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:

Name of CPA – ID Number of CPA

Version Number

Date

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

General Description and Purpose of the CPA

The small-scale CDM Programme activity "Name of CPA – ID Number of CPA" (hereafter referred to as the CPA) is part of the PoA "ETA Solar Water Heater Programme in South Africa (hereafter referred to as the PoA). The CPA is a voluntary initiative implemented by ETA Energy (hereafter referred to as "ETA"), which is a subsidiary 100% owned by the Central Energy Fund (CEF).

The purpose of the CPA is the installation of solar water heaters (SWH) systems for hot water production in (residential households applications) in Name of Municipality. The SWHs replace existing (electric geysers and/or fossil fuel based water heating systems), which will be permanently disabled upon installation of the SWH.

Reduction of greenhouse gas emissions by CPA
xxx SWH systems are to be included in the CPA.

For SWH replacing electric geysers:
By replacing electric geysers with SWH systems the CPA is expected to save xxx GWh of electricity per year on average over 10 years. The displaced electricity would have been sourced from the national power grid and transmitted over long distances from centralised power stations. These utilize a mix of primary energy sources that are predominantly fossil fuel-based. As a result, the CPA is expected to reduce CO_2 emissions by an average of approx. xxx t CO_2 per year.

For SWH replacing fossil fuel-based water heating systems
By replacing fossil fuel-based water heating systems the CPA is expected to save xxx tonnes and/or m^2 of fossil fuels per year on average over 10 years. As a result, the CPA is expected to reduce CO_2 emissions by an average of approx. xxx t CO_2 per year.

Contribution to the sustainable development of the host country (South Africa)

The Department of Energy of the Republic of South Africa has developed sustainable development criteria[3] in order to evaluate the social, economic and environmental impact of projects. The CPA fulfils these criteria and contributes to sustainable development of South Africa in the following ways:

Socio-Economical benefits

The South African government is promoting energy conservation as well as expanding the electricity supply capacity in order to support the rapid development of the economy. The proposed CPA reduces the electricity loads caused by residential water heating during times of peak demand and helps to secure the electricity supply required for the country's continued economic growth[4].

The CPA creates jobs in the SWH sector, with training provided for technicians to install and maintain the SWH systems. The programme's direct contribution to employment will be through the creation of administration and monitoring jobs to ensure the efficient operation of the programme activity, which also contributes to poverty alleviation.

Environmental benefits

The CPA reduces the amount of greenhouse gases (GHGs) produced by fossil fuel combustion. Through promotional activities in the mass media such as television and newspaper advertisements to enhance the use of SWH systems, ETA will communicate the economic and environmental benefits of SWH systems. This publicity will raise awareness of environmental concerns in renewable energy and energy conservation among the public.

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

CPA Implementer

The entity responsible for the proposed CPA is ETA. ETA is also the coordinating and managing entity of the PoA, as indicated in the PoA-DD. ETA is a 100% subsidiary owned by the Central Energy Fund (CEF).

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

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

Name of CPA – ID Number of CPA. The identifying number of the CPA within the PoA is ID Number of CPA.

[3] Sustainable development criteria for approval of clean development mechanism projects by the designated national authority of the CDM, 2004, Department of mineral and energy, p. 3, available under: http://www.dme.gov.za/dna/pdfs/sustainable_criteria.pdf

[4] http://www.eskom.co.za/annreport09/

A.4.1.1. Host Party:

The Republic of South Africa

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

The geographical boundary of the CPA is the Name of Municipality.

