CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAM ACTIVITY DESIGN DOCUMENT FORM (CDM-SSC-CPA-DD)
Version 01

CONTENTS

Annexes

NOTE:

(i) This form is for submission of CPAs that apply a small scale approved methodology using the provision of the proposed small scale CDM PoA.

(ii) The coordinating/managing entity shall prepare a CDM Small Scale Programme Activity Design Document (CDM-SSC-CPA-DD)[1,2] that is specified to the proposed PoA by using the provisions stated in the SSC PoA DD. At the time of requesting registration the SSC PoA DD must be accompanied by a CDM-SSC CPA-DD form that has been specified for the proposed SSC PoA, as well as by one completed CDM-SSC CPA-DD (using a real case). After the first CPA, every CPA that is added over time to the SSC PoA must submit a completed CDM-SSC CPA-DD.

[1] The latest version of the template form CDM-CPA-DD is available on the UNFCCC CDM web site in the reference/document section.

[2] At the time of requesting validation/registration, the coordinating managing entity is required to submit a completed CDM-POA-DD, the PoA specific CDM-CPA-DD, as well as one of such CDM-CPA-DD completed (using a real case).

SECTION A. General description of small scale CDM programme activity (CPA)

A.1. Title of the small-scale CPA:

Please state name of small-scale CPA

A.2. Description of the small-scale CPA:

Please state description of small-scale CPA

A.3. Entity/individual responsible for the small-scale CPA:

>> Here the information on the entity/individual responsible of the CPA shall be included, hence forth referred to as CPA implementer(s). CPA implementers can be project participants of the PoA, under which the CPA is submitted, provided their name is included in the registered PoA.

A.4. Technical description of the small-scale CPA:

A.4.1. Identification of the small-scale CPA:

Please state how and why small-scale CPA was identified

A.4.1.1. Host Party:

Republic of Singapore

A.4.1.2. Geographic reference or other means of identification allowing the unique identification of the small-scale CPA (maximum one page):

>>Geographic reference or other means of identification[3], Name/contact details of the entity/individual responsible for the CPA, e.g. in case of stationary CPA geographic reference, in case of mobile CPAs means such as registration number, GPS devices.

A.4.2. Duration of the small-scale CPA:

A.4.2.1. Starting date of the small-scale CPA:

Please state date in (dd/mm/yyyy)

A.4.2.2. Expected operational lifetime of the small-scale CPA:

Please state expected operational life-time in this case.

[3] E.g. in case of stationary CPA geographic reference, in case of mobile CPAs means such as registration number, GPS devices.

A.4.3. Choice of the crediting period and related information:

10 Years. Most of the chiller plants will decrease in their efficiency after 10 years.

A.4.3.1. Starting date of the crediting period:

Date of Handover of project from ESCO/Tech Provider to Building Owner

A.4.3.2. Length of the crediting period, first crediting period if the choice is renewable CP:

>> 10 years.

NOTE: Please note that the duration of crediting period of any *CPA* shall be limited to the end date of the *PoA* regardless of when the CPA was added..

A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
Year 1				
Year 2				
Year 3				
Year 4				
Year 5				
Year 6				
Year 7				
Year 8				
Year 9				
Year 10				
Total (tonnes of CO_2 e)				

A.4.5. Public funding of the CPA:

Please state

A.4.6. Information to confirm that the proposed small-scale CPA is not a de-bundled component

>>

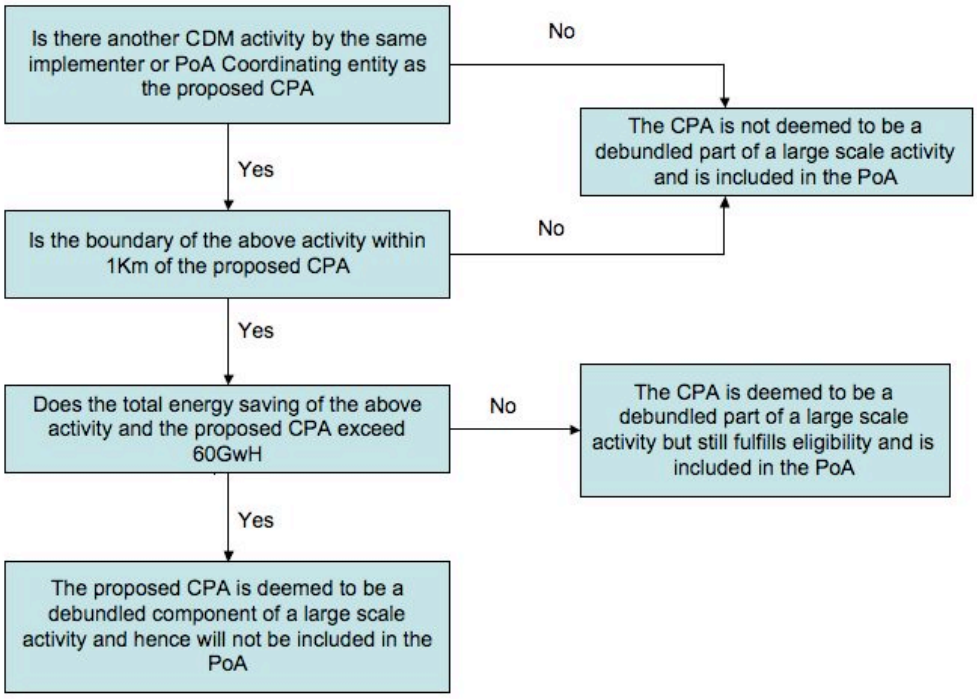
1. For the purposes of registration of a Programme of Activities (PoA)[4] a proposed small-scale CPA of a PoA shall be deemed to be a de-bundled component of a large scale activity if there is already an activity[5], which:

   (a) Has the same activity implementer as the proposed small scale CPA or has a coordinating or managing entity, which also manages a large scale PoA of the same sectoral scope, and;

   (b) The boundary is within 1 km of the boundary of the proposed small-scale CPA, at the closest point.

2. If a proposed small-scale CPA of a PoA is deemed to be a debundled component in accordance with paragraph 2 above, but the total size of such a CPA combined with a registered small-scale CPA of a PoA or a registered CDM project activity does not exceed the limits for small-scale CDM and small-scale A/R project activities as set out in Annex II of the decision 4/CMP.1 and 5/CMP.1 respectively, the CPA of a PoA can qualify to use simplified modalities and procedures for small-scale CDM and small-scale A/R CDM project activities.

The following tool is used as prescribed by the CME in the CDM-SSC-POA-DD:



[4] Only those POAs need to be considered in determining de-bundling that are: (i) in the same geographical area; and (ii) use the same methodology; as the POA to which proposed CPA is being added

[5] Which may be a (i) registered small-scale CPA of a PoA, (ii) an application to register another small-scale CPA of a PoA or (iii) another registered CDM project activity

Please state clearly if debundling rules as stated in the POA are suitably met in this CPA .

A.4.7. Confirmation that small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA:

The CME hereby confirms that the CPA is neither registered, nor seeking registration as a standalone (individual CDM) In any class whatsoever. The CME also guarantees that that the CPA is not part of another registered POA or potentially registered POA by another CME.

