Additional Information on the Proposed Methodology

"Energy Saving by Introduction of High Efficiency Centrifugal Chiller"

1. Necessity to update default COP values of reference chiller

Default COP values are set in the approved JCM methodology ID_AM002 in a conservative manner, and those data were collected at the time of developing the initial version of the methodology in 2014. Technologies of chiller have been developed since then, and chiller efficiency has also improved.

Therefore, COP data of recent chillers as of August 2020 has been collected to decide whether the default COP values need to be updated to ensure conservativeness and net emission reductions.

2. Market share of chiller manufacturer in Indonesia

In Indonesia, chiller manufacturers, such as Company A, Company B, Company C, Company D and Company E occupy relatively high market share in chillers market.

3. Research on the COP values of chillers in Indonesia

3.1 Catalogue COP values

Although the market size of centrifugal chiller today is not quite large, it is expected that it will expand in Indonesia as its economy grows. It is also expected that the same chiller manufacturers who already have certain market share of other chiller types (e.g. screw chiller) will continue to occupy high market share in centrifugal chiller market in the future. Therefore, catalogue COP values of centrifugal chillers sold by those manufacturers are collected except for Company D and Company E because of the following reasons.

- COP values which are calculated with the same conditions are not obtained for Company D
- Chillers by Company E have a refrigerant that is going to be phased out by Montreal Protocol

As a result, total 59 COP values of centrifugal chillers ranging from 300 USRt to 1,250 USRt, provided with the same temperature conditions, are obtained and plotted in Figure 1 below.

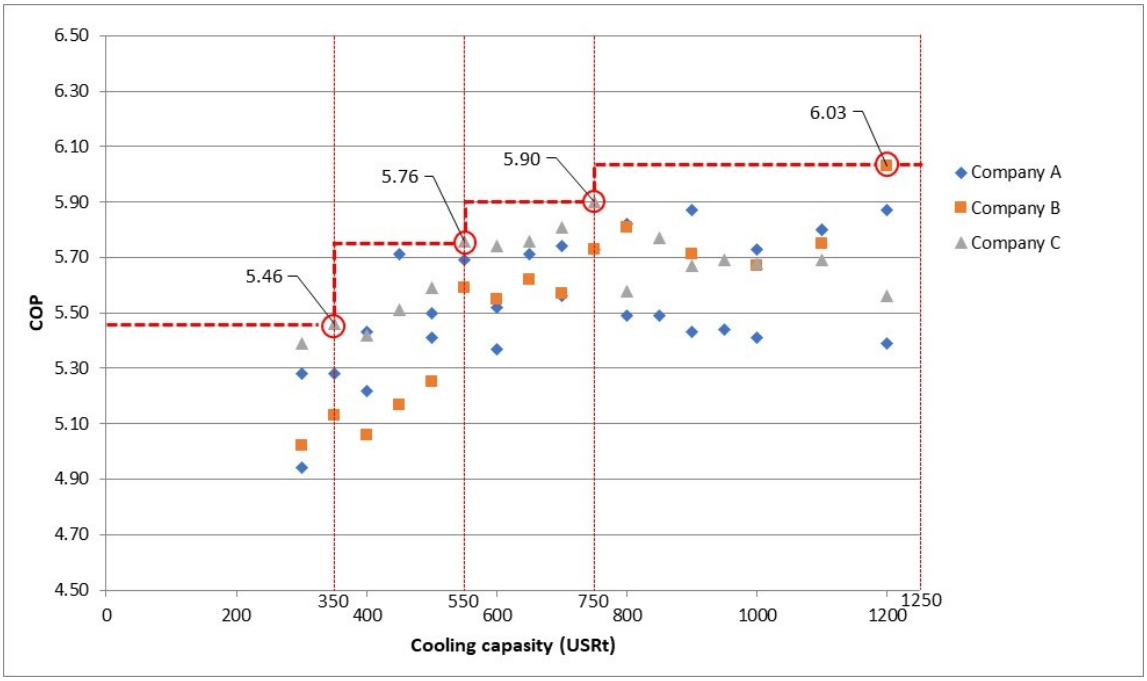

Figure 1: COP values of centrifugal chiller marketed in Indonesia

3.2 Decision on whether to update default COP values

Comparing the COP values collected from chillers recently marketed with the default COP values shown in Table 1, improvement of values can be observed. Therefore, it is concluded that the default COP values need to be updated to ensure conservativeness and net emission reductions.

Table 1: $COP_{RE,i}$ for ID_AM002 version 2.0

Cooling capacity per unit (USRt)	x<300	300≤x<450	450≤x<550	550≤x<700	700≤x<1,250
$COP_{RE,i}$	4.92	5.33	5.59	5.85	5.94

3.3 Determination of the reference COP values

It is observed that similar COP values fall into a certain cooling capacity range. Therefore, four cooling capacity ranges are set to determine the reference COP values for each range. To ensure the conservativeness, the most efficient COP, which has the largest value, in each capacity range is selected as the reference COP and is shown in Figure 1 above in red circles.

The reference COP for each cooling capacity range is determined and shown in Table 2 below. ("x" in the table represents cooling capacity per unit.)

Table 2: Updated $COP_{RE,i}$ for the methodology ID_AM002 version 3.0

Cooling capacity per unit (USRt)	x≤350	350<x≤550	550<x≤750	750<x<1,250
$COP_{RE,i}$	5.46	5.69	5.90	6.03