Figure 1: Map of South Africa

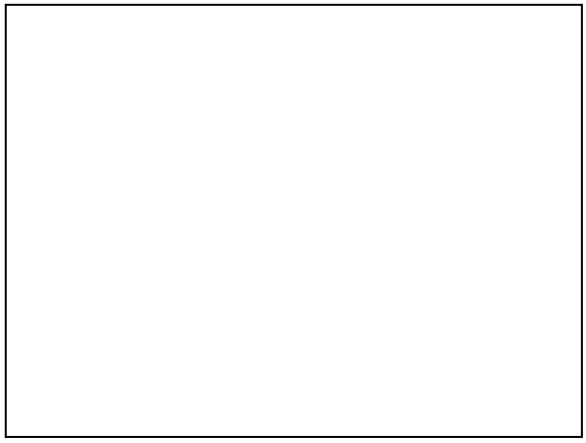

Figure 2: Map of Name of Municipality

The geographic boundaries for Name of Municipality are as follows:

- Northern Boundary GPS coordinates of Municipality
- Eastern Boundary GPS coordinates of Municipality
- Western Boundary GPS coordinates of Municipality
- Southern Boundary GPS coordinates of Municipality

The location of each customer participating in the CPA is uniquely identified in the central database of the PoA by the following information:

1 Street address
2 Electricity account number

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

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

Starting Date of the CPA. Justification of the starting date.

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

15 Years. The operational lifetime of SWHs is generally in excess of 10 years, typically between 15 to 30 years[5].

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

Fixed crediting period

A.4.3.1. Starting date of the crediting period:

Starting date of the crediting period. Justification of the starting date.

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

10 years

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

year	Annual estimation of emission reductions in tonnes of CO_2e
2012	
2013	
2014	
2015	
2016	
2017	
2018	
2019	
2020	
2021	
Total estimated reductions (tonnes CO_2 e)	
Total number of crediting years	10
Annual average of the estimated reductions over the crediting period	

[5] Solar Direct Website 2 May 2010: http://www.solardirect.com/swh/swh.htm

A.4.5. public funding of the CPA:

The proposed CPA will not receive any public funding from Parties included in Annex I of the UNFCCC.

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

In accordance with paragraph 10 of the "Guidelines on assessment of debundling for SSC project activities (version 03)"[6], the CPA is exempted from performing a debundling check. Each of the independent subsystems/measures installed as part of the CPA, i.e. the individual residential SWH systems is no greater than 1% of the small scale thresholds defined by the methodology. AMS I.J. refers to §4(d) of the "General Guidelines to SSC CDM methodologies, i.e. a threshold of 64,000 m^2 of aperture area of the solar collectors. 1% of the threshold is 640m^2, which far exceeds the typical collector areas for residential SWH. The collector area for a typical SWH installed as part of the CPA is expected to be xxx m2.

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

ETA confirms that the CPA is not registered as an individual CDM project activity or a part thereof. The CPA is also not a part of any other registered PoA.

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:

ETA Solar Water Heater Programme in South Africa

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

The CPA meets all the eligibility criteria for inclusion of a SSC CPA in the PoA as listed in section A.4.2.2. of the PoA-DD.

No:	Criteria	Justification
1.	Only CPAs whose purpose is the installation of residential SWH for hot water production are eligible to be included in the PoA.	The purpose of the CPA is the installation of residential SWHs for hot water production.

[6] http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid17.pdf

2.	A CPA shall demonstrate that the SWH systems displace electricity or fossil fuel that would otherwise have been used to produce hot water. It is sufficient to demonstrate that each SWH replaces an existing electric or fossil fuel-based water heating system. This can be done by demonstrating that an existing electric or fossil fuel-based system has been permanently disabled.	Each SWH in the CPA replaces an existing electric geyser and/or fossil fuel-based water heating system. Electric geysers and/or fossil fuel-based water heating systems are permanently disabled on site by the installer. Records of the disabling are included in the Installation Protocol. Copies of the Installation Protocols are archived by ETA as part of the PoA's database.
3.	Only CPA that do not exceed the small-scale threshold for SWH projects of 64000 m^2 in aperture area are eligible for inclusion in the PoA.	The total aperture area of the SWH systems installed under the CPA is below 64,000 m^2.
4.	For each CPA it shall be demonstrated that the energy savings are based on the hot water consumption as defined in paragraph 5 of AMS I.J. For CPAs that use the stipulated energy savings method it is sufficient to demonstrate that the average energy demand exceeds the stipulated energy savings of 450 kWh / year per m^2, as per section 10 (c) (iv) of AMS I.J.	For residential applications: At the time of installation the installer records the number of people in the household. Average daily consumption of hot water is 50 l (at 65°C) per person and day. The energy demand for each household is calculated and compared with the stipulated energy supply from the SWH. For SWH with a demand that does not meet the stipulated energy supply a corrected collector area ($A_{i,\ demand}$) is calculated and used in the emission reduction calculation in order to ensure conservativeness. Please see section B.5.2 for the equations used.
5.	For each CPA energy savings are determined by one of the methods listed in §10 of AMS I.J.: Model-based method / System metering method / Stipulated energy savings method	In section B.5 emission reductions are calculated with the Model-based method / System metering method / Stipulated Energy Savings /method.
6.	For each CPA, it has to be demonstrated that the applicability conditions of the chosen method (See 5.) to calculate energy savings are fulfilled.	At time of installation the installer records that the building where the SWH is installed is a residential building. The installer also records whether the building is the primary residence of the household. The Installation Protocols are archived by ETA; For CPAs that use the Stipulated Energy Savings method:

		(i) Individual solar collector area per system is less than or equal to eight square meters per residential unit. In case the actual area is higher than 8 square meters, than the value of 8 square meters will be used in the emission reduction calculation in order to ensure conservativeness of the emission reduction estimates. At the time of installation the installer records the solar collector area. The records are kept by ETA; (ii) The tilt and orientation of the solar collectors included in the CPA are within +/- 45 degrees of due-equator and a tilt +15 to -25 degrees of latitude. Any SWH systems outside the ranges are excluded from the emission reduction calculation. At the time of installation the installer records the tilt and orientation of the SWH systems. The records are kept by ETA; (iii) SWH included in the CPA have thermal storage volume (preheat tank volume) of at least 50 litres per square meter of collector area. For SWH systems with smaller tank sizes, an adjusted collector area is used in order to be conservative. The adjusted collector area is calculated as tank size (l) divided by 50 l/m^2. Please see section B.5.2 for the equations used. At the time of installation the installer records the tank size and solar collector area. The records are kept by ETA; (iv) At the time of installation the installer records the number of people in the household. Average daily consumption of hot water is 50 l (at 65°C) per person and day. The energy demand for each household is calculated and compared with the stipulated energy supply from the SWH. For SWH with a demand that does not meet the stipulated energy supply a corrected collector area ($A_{i,\ demand}$) is calculated and used in the emission reduction calculation in order to ensure conservativeness. Please see section B.5.2 for the equations used. (v) SWH included in the CPA do not suffer from

		shading of the solar collectors between 10 am to 2 pm on the shortest day of the year at the time of installation. At the time of installation the installer assesses the situation and takes a photo to document that no shading takes place. The records are kept by ETA (vi) All types of SWH systems included in the CPA have been tested by the South African Bureau of Standards. According to the test reports they meet the following conditions: • Unglazed collector must be stabilized against UV degradation; • Glazed collector must have at least one glass cover and be insulated on the sides and back to achieve a loss coefficient not more than 5 W/m^2C; • Evacuated tube collector must maintain vacuum insulation between absorber and ambient. For CPAs that do not use the Stipulated Energy Savings method: Justification that the eligibility criterion is met.
7.	For each CPA monitoring is done according to paragraphs 13 and 14 of AMS I.J.	In section B.6 the monitoring plan is completed in accordance with paragraphs 13 and 14 of AMS I.J.
8.	For each CPA it has to be demonstrated that it is neither being registered as a single CDM project outside the PoA nor being included in another registered PoA.	Yes. Confirmation from the coordinating entity is given in the section A.4.7
9.	For each CPA it has to be demonstrated that it is not a de-bundled component of a large-scale CDM project activity.	Yes. Confirmation from the coordinating entity is given in the section A.4.6.
10.	All installations in a CPA shall take place within the geographical boundaries of the Republic of South Africa.	Yes. The CPA is restricted to the Name of the Municipality, situated in the Republic of South Africa
11.	For all SWHs included in a CPA there must be a Customer Participation Agreement between the ETA and the owner of the SWH.	The existence of a Participating Customer Agreement between ETA and the participating household is recorded in the database. The agreements themselves are archived by ETA.