SECTION B. Eligibility of small-scale CPA and Estimation of emissions reductions

B.1. Title and reference of the Registered PoA to which small-scale CPA is added:

The title of the registered PoA is Climate Action Response Enterprise (CARE) for Energy Efficiency in Chiller Plants in Singapore. The reference number for the Registered POA is 6600

B.2. Justification of the why the small-scale CPA is eligible to be included in the Registered PoA:

Under the PoA, these are the eligibility criteria that have been listed and all criterion have been met by this CPA:

(a) The geographical boundary of the CPA including any time-induced boundary consistent with the geographical boundary set in the PoA –

- The CPA must be within the geographical location of The Republic of Singapore as stated in section A.4.1.2 of the PoA-DD
    - **[CPA name] is within the geographical location of the Republic of Singapore as provided for by GPS coordinates of the building in Section A.4.1.2 of this CPA-DD**

(b) Conditions that avoid double counting of emission reductions like unique identifications of product and end-user locations (e.g. programme logo);

- As per the conditions set out in in the operation and management plan of the PoA – as defined under section A.4.4.1 (Operational and management plan of the PoA-DD). Each CPA shall have a unique identification number (UIN) based on its precise geo-coordinates (GPS) and assigned under the building owner's name. The CME will have this recorded in the database of the operating and management software/hardware system. In addition, a CARE PoA Logo printed sticker with the UIN number shall be issued and must be displayed on the control infrastructure of the chiller plant system of each CPA.
    - **The [CPA Name] has a UIN of: [PLEASE SPECIFY]**

(c) The specifications of technology/measure including the level and type of service, performance specifications including compliance with testing/certifications;

- Each CPA must implement water-cooled chiller technology and shall comply with ASHRAE 14 guidelines and AHRI 550 calibration standards and shall implement a building automation software technology that is able to measure and monitor the performance of the chiller plant system at 1-minute intervals and be able to store such data that the DOE can verify on an annual basis during the crediting period of the CPA.

    - **[CPA Name] as a CPA utilizes water-cooled chiller technology operating at [_____]kW/TR with an optimally designed chiller plant system as prescribed under ASHRAE 14 guidelines and calibrated under AHRI 550 guidelines. Data is measured and monitored at 1minute intervals and has been has been confirmed by the CME.**

- Any building whether industrial, commercial or residential must be operating a chiller plant to cool the building with an installed cooling load capacity of more than 100TR and have a total chiller plant system efficiency of not better than 0.65kW/TR (i.e. 0.66kW/TR and higher).

    - **[CPA Name] is an industrial/commercial building baseline operating with an installed capacity of [ ]TR and has an total system efficiency of [ ] kW/TR in the baseline which is not better than the prescribed EEC of the PoA that would be considered to be included.**

- Each CPA must have completed an energy audit on the chiller plant system and conducted by a registered Energy Service Company (ESCO) accredited by the National Environment Agency (NEA) and prove through a comprehensive report that the measurements and computation that the chiller plant system efficiency was not better than 0.65kW/TR.

    - **[CPA Name] had a baseline energy audit performed by [ESCO Name] prior to the decision to implement the CPA where the baseline EEC was found to be [_____]kW/TR and operating on [type] chiller technology. [ESCO Name] is a registered and accredited ESCO.**

(d) Conditions to check the start date of the CPA through documentary evidence;

- Each CPA to be considered for inclusion under the PoA must prove that the start date is after the start date of the PoA, i.e. the date that the PoA was first published for Global Stakeholder Consultation – April 6 2010. The documentary evidence must show and prove that any Purchase or Works Order made out to the technology provider or main contractor must be after this date.

    - **The Purchase Order to [ESCO Name] to implement the [CPA Name] (start date of the CPA) was done on [date] which is after the start date of the PoA.**

(e) Conditions that ensure compliance with applicability and other requirements of single or multiple methodologies applied by CPAs;

- Each CPA must prove that it adheres to the baseline and monitoring methodology of AMSIIC Version 13.

    - **The [CPA Name] adheres to the baseline and monitoring methodology of AMSIIC Version 13 and validated by the DOE.**

(f) Conditions that ensure that CPAs meet the requirements pertaining to the demonstration of additionality as specified in Section A of EB65 Annex 3;

- The additionality is demonstrated at the PoA level using Attachment A of Appendix B of simplified modalities and procedure for small-scale CDM project Activities. The most appropriate barrier selected is the Prevailing practice barrier and detailed justification of additionality due to prevailing practice in the host country Singapore is provided in the PoA-DD section A.4.3 and it is extended to all CPA's. Based on the description of the Prevailing practice barrier, the following key criteria are identified to demonstrate CPA additionality:

- Each CPA must demonstrate that in the absence of the guidance of the PoA it would not have been able to achieve a chiller plant system efficiency of 0.65kW/TR measured at 1-minute Intervals based on the integrated design-approach for the retrofit of the old Chiller plant systems.

- Each CPA implements the proposed voluntary measure of the PoA and is not a result of any other policy or measure applied within the boundary of the PoA hence, it would not exist in the absence of the PoA.

- Each CPA increases enforcement of the mandatory policy/regulation that would systematically not be enforced, or increases compliance with those requirements for which non-compliance is widespread in the country/region, hence, it results in an increased level of enforcement or compliance that would not be reached in the absence of the PoA;

- Each CPA increases enforcement of the existing mandatory policy/regulation to a level that would not be reached in the absence of the PoA.

    - **As per condition (c) of the eligibility criterion set out herein it has been demonstrated that a baseline energy audit was performed by an accredited ESCO. The baseline audit proves that an inefficient system was operating in the baseline scenario and hence it is implementing [CPA Name] as per the guidance set out in the CARE PoA-DD. The CME has therefore determined that [CPA Name] is additional.**

(g) The PoA-specific requirements stipulated by the CME including any conditions related to undertaking local stakeholder consultations and environmental impact analysis;

- Each CPA must meet the EIA requirements as stated in the EIA Section C – below. Each CPA must also demonstrate and present records that equipment replaced have been scrapped and independently verified. The local stakeholder consultation has already been done at the PoA level and so each CPA does not need to undergo such a separate stakeholder consultation.

- **[CPA Name] meets both these requirements has been confirmed by the CME.**

(h) Conditions to provide an affirmation that funding from Annex I parties, if any, does not result in a diversion of official development assistance;

- Each CPA shall provide documentary evidence for their source of funding for developing their respective retrofit project.

    - **[CPA Name} has met this requirement as confirmed by the CME.**

(i) Where applicable, the requirements for the de-bundling check, in case CPAs belong to small-scale (SSC) or micro-scale project categories.

- Each CPA shall undergo a de-bundling check as prescribed under section A.4.4.1 (Operational and management plan of the PoA-DD) and verified by the DOE prior to inclusion.

    - **[CPA Name] has met this requirement as confirmed by the CME.**

(j) Condition in determining the difference in the loading capacity of the chiller plant system in the baseline scenario as compared to the project activity.

- CPAs where cooling load capacity changes significantly between the baseline and the project activity, i.e. less than 10% or more than 50% as compared to the baseline shall be excluded from this PoA in accordance with the applied methodology AMS IIC Version 13.

    - **[CPA Name] operates at [specify range] as it did as compared to the baseline. This has been confirmed by the CME.**

(k) Condition to determine if the CPA falls within the requirement of an SSC-CPA.

- Each CPA shall not generate an electrical energy savings of more than 60GWh per annum post retrofit.

