



**Approved baseline and monitoring methodology/
methodological tool revision recommendation form
(Version 02.0)**

INFORMATION TO BE COMPLETED BY PANEL/ WG

Date and number of Panel/ WG meeting:	06-09 May 2019 / MP79
Title/Subject of the request for revision:	Amendment of equations 1-5 and unit changes throughout methodology
Reference number of the request for revision:	AM_REV_0259
Exact reference (number, title and version) of the methodology or methodological tool to which the request for revision applies:	AM0117: Introduction of a new district cooling system – Version 1.0

Summary of the request for revision:

Original text from PP:

When completing calculations for the first CPA for the attached PoA, UAE District Cooling Programme of Activities (PoA), it was observed that equations 1, 2, 3, 4 and 5, from the large scale methodology AM0117; Introduction of a new district cooling system (Version 01.0), have errors in them. After diligent algebraic equation balancing and testing of the equations the following changes are recommended to be made, for the following equations:

Equation (1)

In the methodology, on page 8 of 23, Equation (1) states the following:

$$SEER_{B,i} = \frac{OPC_i}{(IPE_i \times 0.000278 + IPT_i)}$$

Where:

- $SEER_{B,i}$ = Seasonal Energy Efficiency Ratio of the baseline cooling technology i
- OPC_i = Output cooling energy of baseline technology i (kJ)
- IPE_i = Input electrical energy of baseline technology i (kWh)
- IPT_i = Input thermal energy of baseline technology i (kJ)

This should be changed to the following:

$$SEER_{B,i} = \frac{OPC_{B,i}}{(IPE_{B,i} + IPT_{B,i})} \times 1 \times 10^{-6}$$

Where:

- $SEER_{B,i}$ = Seasonal Energy Efficiency Ratio of the baseline cooling technology i (Btu/Wh)
- $OPC_{B,i}$ = Output cooling energy of baseline technology i (Btu)
- $IPE_{B,i}$ = Input electrical energy of baseline technology i (MWh)
- $IPT_{B,i}$ = Input thermal energy of baseline technology i (MWh)

Equation (2)

In the methodology, on page 8 of 23, Equation (1) states the following:

$$IPT_i = FF_i \times NCV_i \times 10^6$$

Where:

- IPT_i = Input thermal energy of baseline technology i (kJ)
 FF_i = Fossil fuel consumption used in the baseline technology i (mass unit)
 NCV_i = Net calorific value of the fossil fuel used in the baseline technology i (GJ per mass unit)

This should be changed to the following:

$$IPT_{B,i} = FF_{B,i} \times NCV_{B,i} \times 0.2778$$

Where:

- $IPT_{B,i}$ = Input thermal energy of baseline technology i (MWh)
 $FF_{B,i}$ = Fossil fuel consumption used in the baseline technology i (t)
 $NCV_{B,i}$ = Net calorific value of the fossil fuel used in the baseline technology i (GJ/t)

Equation (3)

In the methodology, on page 9 of 23, Equation (3) states the following:

$$BE_y = \frac{Q_{B,y}}{3600} \times EF_{FF,y}$$

Where:

- BE_y = Baseline emissions in year y (tCO₂e/yr)
 $Q_{B,y}$ = Quantity of energy consumed in baseline by baseline cooling technologies in year y (MWh/yr)
 $EF_{EL,y}$ = CO₂ emission factor for electricity source used in baseline (tCO₂e/MWh)
 $EF_{FF,y}$ = CO₂ emission factor of the least carbon intensive energy source used in the absorption baseline technology (tCO₂e/GJ)

This should be changed to the following:

$$BE_y = Q_{B,y} \times EF_{FF,y} \times 3.6$$

- BE_y = Baseline emissions in year y (tCO₂e)
 $Q_{B,y}$ = Quantity of energy consumed in baseline by baseline cooling technologies in year y (MWh)
 $EF_{B,y}$ = CO₂ emission factor of the least carbon intensive energy source used in the absorption baseline technology (tCO₂e/GJ)