12.	Each CPA and each SWH in a CPA shall be uniquely identified by way of unique identifying numbers.	The CPA has received the ID number of the CPA. The SWH installed as part of the CPA will be numbered continuously (starting with 00001) according to the time of inclusion into the CPA.
13.	For each CPA included in the PoA additionality shall be demonstrated using one of the following guidelines and applicable tools approved by the CDM Executive Board. 1. "Guidelines on the Demonstration of Additionality of Small-Scale Project Activities, Version 09.0.[7] It needs to be shown that in the absence in the CPA, emission reductions would not occur due to the existence of barriers. If the barriers for the CPAs are identical to the barriers faced by the overall PoA as detailed in section A.4.3, it is sufficient to demonstrate that the barriers preventing the PoA are still in existence at the starting date of the CPA. Inasmuch as the penetration rate of SWHs in South Africa is relevant to demonstrate the existence of barriers, it should be distinguished between those SWHs that are installed with the benefit of carbon revenue from the CDM and those SWH that are installed without such revenue. Only SWH that are installed without carbon revenue should be counted as part of the penetration rate. 2. "Guidelines for Demonstrating Additionality of Micro-scale Project Activities", Version 04.[8] In particular it needs to be demonstrated that (a) the installed capacity of the SWHs in the CPA is less than 5 MW; (b) the CPA is designed for distributed energy generation (, i.e. the SWHs are not connected to a national or regional grid);	To be completed

[7] The document is available at http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid05.pdf.

[8] The document is available at http://cdm.unfccc.int/Reference/Guidclarif/ssc/methSSC_guid22.pdf.

	(c) Each of the SWHs in the CPA is smaller than or equal to 1500kW electrical installed capacity; (d) End users of the SWHs are residential households	

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

For CPAs that use the "Guidelines on the Demonstration of Additionality of Small-Scale Project Activities, Version 09.0" to demonstrate additionality.

The CPA uses the "Guidelines on the Demonstration of Additionality of Small-Scale Project Activities, Version 09.0" to demonstrate additionality. According to section 5.1 of the PoA-DD, it only needs to be demonstrated that the barriers that apply for the PoA continue to exist at the starting date of the CPA. Inasmuch as the penetration rate of SWHs in South Africa is relevant to demonstrate the existence of barriers, it should be distinguished between those SWHs that are installed with the benefit of carbon revenue from the CDM and those SWH that are installed without such revenue. Only SWH that are installed without carbon revenue should be counted as part of the penetration rate.

For CPAs that use the "Guidelines for demonstrating additionality of renewable energy projects =< 5 MW and energy efficiency projects with energy saving <=20 GWh per year". In particular it needs to be demonstrated that

(a) the installed capacity of the SWHs in the CPA is less than 5 MW;
(b) the CPA is designed for distributed energy generation (, i.e. the SWHs are not connected to a national or regional grid);
(c) Each of the SWHs in the CPA is smaller than or equal to 1500kW electrical installed capacity;
(d) End users of the SWHs are residential households

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.

According to AMS-I.J the CPA boundary is the the physical, geographical site of the SWH systems. The boundary also extends to the facilities consuming the heated water generated by the SWH systems.

For CPAs that use the Stipulated Energy Savings method:

The CPA uses the stipulated savings method. According to section E.3 of the PoA-DD, emission reductions are therefore calculated directly as per paragraph 10 (c) (i) and (ii) of AMS I.J. A detailed calculation of baseline and project emissions is not necessary.