    - **[CPA Name] does not generate electrical energy savings of more than 60GWh per annum. It generates savings of [please specify] kWh per annum**.

(l) Condition to determine if the CPA is eligible to be included in the PoA if parts of the system are shut down and/or if there is no actual retrofit but only optimization or calibration works performed to improve chiller plant system efficiency.

- Such CPAs will not be included.

    - **[CPA Name] is a complete and entire retrofit.**

(m) Conditions to determine if a CPA is eligible to be included in the PoA based on Refrigerant Usage

- CPAs switching from use of older refrigerants R11/R12/R22 to a non-CFC refrigerant such as R134a or R123 are allowed.
- CPAs switching from any of R134a or R123 refrigerants to a new refrigerant that is commercially available that is CFC-free and which refrigerant has a lower GWP than any of R134a or R123 refrigerants – in the future – is allowed.

    - **[CPA Name] utilized [please specify] refrigerant in the baseline and utilizes [please specify] refrigerant in the project activity. This is allowed under this PoA.**

B.3. Assessment and demonstration of additionality of the small-scale CPA , as per eligibility criteria listed in the Registered PoA:

As per the description for the assessment of additionality demonstrated in section A.4.3 of the Registered PoA 6600 - a typical SSC shall be assessed to be additional if it meets the following criteria:

- The baseline efficiency of the chiller plant system was higher than 0.65kW/TR and/or a accurate monitoring system taking readings at 1-minute intervals was not in place. A baseline energy audit was conducted by an accredited ESCO.
- The new Chiller Plant System Efficiency must achieve 0.65kW/TR
- The typical CPA-DD must meet all the eligibility criteria set out in section A.4.2.2 of the Registered PoA-DD
- All data measured and monitored at 1-minute intervals.
- Design-approach must be consistent with ASHRAE Guidelines 14
- Calibration & Measurement Accuracy must be consistent with AHRI 550 Guidelines
- Cooling load capacity in the CPA must not deviate by less than 10% or more than 50% from the baseline cooling load

This [CPA Name] has been assessed with respect to all of the criteria mentioned above and meets all the requirements for additonality as well as all the eligibility criteria set out within the Registered PoA-DD.

B.4. Description of the sources and gases included in the project boundary and proof that the small-scale CPA is located within the geographical boundary of the registered PoA.

The major gas considered in this CPA is CO_{2eq} that is derived from 2 sources:

(a) Electrical Energy consumption from the National Grid.
(b) Refrigerant gases calculated in CO_{2eq} in accordance with their respective GWP potential in both the baseline and project activity scenario.
(c) No other gases as defined under the Kyoto Protocol have been included.

The Longitudes and Latitudes provided for in the CPA in section A.4.1.2 can be located and seen on technologies like Google Earth and Nokia Maps. It clearly shows that the CPA well within the geographical and legal boundary of the Republic of Singapore, as stated in the POA.

This information will be stored in a central database to be maintained by the CME.

B.5. Emission reductions:

B.5.1. Data and parameters that are available at validation:

Parameter 1:	**Electrical Power Demand – Baseline (P_i)**
Data unit:	kW
Description:	Power of the devices of the group of *"i"* baseline devices (e.g., 40W incandescent bulb, 5hp motor). In the case of a retrofit activity, "power" is the weighted average of the devices replaced. In the case of new installations, "power" is the weighted average of devices in the chiller plant.
Source of data used:	Power transducer
Value applied:	Range of data measured at 1-minute intervals to compute kWh. Measured as _____ kw per hour on average over the baseline audit period. This is the value applied
Justification of the choice of data or description of measurement methods and procedures actually applied :	As measured and computed using integrated area under curve by data logger in acquisition system.
Any comment:	Baseline measurement taken at 1minute intervals from [start date of energy audit] to [end date of audit]

Parameter 2:	**Average annual operating hours in the baseline (O_i)**
Data unit:	Hours
Description:	Average annual operating hours of the devices of the group of *"i"* baseline devices in the chiller plant
Source of data used:	Extracted from data-logger or automation system used in 1-minute intervals.
Value applied:	**8760 hrs**
Justification of the choice of data or description of measurement methods and procedures actually applied :	This data is essential to capture the operating hours of the devices in the baseline in order to determine the electrical energy consumption in KwH by multiplying Parameter 1 (Kw)
Any comment:	Total power consumed by the devices in the baseline period over ____ days (_____ hours). _____ Kw per hour was measured over the measured period. Hence it will be _____ Kw x 8760 hrs = _____ KwH per annum.

Parameter 3:	**Chilled Water Flow Demand in Baseline**
Data unit:	Litres/sec
Description:	Total chilled water flow produced by the chiller plant
Source of data used:	Magnetic or ultrasonic flow meter
Value applied:	Range of data measured at 1-minute intervals to compute cooling load (TR)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As described in monitoring plan
Any comment:	

Parameter 4:	**Chilled Water Supply Temperature in Baseline**
Data unit:	Degrees C
Description:	Chilled water flow temperature supplied from the chiller plant
Source of data used:	Thermistor probe
Value applied:	Range of data measured at 1-minute intervals to compute cooling load (TR)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As described in monitoring plan
Any comment:	

Parameter 5:	**Chilled Water Return Temperature in Baseline**
Data unit:	Degrees C
Description:	Chilled water flow temperature return to the chiller plant
Source of data used:	Thermistor probe
Value applied:	Range of data measured at 1-minute intervals to compute cooling load (TR)
Justification of the choice of data or description of measurement methods and procedures actually applied :	As described in monitoring plan
Any comment:	

Parameter 6:	**Chilled Water Cooling Load in Baseline**
Data unit:	TR (refrigerant tonnes)
Description:	Chilled Water Heat load
Source of data used:	Calculated TR=1.19 x CHW flow rate (L/S) x CHW Delta T (C)
Value applied:	Range of data computed at 1-minute intervals
Justification of the choice of data or	Deriving conversion factor of 1.19 for computing cooling load in TR:

description of measurement methods and procedures actually applied :	(Computing flow rate of water in litres/second @10 degree F to convert into 1 TR of cooling). The following is a logic matric explanation on how 1.19 is derived based on standard units available from various sources such as SI units and other internationally recognized units of conversion of imperial to metric units: 1 Refrigerant ton of cooling (TR) = 12,000 British Thermal Units (BTU)/hr by definition. 1 TR of cooling also means that this refers to flow of water at 2.4 United States Gallons Per Minute (USGPM) at a temperature differential (delta T) of 10 degrees Farenheit given the specific density of water at this delta T So this means 2.4 USGPM x 10 degrees Farenheit delta T = 12,000 BTU/hr To convert to 1 ton TR = (2.4USGPM x delta 10 degrees F) divided by 24 Remembering that 1 degree Celsius = 1.8 Farenheit Since 1 Litre / Second is essentially 15.85 US GPM by SI units conversion and where 1 degree Celsius = 1.8 degree Farenheit Hence this means that conversion factor is: 15.85GPM *1.8 degree farenheit/ 24 ~ 1.19 (conversion factor)
Any comment:	

Parameter 7:	**Chilled Water Cooling Load Energy in Baseline**
Data unit:	TR-H (refrigerant tonnes-Hour)
Description:	Chilled Water Cooling Load Energy
Source of data used:	Integrated area under-curve of cooling load (TR) usage over time series
Value applied:	_____ **TR-H**
Justification of the choice of data or description of measurement methods and procedures actually applied :	The integrated area under-curve measurement (trapezoidal rule) is more accurate than using the other method of averaging the data measured for TR and KW over a time series.
Any comment:	Baseline measurement and computation taken at 1minute intervals from [start date of energy audit] to [end date of energy audit] (_____ TR-H per week on average) and multiplied by 52 weeks.