Equation (4)

On page 10 of 23, Equation (4) states the following:

$$Q_{B,y} = \sum C_{P,r,y} \times SEER_B$$

Where:

- $Q_{B,y}$ = Estimated electricity consumption of isolated and less efficient air-cooled reciprocating chiller systems in year y (MWh/yr)
 $C_{P,r,y}$ = Cooling output of new district cooling plant r in year y (MWh/yr)
 $SEER_B$ = Average Seasonal Energy Efficiency Ratio of less efficient air-cooled reciprocating chiller systems (kW/TR)

This should be changed to the following:

$$Q_{B,y} = \sum_r \frac{(1 \times 10^{-6}) OPC_{r,y}}{SEER_{B,i}}$$

Where:

- $Q_{B,y}$ = Quantity of energy consumed in baseline by baseline cooling technologies in year y (MWh)
- $OPC_{r,y}$ = Cooling output of new district cooling plant r in year y (Btu)
- $SEER_{B,i}$ = The benchmark Seasonal Energy Efficiency Ratio of the baseline cooling technology i (Btu/Wh)

Equation (5)

On page 10 of 23, Equation (5) states the following:

$$C_{P,r,y} = c_P \times F_{r,y} \times \Delta T_{r,y} \times h_{r,y} \times 3.6 \times 10^9$$

- $F_{r,y}$ = Average flow rate (integrated over the year) of new district cooling plant r in year y (g/hour)
- $\Delta T_{r,y}$ = Temperature difference between supply and return of chilled water from/to new district cooling plant r in year y (°C)
- $h_{r,y}$ = Number of the operating hours of the new district cooling plant r in year y (hours)
- $C_{P,r,y}$ = Cooling output of new district cooling plant r in year y (MWh/yr)
- c_P = Specific heat capacity of coolant (J/ g)

This should be changed to the following:

$$OPC_{r,y} = c_P \times F_{r,y} \times \Delta T_{r,y} \times h_{r,y} \times 2.7 \times 10^{-10}$$

Where:

- $F_{P,r,y}$ = Average mass flow rate (integrated over the year) of new district cooling plant r in year y (g/hour)
- $OPC_{r,y}$ = Cooling output of new district cooling plant r in year y (Btu)
- $\Delta T_{r,y}$ = Temperature difference between supply and return of chilled water from/to new district cooling plant r in year y (°C)
- $h_{r,y}$ = Number of the operating hours of the new district cooling plant r in year y (hours)
- c_P = Specific heat capacity of coolant (J/g.°C)

Additional amendments were made to the tables, including, but not limited to:

- The units of emissions to be written as tCO₂e throughout the tables in the methodology instead of tCO₂e/year (as the time year y is stipulated already)
- The mass unit being unified to 't' throughout
- The 'Data/Parameter' tables correctly numbered sequentially
- The cooling output units changed to Btu
- The SEER units changed to Btu/Wh

Any remaining minor formatting amendments can be seen in the attached file 'F-CDM-AM0117 - Amended Methodology.docx' which has all changes tracked.

Recommended decision to the Board on the request for revision

- ☒ Approve the proposed revised methodology or methodological tool ("A case")
- ☐ Reject the proposed revised methodology or methodological tool ("C case")

Type of the revision if the recommendation is A case

- ☐ The revision is a major revision

<input checked="" type="checkbox"/> The revision is a minor revision
Reasons for rejection if the recommendation is C case
Any other issues arising from the request for revision

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Document information

<i>Version</i>	<i>Date</i>	<i>Description</i>
02.0	18 July 2013	Revised to remove the row "Date and signature of the chair and vice chair of Panel/WG"
01.0	4 July 2013	Initial publication. This document supersedes and replaces the following documents: <ul style="list-style-type: none"> • Recommendation form for Small Scale Methodologies (F-CDM-SSCwg) (Version 01.1) • Recommendation Form for Small Scale A/R Methodologies and Procedures (F-CDM-SSC-AR) (Version 01.1)

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