For CPAs that do not use the Stipulated Energy Savings method:

Source	Source	Green-	Direct /	Included /	Justification / Explanation

No.		house Gas	Indirect	Excluded	
SB1	Electricity consumption at the existing water heating systems	CO_2	Indirect	Included	SWH systems included in the CPA replace existing water heating systems that would have consumed grid-based electricity in order to produce hot water.
SB2	Fossil fuel consumption at the existing water heating systems	CO_2	Direct	Included	The source should be included if the SWH systems included in the CPA replace existing water heating systems that would have consumed fossil fuels in order to produce hot water.
SP1	Electricity consumption by SWH systems	CO_2	Indirect	Included	SWH systems included in the CPA consume grid-based electricity for auxiliary equipment, such as pumps or back-up heaters.
SP2	Fossil fuel consumption by the SWH systems	CO_2	Direct	Included	The source should be included if SWH systems included in the CPA consume fossil fuels for auxiliary equipment.

Table 1: Baseline & Project Emission Sources

B.5. Emission reductions:

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

Data / Parameter:	TDL
Data unit:	%
Description:	Transmission and distribution loss
Source of data used:	Eskom Holdings Limited Integrated Report 2011, Customer Network Business, Distribution division p. 186 [downloaded from http://financialresults.co.za/2011/eskom_ar2011/ http://www.eskom.co.za/c/84/annual-report/ http://www.eskom.co.za/live/click.php?u=http%3A%2F%2Ffinancialresults.co.za%2F2011%2Feskom_ar2011%2Findex.php&o=Item%2B600&v=990da8
Value applied:	8.25%
Justification of the choice of data or description of measurement methods and procedures actually	The data is official data published by the national power utility Eskom.

applied :	
Any comment:	n/a

Data / Parameter:	**EF_{grid}**
Data unit:	tCO_2/MWh
Description:	Carbon emission factor for grid-based electricity
Source of data used:	Section E.6.1 of the PoA-DD.
Value applied:	0.9737 tCO_2e/MWh
Justification of the choice of data or description of measurement methods and procedures actually applied :	The factor has been calculated according to the "Tool to calculate the emission factor for an electricity system"
Any comment:	A supporting spreadsheet detailing the calculations has been made available to the verifier.

Data / Parameter:	**Q_{450}**
Data unit:	MJ / m^2 / day
Description:	Stipulated daily energy supply for SWH in households with hot water consumption demand year-round
Source of data used:	Calculated based on value of 450 kWh / m^2 per year in stipulated energy savings in AMS I.J
Value applied:	4.438
Justification of the choice of data or description of measurement methods and procedures actually applied :	According to AMS I.J stipulated energy savings are 450 kWh / m^2 per year. At a 100% efficiency factor for the baseline equipment the annual stipulated energy supply from the SWH is also 450 kWh per year or 4.438 MJ per day. The assumption of 100% efficiency is conservative since the stipulated energy supply would be lower at lower efficiencies. A lower stipulated energy supply would result in more cases where energy demand exceeds energy supply so that more SWH qualify for the CPA.
Any comment:	

Data / Parameter:	**V_d**
Data unit:	Liters
Description:	Daily hot water demand per person
Source of data used:	Josua P. Meyer. A review of domestic hot-water consumption in South Africa. R&D Journal, 2000, 16 (3), p.59.
Value applied:	59
Justification of the choice of data or description of	The value is for houses in medium-density communities, which are representative of the developed communities targeted by the PoA.

measurement methods and procedures actually applied :	
Any comment:	

Data / Parameter:	**T_h**
Data unit:	°C
Description:	Temperature of hot water that corresponds to daily hot water demand per person
Source of data used:	Meyer
Value applied:	65
Justification of the choice of data or description of measurement methods and procedures actually applied :	Josua P. Meyer. A review of domestic hot-water consumption in South Africa. R&D Journal, 2000, 16 (3), p.57.
Any comment:	

Data / Parameter:	**T_c**
Data unit:	°C
Description:	Temperature of cold water entering the SWH system
Source of data used:	Dr. Riaan Rankin & Dr. Martin van Eldik: An Investigation into the Energy Savings and Economic Viability of Heat Pump Water Heaters applied in the residential sector – A Comparison with Solar Water Heating Systems. Updated: Current Market Economics. M-Tech Industrial (Pty) Ltd / North-West University October 2010 (Original Article released in September 2008), page 5.
Value applied:	14°C
Justification of the choice of data or description of measurement methods and procedures actually applied :	
Any comment:	

For CPAs that do not use the Stipulated Energy Savings method:
Add additional parameters as required by the method.