Parameter 8:	**Energy consumption in project activity in year *y*. ($E_{PJ,y}$)**
Data unit:	Kw
Description:	Total power demand of all chiller plant equipment
Source of data to be used:	Power Transducer (multiple)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Range of data measured *ex-post* at 1-minute intervals: Measured as _____ kW per hour on average
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class. **Electrical Demand Measurement** Electrical input to the system consists of the power usage for the CH, CHWP, CWP and CT. Electrical Power can be measured quite accurately by using a ±1% digital power meter. Since, the data are converted and transmitted digitally using Modbus protocol, the error of A/D conversion is eliminated.
QA/QC procedures to be applied:	Based on maintenance schedule
Any comment:	

Parameter 9:	**Average annual operating hours in the project activity (O_i)**
Data unit:	Hours
Description:	Integrated power usage over time or hours used to measure power consumption during the audit of the project activity
Source of data to be used:	Extracted from data-logger or automation system used in 1-minute intervals.
Value of data applied for the purpose of calculating expected emission reductions in section B.5	8760 hrs
Description of measurement methods and procedures to be applied:	This data is essential to capture the operating hours of the devices in the project activity in order to determine the electrical energy consumption in KwH by multiplying value applied in Parameter 8 (Kw)
QA/QC procedures to be applied:	Based on maintenance schedule
Any comment:	Total power consumed (measured) by the devices in the project activity period over _____ days (_____hours) = _____ kw per hour over the measured period. Hence it will be _____kw x 8760 hrs = _____ KwH per annum

Parameter 10:	**Chilled Water Flow Demand in Project Activity**

Data unit:	Litres / Second
Description:	Total chilled water flow produced by the chiller plant
Source of data to be used:	Magnetic or Ultrasonic Flow Meter
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Range of data measured at 1-minute intervals
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class. **Water Flow Rate Measurement** Flow can be measured accurately by installing a magnetic flow meter or ultrasonic flow meter at the correct location and correct straight pipe length as suggested by the manufacturer. The accuracy of the flow measurement can be good to 0.5% of the rate for magnetic flow meter and 1.0% for ultrasonic flow meter. However, site conditions sometimes do not permit the correct straight pipe length upstream and downstream of the flow meter. Therefore an error allowance of +/- 2% is allocated for site flow rate measurement.
QA/QC procedures to be applied:	
Any comment:	

Parameter 11:	**Chilled Water Supply Temperature during Project Activity**
Data unit:	Degrees Celsius
Description:	Chilled water flow temperature supplied from the chiller plant
Source of data to be used:	Thermistor Probe
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Range of data measured at 1-minute intervals
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class. **Water Temperature Measurement** To measure temperature of water accurately, only laboratory-graded sensors will be used. Chilled water temperature difference is defined as the difference in chilled water temperature return with respect to chilled water supply temperature. A ±0.5°C error in temperature sensor will cause an error of 17.86% in TR measurement (see table below).

	<table><tr><td>Temperature Sensor Error</td><td>±0.0°C</td><td>±0.5°C</td><td>±0.03°C</td></tr><tr><td>usgpm (no error)</td><td>2,400</td><td>2,400</td><td>2,400</td></tr><tr><td>CHWS °C</td><td>6.700</td><td>6.200</td><td>6.670</td></tr><tr><td>CHWR °C</td><td>12.300</td><td>12.800</td><td>12.330</td></tr><tr><td>DT °C</td><td>5.600</td><td>6.600</td><td>5.660</td></tr><tr><td>Computed Tons</td><td>1,008</td><td>1,188</td><td>1,019</td></tr><tr><td>Errror %</td><td></td><td>17.86%</td><td>1.07%</td></tr></table> A temperature sensor that has an uncertainty of ±0.03°C error at site will cause an error of 1.07% in Ton measurement. Therefore, temperature sensor in the laboratory must have an uncertainty of ±0.01°C or better.
QA/QC procedures to be applied:	Based on maintenance schedule
Any comment:	

Parameter 12:	**Chilled Water Return Temperature in Project Activity**
Data unit:	Degrees Celsius
Description:	Chilled water flow temperature return to the chiller plant
Source of data to be used:	Thermistor Probe
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Range of data measured at 1-minute intervals
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class. **<u>Water Temperature Measurement</u>** To measure temperature of water accurately, only laboratory-graded sensors will be used. Chilled water temperature difference is defined as the difference in chilled water temperature return with respect to chilled water supply temperature. A ±0.5°C error in temperature sensor will cause an error of 17.86% in TR measurement (see table below). <table><tr><td>Temperature Sensor Error</td><td>±0.0°C</td><td>±0.5°C</td><td>±0.03°C</td></tr><tr><td>usgpm (no error)</td><td>2,400</td><td>2,400</td><td>2,400</td></tr><tr><td>CHWS °C</td><td>6.700</td><td>6.200</td><td>6.670</td></tr><tr><td>CHWR °C</td><td>12.300</td><td>12.800</td><td>12.330</td></tr><tr><td>DT °C</td><td>5.600</td><td>6.600</td><td>5.660</td></tr><tr><td>Computed Tons</td><td>1,008</td><td>1,188</td><td>1,019</td></tr><tr><td>Errror %</td><td></td><td>17.86%</td><td>1.07%</td></tr></table>

	A temperature sensor that has an uncertainty of ±0.03°C error at site will cause an error of 1.07% in Ton measurement. Therefore, temperature sensor in the laboratory must have an uncertainty of ±0.01°C or better.
QA/QC procedures to be applied:	Based on maintenance schedule
Any comment:	

Parameter 13:	**Chilled Water Cooling Load in Project Activity**
Data unit:	Metric Tonnes of Refrigeration (TR)
Description:	Chilled Water Heat Load
Source of data to be used:	Calculated TR=1.19 x CHW flow rate (L/S) x CHW Delta T (C)
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Range of data computed at 1-minute intervals
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class. As prescribed for water temperature measurement and water flow that is measured and subsequently used in this calculation.
QA/QC procedures to be applied:	Based on maintenance schedule
Any comment:	Deriving conversion factor of 1.19 for computing cooling load in TR. (Computing flow rate of water in litres/second @10 degree F to convert into 1 TR of cooling). The following is a logic matric explanation on how 1.19 is derived based on standard units available from various sources such as SI units and other internationally recognized units of conversion of imperial to metric units: 1 Refrigerant ton of cooling (TR) = 12,000 British Thermal Units (BTU)/hr by definition. 1 TR of cooling also means that this refers to flow of water at 2.4 United States Gallons Per Minute (USGPM) at a temperature differential (delta T) of 10 degrees Farenheit given the specific density of water at this delta T So this means 2.4 USGPM x 10 degrees Farenheit delta T = 12,000 BTU/hr To convert to 1 ton TR = (2.4USGPM x delta 10 degrees F) divided by 24 Remembering that 1 degree Celsius = 1.8 degree Farenheit Since 1 Litre / Second is essentially 15.85 US GPM by SI units conversion and where 1 degree Celsius = 1.8 degree Farenheit Hence this means that conversion factor is: 15.85GPM *1.8 degree farenheit/ 24 ~ 1.19 (conversion factor)

