

## Additional Information

### 1. Market share of chiller manufacturer in Bangladesh

In Bangladesh, most of the centrifugal chillers installed and operated are the American manufacturers and the top three manufacturers, namely Carrier, Trane and York has a total share of 90 % in the market according to a report published by BSRIA<sup>1</sup> in 2015. This is consistent with the result of an interview with these manufactures in Bangladesh conducted by the methodology proponent.

### 2. Research on the COP values of chillers in Bangladesh

#### 2.1 Standardized COP\* values

COP values of centrifugal chillers marketed in Bangladesh are calculated from values of the practical data by manufacturer's testing from one of the top three manufacturers, standardized by the parameters as indicated in the proposed methodology. These are summarized in Table 1 below. It is known that the chillers with larger cooling capacity tend to have higher energy efficiency than ones with smaller cooling capacity. Accordingly, the COPs are categorized based on the cooling capacity ranges.

\*standardized COP is calculated based on the same manner stated in Criterion 2 on the proposed methodology

Table 1: Standardized COP values of centrifugal chiller by cooling capacity in Bangladesh

Cooling capacity (USRt)	300	525	700	1050
COP*	5.13	5.50	5.46	5.66

(Source: Information from one of the top three manufacturers)

#### 2.2 Actual measured COP values

Actual measured values of chillers of the other top three manufacturers were collected on the ground (at a shopping mall where the total capacity of the chiller was 550 USRt and at a university where the capacity of the chiller was 1,150 USRt. The result shows that COP values are 2.72 for 550 USRt and 4.88 for 1,150 USRt respectively. It has been confirmed by expert opinion that the values are representative of centrifugal chillers operating in the country. Therefore it can be said that the COP values under actual operational conditions are much lower than the standardized COP values, indicating that the standardized values which forms the basis for calculation of reference emissions

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

are conservative.

### 3. Conclusion

As shown above, the research shows that the standardized values are conservative compared with the actual performance of chiller in Bangladesh. It has been confirmed by expert opinion that the collected information on market share and COP in Table 1 and the actual measured value mentioned above are reliable.

Therefore the reference COP is determined based on the above standardized COP values as shown in Table 2 below.

Table 2: Established  $COP_{re,i}$  for the proposed methodology

Cooling capacity (USRt)	$x < 300$	$300 \leq x < 700$	$700 \leq x < 1,150$
$COP_{re,i}$	5.13	5.50	5.66

These reference COP values are conservative from the following perspectives:

- The reference COP values are based on the calculated data of the chiller currently marketed in Bangladesh. These COP values are calculated at full load for each cooling capacity.
- Actual measured COP values are far below from those standardized values
- COP of centrifugal chillers tend to be higher with increasing capacity. Therefore, COP is defined in the step-wise manner, the maximum values of COP in each cooling capacity ranges are defined as the reference COP representing higher end of the each cooling capacity range as show in the Figure 1 below.

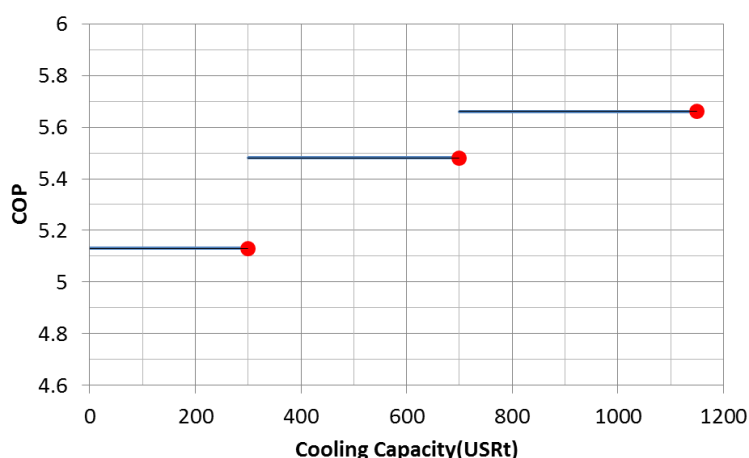


Figure 1: Reference COP values set in step-wise manner