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

Emission Reductions

According to paragraph 9 of AMS I.J "emission reductions are calculated as the energy savings that result from the project implementation multiplied by an emission factor for the electricity and/or fossil fuel displaced."

For CPAs that use the Stipulated Energy Savings method:
The emission factor for the displaced grid-based electricity is derived in Annex 3.
The electricity savings are calculated with the stipulated savings method detailed in paragraph 10(c) of AMS I.J.

$$ER_y = EF_y * ES_y / (1 - TDL) \quad (1)$$

Data/parameter	Description
ER_y	Emission reductions in year y (t CO_2)
EF_y	Carbon emission factor for grid-based electricity in year y (t CO_2 / MWh)
TDL	Transmission and distribution losses (%)
ES_y	Electricity savings in year y (MWh)

$$ES_y = P_{plan,y} * \sum_j f_{j,y} * [A_{j,corr} * (YRD_j * 450\ kWh + (1 - YRD_j) * 300\ kWh)] + P_{noplan,y} * \sum_k f_{k,y} * [A_{k,corr} * (YRD_k * 450\ kWh + (1 - YRD_k) * 300\ kWh)] \quad (2)$$

with

$$P_{plan,y} = \sum_m I_{m,y} \quad (2a)$$

$$P_{noplan,y} = \sum_l I_{l,y} \quad (2b)$$

Data/parameter	Description
ES_y	Electricity savings in year y (MWh)
$F_{i,y}$	Fraction of year y, during which SWH_i was operational
$A_{i,corr}$	Corrected collector area of SWH_i (m^2) in order to ensure conservativeness in line with the requirements of AMS I.J.
YRD_i	Confirmation whether SWH application has hot water consumption demand year-round. YRD takes the value 1 if there is year-round hot water consumption, for example whenever a residential building is the primary residence. YRD takes the value 0 if there is no year-round hot waterconsumption, for example if a residential building is a secondary residence or rented to tourists.
$P_{plan, y}$	Percentage of SWH systems operating and in compliance with manufacturer-required maintenance procedures among SWHs that are either maintenance-free or are under a maintenance plan during the monitoring period. The percentage is established via bi-annual inspection of a sample of SWHs as described in section

	B.6.1.
$P_{noplan, y}$	Percentage of SWH systems operating and in compliance with manufacturer-required maintenance procedures Percentage of SWHs that have successfully passed the bi-annual inspection among SWH that require maintenance and are not covered by a maintenance plan during the monitoring period. The percentage is established via bi-annual inspection of a sample of SWHs as described in section B.6.1.
$I_{m,y}$	Result of bi-annual inspection in year y. $I_{m,y}$ = 1 if the SWH m successfully passes the inspection. $I_{m,y}$ = 0 if the SWH m fails the inspection.
$I_{l,y}$	Result of bi-annual inspection in year y. $I_{l,y}$ = 1 if the SWH l successfully passes the inspection. $I_{l,y}$ = 0 if the SWH l fails the inspection.
j	j = 1,2,3,…n; for SWH installed in buildings that have substantial hot water consumption year-round
k	k = 1,2,3,…n; for SWH installed in buildings that do not have substantial hot water consumption year-round
m	m = 1,2,3,…M; where M is the sample size for SWHs that are either maintenance-free or are under a maintenance plan
l	L = 1,2,3 … L; where L is the sample size for SWHs that require maintenance and are not covered by a maintenance plan

The actual collector area Ai is corrected in order to ensure conservativeness in line with the requirements of AMS I.J., in particular applicability condition (iii) and (iv) on page 5 of the methodology:

Applicability condition (iii) requires that "Thermal storage volume (preheat tank volume) is either: (a) At least 50 litres per square meter of collector area; or (b) Adequate to bridge time gap between solar supply and load demand during an average winter day for a typical installation, as demonstrated by calculation or model." By setting a maximum for Ai,corr of TSi / (50l/m2) it is ensured that any SWH included in the database will always meet condition (a).