Parameter 14:	**Chilled Water Cooling Load Energy in Project Activity**
Data unit:	Metric Tonnes of Refrigeration per Hour (TR-H)
Description:	Integrated area under-curve of cooling load (TR) usage over time series
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	Value applied will be calculated as follows: Obtain TRH data measured from 1-minute intervals of TR (cooling load) reading over a 1-year period using trapezoidal rule (integration of area under curve) during the project activity. **This value is _____ TRH**
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class As prescribed for water temperature measurement and water flow that is measured and subsequently used in this calculation with time-series factor.
QA/QC procedures to be applied:	Based on maintenance schedule
Any comment:	

Parameter 15:	**Annual Chiller Plant System Cooling Efficiency in Project Activity**
Data unit:	Kilowatt Hours (KW-H) divided by Tonnes of Refrigeration per Hour (TR-H) known as: KWH/TRH
Description:	Calculating Energy Efficiency of Chiller Plant System in Project Activity
Source of data to be used:	(Parameter 8*9) divided by Parameter 14
Value of data applied for the purpose of calculating expected emission reductions in section B.5	**_____ KWH / _____ TRH = _____ KWH/TR-H**
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class. As prescribed for water temperature measurement and water flow that is measured and subsequently used in this calculation with time-series factor.
QA/QC procedures to be applied:	Based on maintenance schedule
Any comment:	

Parameter 16:	**Calculated annual electrical energy savings of project activity**
Data unit:	Kilowatt Hours (KW-H) per year : KWH/year
Description:	The numerical difference between the product of (Parameter 1 * Parameter 2) and (Parameter 8 * Parameter 9)
Source of data to be used:	
Value of data applied for the purpose of calculating expected emission reductions in section B.5	**_____ KWH – _____KWH = _____ KWH**
Description of measurement methods and procedures to be applied:	In this section the project participants shall provide description of equipment used for measurement, if applicable, and its accuracy class. As prescribed for water temperature measurement and water flow that is measured and subsequently used in this calculation with time-series factor.
QA/QC procedures to be applied:	Based on maintenance schedule
Any comment:	

Parameter 17:	**Calculated Grid Emission Factor (Combined Margin).**
Data unit:	$kgCO_2/KwH$
Description:	The calculated Grid Emission Factor of the Singapore Grid based on information provided for by the DNA
Source of data to be used:	The Simple Operating Margin (OM) and Build Margin (BM) data provided over a 3 year period and averaged for the 3 year period (at each margin) and multiplied by the weighted factor of 0.5 for each margin. Utility or government records or official publications.
Value applied:	$EF_{grid,CM,y}$ = (0.5000 x 50%) + (0.4023 x 50%) = 0.25 + 0.2012 = **0.4512 kg CO_2 / KWH**
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	-
Any comment:	

Parameter 18:	**Technical Losses of the Grid**
Data unit:	Percentage
Description:	Transmission & Distribution Losses of the National Power Grid
Source of data to be used:	Utility or government records or official publications. In this case: The National Climate Change Secretariat and the National Research Foundation of Singapore
Value applied:	3%
Description of measurement methods and procedures to be applied:	-
QA/QC procedures to be applied:	-
Any comment:	Fixed over life-time of PoA

Parameter 19:	**$Q_{ref,BL}$**
Data unit:	Tons/year
Description:	Average annual quantity of refrigerant used in the baseline.
Source of data to be used:	Each chiller manufacturer or ESCO should supply the actual figure (in kg) for the initial refrigerant charge in the baseline. In the event this data is not available this quantity may be qualified and calculated by utilizing the data in Table 9 (Page 62) and based on each refrigerant charge in kg/kW of a specific refrigerant gas - of the "Energy and Global Warming Impacts of HFC Refrigerants published by US EPA and DOE together with the Alternative Fluorocarbons Environmental Acceptability Study (AFEAS)
Value applied:	____tons per annum
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per guidance from Chapter 7: Emissions of fluorinated substitutes for Ozone depleting substances, Volume 3, Industrial Processes and Product Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories. As per table 7.9 this refrigerant charge may range from 10kg to 2,000kg per chiller and a maximum leakage of 15% per annum is determined for developing countries. Further - The refrigerant charge used for these calculations is a composite kg/kW value for screw and centrifugal compressors integrated over the size range of interest. Individual sources for these values were 1) those published in the original TEWI report, 2) those estimated by an Ad-Hoc subcommittee formed by ARI member companies, and 3) those published in the 1995 UNEP Report (Fischer 1991, Hourahan 1996a, UNEP 1995). Since each chiller is rated in the baseline at _____TR and since 1TR = 3.65712 kW then the capacity rating of each chiller =_____ kW. Since _____ refrigerant is provided at _____kg/kW – this means that the quantity charged per chiller is _____kg. Based on 15% leakage per annum per this means that each chiller releases ____kg per annum. Therefore _____ chillers would release = _____kg or _____ tons per annum
Any comment:	This data parameter will remain constant for the entire crediting period of the CPA.

Parameter 20:	**$GWP_{ref,BL}$**
Data unit:	Tons CO_{2eq}/t refrigerant
Description:	Global warming potential of the baseline refrigerant
Source of data to be used:	IPCC values
Value applied:	To be applied with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	This is in line with the requirement of the baseline and monitoring methodology.
Any comment:	This data parameter will remain constant for the entire crediting period of the CPA.

Parameter 21:	**$Q_{ref,Y}$**
Data unit:	tons/year
Description:	Average annual quantity of refrigerant used in year *y* in the project activity to replace refrigerant that has leaked in year *y*
Source of data to be used:	Each chiller manufacturer or ESCO needs to supply the actual figure (in kg) for the initial refrigerant charge in the CPA.
Value applied:	To be applied with respect to each CPA (tons per annum)
Justification of the choice of data or description of measurement methods and procedures actually applied:	As per guidance from Chapter 7: Emissions of fluorinated substitutes for Ozone depleting substances, Volume 3, Industrial Processes and Product Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories. This range may be from 10kg to 2,000kg per chiller and a maximum leakage of 15% per annum is determined for developing countries. Therefore in this CPA annual refrigerant leakage per chiller would be _____ Kg * 15% = _____Kg. Since there are _____chillers in the project scenario this therefore means that the annual project activity refrigerant leakage will be = _____ = _____ tons per annum
Any comment:	This data parameter will remain constant for the entire crediting period of the CPA.

Parameter 22:	**$GWP_{ref,PJ}$**
Data unit:	Tons CO_{2eq}/t refrigerant
Description:	Global warming potential of the refrigerant that is used in the project equipment.
Source of data to be used:	IPCC Values
Value applied:	To be applied with respect to each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied:	This is in line with the requirement of the baseline and monitoring methodology.
Any comment:	This data parameter will remain constant for the entire crediting period of the CPA.

