures have total 90% of the market share (Company C 35%, Company A 30% and Company B 25%)
PT. York	Top 3 manufactures have total 85% of the market share, or Company A 35%, Company C 30% and Company D (Company D mainly produces screw chillers)

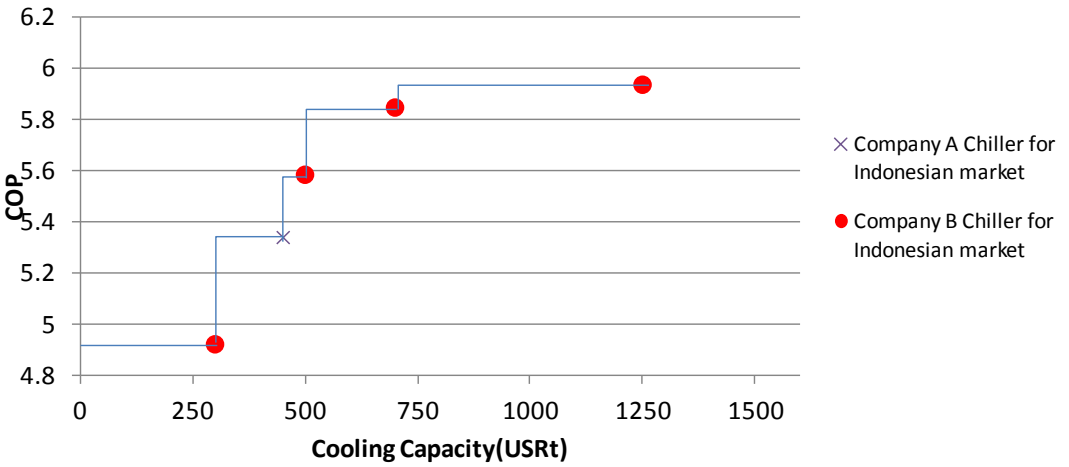
Source: Interview survey was done by the Study Team (2013)

Generally speaking, it is assumed that the existing old type chiller that COP is approximately 5.0 will be used continuously in case that the project is not implemented because of avoiding new investment for chiller replacement/new installation of chiller. In case of new installation, it is possible to assume that centrifugal type chiller of Company A and Company B will be chosen. This is because that, according to the

[1] BSRIA is a test, instruments, research and consultancy organisation, providing specialist services in construction and building services.https://www.bsria.co.uk/

survey, top 3 manufactures have dominant market share while the chiller of company C may be omitted as it is equipped with a refrigerant which is decided to be phased out by Montreal Protocol.

The following figure 1 shows the COPs of the chillers available in the Indonesian market. Representative COP values of Indonesian chiller market have been obtained, one specified COP value for Company A and four specified COP values for Company B. All data were surveyed in the same standard temperature conditions[2].



Source : Based on the manufacturer's information, Indonesian power specification etc., the above figure was prepared.

Figure 1 : COP Values of Candidate Reference Chillers

It is known that the chillers with larger cooling capacity tend to have better energy efficiency than ones with smaller capacity. Accordingly, the COPs are categorized based on the cooling capacity ranges.

5 surveyed COP values are assumed to represent the COPs for each categorized ranges as these chillers have high market share. The default COP values are set conservatively in the following manner:

1. The COP value tends to increase as the cooling capacity become larger.
2. The reference COP, which has a certain cooling capacity, is set at a maximum value in corresponding cooling capacity range.
3. The maximum values of COP in each cooling capacity ranges are defined as $COP_{RE\_default}$ as described in Table 3.

[2] *Chilled water: output : 7 degree Celsius, input : 12 degree Celsius*
Cooling water: output : 37 degree Celsius, input : 32 degree Celsius

Table 3 : Default $COP_{RE\_default}$

Cooling Capacity /unit (USRt)	x<300	300≦x<450	450≦x<500	500≦x<700	700≦x<1,250
$COP_{RE\_default}$	4.92	5.33	5.59	5.85	5.94

Source: Study Team