B.5.2. Ex-ante calculation of emission reductions:

Savings in KWH x Grid Emission Factor = tons of emission reductions in tCO2 including emission calculations from emissions in refrigerant usage in the baseline as compared the CPA. This explanation is given as follows:

Under the EB50 Report – Annex 14: "Methodological Tool to calculate the emission factor for an electricity system" it states that:

"If the DNA of the host country has published a delineation of the project electricity system that is connected electricity systems, these delineations should be used."

The Singapore DNA, which is the National Environment Agency (NEA), has published these numbers on February 25 2011 (latest publication) which applies to CDM projects or programs in Singapore.

The Singapore DNA has also chosen to use the Step 3(a) as prescribed under EB50 Annex 14 which is to calculate the Simple Operating Margin (OM) of the grid. In the case of Singapore, data has been provided over a 3 year chosen period as per the document provided for by the DNA that has been gathered over the years, 2007, 2008 and 2009. The document itself is dated February 25, 2011 and is publicly available at www.nea.gov.sg

The PME (CRX) has decided to use the *Ex ante* option which complies with the EB50 Annex 14 rule, where-in it states that:

"If the *Ex ante* option is chosen, the emission factor is determined once at the validation stage, thus no monitoring and recalculation of the emissions factor during the crediting period is required. For grid power plants, use a 3-year generation-weighted average, based on the most recent data available at the time of submission of the CDM-PDD to the DOE for validation."

This too applies for The Build Margin as well which has also been derived from data from the Singapore DNA. Under Step 5, Option 1 of EB50 Annex 14 this is defined as:

"For the first crediting period, calculate the build margin emission factor *ex ante* based on the most recent information available on units already built for sample group *m* at the time of CDM-PDD submission to the DOE for validation."

A 3-year generation weighted average has been derived for the years, 2007,2008 and 2009.

For both sets of (OM and BM) data these have presented as follows by the Singapore DNA:

2009	a. Simple Operating Margin (OM)	0.4761 kg CO_2/kWh
	b. Build Margin (BM)	0.3988 kg CO_2/kWh
2008	a. Simple Operating Margin (OM)	0.5016 kg CO_2/kWh
	b. Build Margin (BM)	0.4111 kg CO_2/kWh
2007	a. Simple Operating Margin (OM)	0.5233 kg CO_2/kWh
	b. Build Margin (BM)	0.3990 kg CO_2/kWh

Therefore the average the Simple OM for the Singapore Grid is:

$(\sum 0.4761, 0.5016, 0.5233)/3 = 0.5000$ kg CO_2/kWh

and it follows that the average BM is:

$(\sum 0.3988, 0.4111, 0.3990)/3 = 0.4023$ kg CO_2/kWh

In order to calculate the overall grid emission factor: the build and operating margins of the grid are considered as a product of the weighted average for each margin and summed to give the final value of the emission factor ($EF_{grid,CM,y}$) and expressed in kilograms $C0_2$ per KWH as follows:

Hence:

$EF_{grid,CM,y} = EF_{grid,OM,y} \times W_{OM} + EF_{grid,BM,y}, \times W_{BM}$

Where,

$EF_{grid,BM,y}$ = Build margin CO_2 emission factor in year y (kg CO_2/KWH)
$EF_{grid,OM,y}$ = Operating margin CO_2 emission factor in year y (kg CO_2/KWH)
W_{OM} = Weighting of operating margin emission factor (%)
W_{BM} = Weighting of build margin emission factor (%)

Therefore in accordance with the values provided by the DNA, the Grid Emission Factor for Singapore is calculated as:

Where default values of 50% have been used for the W_{OM} & W_{BM} as prescribed by the tool for projects not concerned with wind and solar power in the first crediting period.

$EF_{grid,CM,y}$ = (0.5000 x 50%) + (0.4023 x 50%) = 0.25 + 0.2012 = **0.4512kg CO_2 / KWH**

Where default values of 50% have been used for the W_{OM} & W_{BM} as prescribed by the tool for projects not concerned with wind and solar power in the first crediting period.

In 2011, the National Climate Change Secretariat (NCCS) and the National Research Foundation (NRF) of Singapore published a report entitled: “Smart Grid Technology Primer: A Summary” which can be found at : http://app.nccs.gov.sg/data/resources/docs/TechPrimers/Smart%20Grid%20Primer.pdf. In there it can found on page 2 that the transmission losses of the Singapore grid is at about 3%.

Therefore using all of the available data gathered during the baseline audit of this CPA as well as the data gathered during the operation of the project activity, we are able to utilize the algorithm provided for in AMSIIC Version 13 (option 1) for the ex-ante determination of emission reductions in the CPA as follows:

Precise data measured at 1-minute intervals measured during the baseline energy audit has been captured. These include the power consumed by the chiller plant system (kW), Cooling load (RT), ambient temperature, flow rate of chilled water, humidity chilled water inlet and chiller water outlet temperatures.

Baseline Emissions

$BE_y = E_{BL,y} * EF_{CO2,ELEC,y} + Q_{ref,BL} \times GWP_{ref,BL}$ (1)

$$E_{BL,y} = \sum_i (n_i * \rho_i * o_i)/(1 - l_y) \quad (2)$$

BE_y	Baseline emissions in year *y* (tCO2e)
$E_{BL,y}$	Energy consumption in the baseline in year *y* (kWh)
$EF_{CO2,ELEC,y}$	Emission factor in year *y* calculated in accordance with the provisions in AMS-I.D (tCO2/MWh)
Σ_i	Sum over the group of *"i"* devices (e.g., 40W incandescent bulb, 5hp motor) replaced, for which the project energy efficient equipment is operating during the year, implemented as part of the project activity
n_i	Number of devices of the group of *"i"* devices (e.g., 40W incandescent bulb, 5hp motor) replaced, for which the project energy efficient equipment is operating during the year
p_i	Power of the devices of the group of *"i"* baseline devices (e.g., 40W incandescent bulb, 5hp motor). In the case of a retrofit activity, "power" is the weighted average of the devices replaced. In the case of new installations, "power" is the weighted average of devices on the market
o_i	Average annual operating hours of the devices of the group of *"i"* baseline devices
l_y	Average annual technical grid losses (transmission and distribution) during year *y* for the grid serving the locations where the devices are installed, expressed as a fraction. This value shall not include non-technical losses such as commercial losses (e.g., theft/pilferage). The average annual technical grid losses shall be determined using recent, accurate and reliable data available for the host country. This value can be determined from recent data published either by a national utility or an official governmental body. Reliability of the data used (e.g., appropriateness, accuracy/uncertainty, especially exclusion of non technical grid losses) shall be established and documented by the project participant. A default value of 0.1 shall be used for average annual technical grid losses, if no recent data are available or the data cannot be regarded accurate and reliable
$Q_{ref,BL}$	Average annual quantity of refrigerant used in the baseline to replace the refrigerant that has leaked (tonnes/year). Values from Chapter 7: Emissions of fluorinated substitutes for Ozone depleting substances, Volume 3, Industrial Processes and Product Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories may be used
$GWP_{ref,BL}$	Global Warming Potential of the baseline refrigerant (t CO_2e/t refrigerant)

Further:

$n_{i=}$ 1 complete chiller plant system

$p_{i=}$ total power consumed by the devices in the baseline period over __ days (___ hours) = ____ kw per hour. Hence it will be _____kw x 8760 hrs = _____KwH per annum

l_y = 0.03 used as published value.

Therefore using the formula in (2) we arrive at:

1*_____ KwH / (1-0.03)

= _____ KwH / 0.97

= _____ KwH

And since:

$Q_{ref,BL}$ = _____ tons per annum

And since:

$GWP_{ref,BL}$ = _____ (GWP)

Then:

Using the formula in (1):

$BE_y = E_{BL,y} * EF_{CO2,ELEC,y} + Q_{ref,y} X GWP_{PJy}$

BE_y = _____ KwH * 0.4512 kgCo2/KwH + [Quantity refrigerant leakage *(GWP]

BE_y = _____ ton CO_2 per annum

Project Activity Emissions:

$$PE_y = EP_{PJ,y} * EF_{CO2,y} \quad (1)$$

Where:

PE_y	Project emissions in year *y* (tCO2e)
$E_{PJ,y}$	Energy consumption in project activity in year *y*. This shall be determined *ex post* based on monitored values
$EF_{CO2,Y}$	Emission factor for electricity or thermal baseline energy. The emissions associated with grid electricity consumption should be calculated in accordance with the procedures of AMS-I.D. For fossil fuel displaced reliable local or national data for the emission factor shall be used; IPCC default values should be used only when country or project specific data are not available or difficult to obtain

Project energy consumption in case of project activities that displace grid electricity is determined as follows using the data of the project equipment or system:

$$E_{PJ,y} = \sum_i (n_i * \rho_i * o_i) / (1 - l_y)$$

n_i = 1 complete chiller plant system

$p_{i=}$ total power consumed (measured) by the devices in the project activity period over ____ days (_____hours) = _____ kw per hour. Hence it will be _____kw x 8760 hrs = _____KwH per annum

l_y = 0.03 used as published value.

Therefore using the formula in (2) we arrive at:

1* _____KwH / (1-0.03)

= _____KwH / 0.97

= _____KwH

Then:

$$PE_y = EP_{PJ,y} * EF_{CO2,y}$$

PE_y = _____KwH * 0.4512kgCO_2/KwH

PE_y = _____ ton CO2 per annum

Also - Since project emissions from physical leakage of refrigerants should be accounted for - all GHGs as defined per Article 1, paragraph 5 of the Convention shall be considered as per the guidance by the Board:

$PE_{ref,y}$ is calculated as follows:

Where:

$PE_{ref,y}$ are project emissions from physical leakage of refrigerant from the project equipment in year *y* (t CO2e/y)

$Q_{ref,PJ,y}$ is the average annual quantity of refrigerant used in year *y* to replace refrigerant that has leaked in year *y* (tonnes/year). Values from Chapter 7: Emissions of fluorinated substitutes for Ozone depleting substances, Volume 3, Industrial Processes and Product Use, 2006 IPCC Guidelines for National Greenhouse Gas Inventories may be used

$GWP_{ref,PJ}$ *is the* Global Warming Potential of the refrigerant that is used in the project equipment (t CO2e/t refrigerant)

And following the guidance of AMSIIC Version 13,

$PE_{ref,y} = Q_{ref,PJ,y} * GWP_{ref,PJ}$

= _____tons refrigerant leakage * _____GWP = _____ ton CO_{2eq}

Hence total Project Emissions = _____ton CO_{2eq} (from kWh) + ton CO_{2eq} (from refrigerant leakage)

= _____ ton CO_{2eq}

Also - As per the guidance provided for by AMS IIC Version 13 an in accordance with the additional guidance provided for in EB34 meeting report Paragraph 17(b) leakage is not computed since no energy efficiency technology is transferred from another project activity.

Therefore emission reductions are determined as:

[baseline emissions] – [CPA emissions] ton CO_2 per annum

= _____CERs per annum

B.5.3. Summary of the ex-ante estimation of emission reductions:

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Year	Estimation of project activity emissions (tonnes of CO_2 e)	Estimation of baseline emissions (tonnes of CO_2 e)	Estimation of leakage (tonnes of CO_2 e)	Estimation of overall emission reductions (tonnes of CO_2 e)
Year A				
Year B				
Year C				
Year …				
Total (tonnes of CO_2 e)				

B.6. Application of the monitoring methodology and description of the monitoring plan:

B.6.1. Description of the monitoring plan:

Objective of the Monitoring Plan for a typical SSC-CPA

The objective in creating a high-standard in the monitoring plan is to conduct and produce accurate, long-term and measurable data gathering and verification systems, in order to achieve factory-standards where the actual equipment is manufactured. This is in line with ARI550, which prescribes accuracy tolerance range of ±5% for cooling load demand. In addition, in order to achieve overall consistency in the monitoring plan, the overall heat balance in the chiller plant room shall be computed for counter-checking the accuracy of data and resultant computation.

The second objective is to ensure that old chillers from the baseline scenario is / are effectively scrapped by keeping track by ensuring 3rd parties ensure that equipment is removed and disposed off according to the code of practices recommended by the government. The serial number of the new chillers shall also be compared against replaced chillers and in accordance with manufacturers specifications for newer equipment. These specifications shall be stored in the database managed by the CME and which data shall be easily verifiable and comparable.

Post-Retrofit Monitoring Procedures

Temperature Sensors: The temperature sensors should be 10k Thermistor type. The temperature sensors used should be calibrated at 3 points (Triple Point of Water, Gallium and 15 Deg C Water bath) to ensure good accuracy of ±0.01° C. No resistance to analogue converter is allowed. All temperature computation shall be NTC non linear.

Data Acquisition System: Data acquisition system used should have an A/D bit of 16-20 bit resolution.

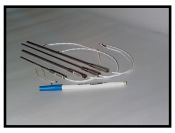
Data Logging Software: All data should be trended at 1minute sampling time interval.

Flow meter: The flow meter should be full bore electromagnetic flow meter for chillers (accuracy ±1%) and clamped-on ultrasonic for headers (accuracy of ±2%).

KW power meter: Power meter should be digital and split cored CT. Power Meters used shall have total system accuracy of ±1% and conform to ANSI C12.1 metering standard.

Data Acquisition & Control System to determine Efficiency (kW/TR)

Magnetic Flow meter from Siemens (accuracy ±0.25%)



10K/30K thermistors for temperature measurement. All sensors are manually calibrated in our laboratory to achieve uncertainty of **±0.01°C**. The 3 calibration points are triple point of water (0.01°C), Gallium melting point (29.7646°C) and water bath (15°C).

3-phase network split core power meter from Veris (±1% total system accuracy, 10% to 100% CT rating)

IO card (Agilent 34901A)

Data Acquisition System (Agilent 34970A)

AT1616L digital IO card (for Status and Start/Stop Control)

Data acquisition and Control server (DAC Server) – Reliable Industrial PC server with redundancy features

Step-by-step description of a typical monitoring plan using the above standards and required accuracies: *(Please note that ALL data is captured at 1-minute intervals to ensure high resolution of data accuracy)*

1. Data is measured for electrical power demand for equipment within the chiller plant using a series of power transducers.

2. Data is measured for chilled water (CHW) flow in litres / second using a magnetic or ultrasonic flow meter.

3. Data is measured for the temperature of chilled water (CHW) supply (CHWS) and chiller water return (CHWR) in degrees Celsius using a thermistor probe. The delta (difference) in the temperature is the data gathered for computation.

4. The chilled water cooling is then computed by the software (Energy Management System) in tonnes of refrigeration (TR) using the equation:

TR=1.19 x CHW flow rate (L/S) x CHW Delta T (C)

5. Electrical Energy Consumption in KWH is then computed using the rule: integration of area under curve (trapezoidal rule) – electrical energy demand over a time series. This computed by the EMS software.

6.Chilled Water-cooling demand in TRH is also computed using the rule: integration of area under curve (trapezoidal rule) – chiller water-cooling demand over a time series. This is computed by the EMS software.

7. The EMS system then divides Point 5 by Point 6 (KWH/TRH) resulting in the energy efficiency coefficient of KW/TR. This system efficiency is captured and stored in the database.

8.The KWH savings – which is the difference between the electrical energy consumption in the baseline scenario (pre-retrofit) and the electrical energy consumption during the operation of the SSC-CPA (post-retrofit) – **for the same cooling load**, is also computed by the EMS and can be shown on a monthly basis.

9. The KWH savings data is then stored by the EMS and kept securely captured by the Coordinating Entity on a monthly basis and computed for 12 month to determine the KWH savings per year.

10. KWH savings per annum is then multiplied by the National Grid Emission Factor, which in the case of Singapore is **0.4512 kg CO_2 / KWH**. Hence the equation: Annual KWH savings x **0.4512 kg CO_2 / KWH** / 1000 = ton CO2eq per annum.

11. Refrigerant emissions must also be calculated in the both baseline scenario as well as in the CPA. Net emission reductions shall be included in both scenarios to determine the final quantum of the CERs eligible for each CPA.

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

According to the rules defined in the CDM Modalities & Procedures Annex - Section G Paragraph 37(c): "Project participants have submitted to the designated operational entity documentation on the analysis of the environmental impacts of the project activity, including trans-boundary impacts and, if those impacts are considered significant by the project participants or the host Party, have undertaken an environmental impact assessment in accordance with procedures as required by the host Party".

THE EIA is done at the CPA level.

The justification to choose the SSC-CPA level for the environmental impact is done so as to establish the standard or level of compliance at which each SSC-CPA (must be demonstrated with evidence) joining the POA - must comply with and is thus set out as an eligibility criterion for inclusion into the SSC-POA.

☐ Please tick if this information is provided at the PoA level. In this case sections C.2. and C.3. need not be completed in this form.

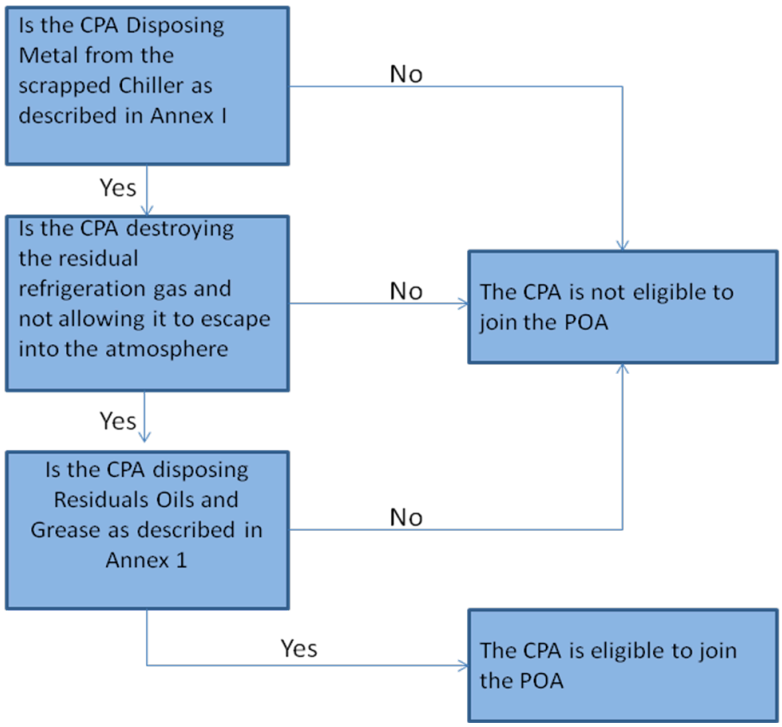
C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

(a) The PME have setup the following criterion which assures that the scrapping of old chillers replaced as a result of the POA implementation has no significant impact to the Environment – provided that they conform to the code of practice on the disposal and recycling of equipment as prescribed and administered by the National Environment Agency (NEA). These code of practices can be found at www.nea.gov.sg

(b) Only those CPAs that can demonstrate that they adhere to these procedures and furthermore to the criteria below will be included under the POA.

Criteria	Description
Scrapping of Metal Parts	Should be disposed off by a licensed general industrial waste contractor
Safe disposal of Refrigeration Gas	Should not be allowed to openly vent in the atmosphere. Can be recycled or resold for re-use. R11 and R12 refrigerants cannot be re-used again under the Montreal Protocol
Oils and Greases	Should be disposed off by a licensed toxic industrial waste contractor

Tool to demonstrate EIA eligibility of CPA to join POA:



Under the Guidance of this tool and in accordance with local requirements –

"Is this CPA is eligible to be included into the POA?"

Under the POA requirements for EIA: The following are the documents required to be submitted by the CPA to the PME for consideration of inclusion into the POA

1. The old chillers have been scrapped and a letter from an approved (licensed) agent – general waste contractor: stating that non-toxic general waste such as all metal parts has been scrapped.

2. The refrigerant has been resold for use (or recycled) by the licensed agent – general waste contractor for chillers that use the same. This does not apply to R11 and R12 refigerants that cannot be re-used again.

3. Residuals Oils and Greases from the chillers are disposed off by a licensed industrial toxic waste contractor and not allowed to run off in common water drainage system and can be recycled where appropriate by the licensed agent.

Further – there are no significant trans-boundary environmental impacts of the POA since the CPA must adhere to the prescriptions listed above and also adheres to the Codes Of Practice provided for by the NEA (Host Party). This will be especially made so by the condition that no chillers or other equipment from the old chiller plants are re-sold or re-directed to other nations for re-use.

Does this CPA meet this requirement?

C.3. Please state whether an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA), in accordance with the host Party laws/regulations:

An Environmental impact assessment is not required for any energy efficiency projects in replacing chiller plants specifically. However – as described above – each CPA must conform to the requirements stated in this POA and also to follow the requirement spelt out under the Codes of Practice stipulated by the NEA (Host Party).

Does the CPA meet this requirement?

SECTION D. Stakeholders' comments

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D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

☐ Please tick if this information is provided at the PoA level. In this case sections D.2. to D.4. need not be completed in this form.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>

D.3. Summary of the comments received:

>>

D.4. Report on how due account was taken of any comments received:

>>

Annex 1

CONTACT INFORMATION ON ENTITY/INDIVIDUAL RESPONSIBLE FOR THE SMALL-SCALE CPA

Organization:	
Street/P.O.Box:	
Building:	
City:	
State/Region:	
Postfix/ZIP:	
Country:	
Telephone:	
FAX:	
E-Mail:	
URL:	
Represented by:	
Title:	
Salutation:	
Last Name:	
Middle Name:	
First Name:	
Department:	
Mobile:	
Direct FAX:	
Direct tel:	
Personal E-Mail:	

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Annex 3

BASELINE INFORMATION

Annex 4

MONITORING INFORMATION

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