Applicability condition (iv) requires that "The sizing calculations of the SHW systems are documented to be such that the average annual, daily amount of water heated by the SWH systems is less than or equal to the average annual, daily hot water demand for a typical installation." By setting a maximum for Ai,corr of Ai,demand it is ensured that any SWH included in the database will always meet this condition. Ai,demand is calculated based on the number of people in the household, the average hot water consumption per person, the hot water temperature, the inlet water temperature, and the stipulated energy savings per m2 according to AMS I.J.[9]

$$A_{i,corr} = \min [A_i ; TS_i / (50l/m^2) ; A_{i,demand}] \quad (3)$$

Data/parameter	Description
$A_{i,corr}$	Corrected collector area of SWHi (m^2)
A_i	Actual collector area of SWHi (m^2)

[9] A supporting spreadsheet has been provided to the validation team in order to demonstrate how Ai,corr and Ai,demand will be calculated.

TS_i	Tank size of SWHi (liters)
$A_{i,demand}$	Collector area required to produce average annual hot water demand (m^2)
i	i = 1,2,3,…n; for SWH installed in buildings that have substantial hot water consumption year-round

$$A_{i,demand} = N_i * V_d * m * G * (T_h - T_c) / Q_{450} \quad (4)$$

Where

N_i	Number of people in household served by SWHi (unit-less)
V_d	Average annual hot water consumption per person (50 liters / day)
m	Mass of water (1.00 kg / liter)
G	Specific heat capacity of water (4.18 kJ / (°C * kg)
T_h	Temperature of hot water (65°C)
T_c	Temperature of cold inlet water (14°C)
Q_{450}	Stipulated energy supply for SWH in households with hot water consumption demand year-round (4.438 MJ / m^2/ day, equivalent to 450 kWh per year)

For CPAs that do not use the Stipulated Energy Savings method:
Calculation of energy savings and emission factors for displaced fossil fuels in accordance with paragraphs 9-11 of AMS I.J.

A supporting spreadsheet which details the calculation of emission reductions has been provided to the verifier.

Leakage

According to paragraph 12 of AMS I.J no leakage has to be considered. The project equipment is not transferred from another activity, and the baseline equipment is permanently destroyed upon installation of the SWH. The installer permanently disables the existing electric geyser and/or fossil fuel-based water heating system and disconnects the electricity and water supplies. The destruction process is recorded in the Installation Protocol by the installer at the time of installation. The records are kept by ETA.

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

For CPAs that use the Stipulated Energy Savings method:

The CPA uses the stipulated savings method. According to section E.3 of the PoA-DD, emission reductions are therefore calculated directly as per paragraph 10 (c) (i) and (ii) of AMS I.J. A detailed calculation of baseline and project emissions is not necessary.

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)
2012	Not applicable	Not applicable	0	
2013	Not applicable	Not applicable	0	
2014	Not applicable	Not applicable	0	
2015	Not applicable	Not applicable	0	
2016	Not applicable	Not applicable	0	
2017	Not applicable	Not applicable	0	
2018	Not applicable	Not applicable	0	
2019	Not applicable	Not applicable	0	
2020	Not applicable	Not applicable	0	
2021	Not applicable	Not applicable	0	
Total (tonnes of CO_2 e)	Not applicable	Not applicable	0	

For CPAs that do not use the Stipulated Energy Savings method:

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)
2012				
2013				
2014				
2015				
2016				
2017				
2018				
2019				
2020				
2021				
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:

Data to be monitored
The following data/parameters will be monitored throughout the crediting period of the CPA:

For CPAs that do not use the Stipulated Energy Savings method:

Data / Parameter:	**A_i**
Data unit:	m^2
Description:	Collector area of SWH_i, where i is the ID number of a particular SWH in the CPA
Source of data to be used:	Technical Specifications of each SWH type. The data is included in the sheet "SWH System Specs".
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3.41 m^2 (on average)
Description of measurement methods and procedures to be applied:	The installer enters the value into the installation protocol.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**$A_{i,corr}$**
Data unit:	m^2
Description:	Corrected collector area of SWH_i, where i is the ID number of a particular SWH in the CPA. The collector area is corrected in order to ensure conservativeness with regard to the applicability conditions (iii) and (iv) on page 5 of AMS I.J.
Source of data to be used:	Calculated based on equation (3).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	3.08 m^2 (on average). The number of SWHs where corrections are necessary is expected to be very small.
Description of measurement methods and procedures to be applied:	The calculation is based on the monitored values of A_i, TS_i and N_i, the latter indirectly via Ai,demand.
QA/QC procedures to	See tables for A_i, TS_i and N_i.

be applied:	
Any comment:	

Data / Parameter:	**$A_{i,demand}$**
Data unit:	m^2
Description:	Collector area of SWH_i that would be sufficient to provide the stipulated energy savings according to AMS I.J, where i is the ID number of a particular SWH in the CPA
Source of data to be used:	Calculated based on equation (4).
Value of data applied for the purpose of calculating expected emission reductions in section B.5	>3.41 m^2 (on average). The value is expected to regularly exceed the actual collector area.
Description of measurement methods and procedures to be applied:	The calculation is based on the monitored value for N_i, the number of people in the household.
QA/QC procedures to be applied:	See table for N_i.
Any comment:	

Data / Parameter:	**TS_i**
Data unit:	liters
Description:	Tank size of SWH_i, where i is the ID number of a particular SWH in the CPA
Source of data to be used:	Installation Protocol
Value of data applied for the purpose of calculating expected emission reductions in section B.5	251 liters (on average)
Description of measurement methods and procedures to be applied:	The installer enters the value into the installation protocol.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	**N_i**
Data unit:	Unit-less

Description:	Number of people in the household served by SWHi, where i is the ID number of a particular SWH in the CPA
Source of data to be used:	Eskom rebate Application Form
Value of data applied for the purpose of calculating expected emission reductions in section B.5	4 (on average)
Description of measurement methods and procedures to be applied:	The installer enters the value on the Eskom application form.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\mathbf{f_{i,y}}$
Data unit:	%
Description:	Fraction of the year y, for which SWH_i was operational
Source of data to be used:	The monitored emission reductions are calculated based on installation records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	For the ex-ante emission reduction calculation the following values are applied: 100%, if SWH is already installed at the beginning of year y 40%, if SWH is installed during year y The 40% reflects that SWHs that are installed during year y contribute energy savings only for a portion of the year. 50% could be used as a default given that it is unknown in advance at what time during the year the SWH will be installed. 40% has been chosen in order to ensure conservativeness.
Description of measurement methods and procedures to be applied:	The installer enters the date into the installation protocol.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\mathbf{AT_i}$
Data unit:	Success / Failure
Description:	Result of acceptance test
Source of data to be used:	Acceptance test protocol

Value of data applied for the purpose of calculating expected emission reductions in section B.5	For the emission reduction calculation it is assumed that 100% of the installed SWH will pass the acceptance test.
Description of measurement methods and procedures to be applied:	Acceptance test covers: • system operation per-design specifications • change-of-operating modes over a range of typical operating conditions SWH that do not pass the acceptance test are not included in the CPA
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\mathbf{I_{m,y}}$, $\mathbf{I_{l,y}}$
Data unit:	Dimensionless
Description:	Result of bi-annual inspection in year y
Source of data to be used:	Inspection records
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1, if the SWH successfully passes the inspection 0, if the SWH fails the inspection For the ex-ante emission reduction calculation it is assumed that 95% of the installed SWH pass the inspection.
Description of measurement methods and procedures to be applied:	The inspection covers the following items: • Check that system is in operation • Review of maintenance records. Compliance with manufacturer-required maintenance procedures.
QA/QC procedures to be applied:	
Any comment:	

Data / Parameter:	$\mathbf{P_{plan,y}}$
Data unit:	%
Description:	Probability that a SWH that is either maintenance-free or covered by a maintenance plan is operating and in compliance with manufacturer-required maintenance procedures
Source of data to be used:	Calculated based on results of biannual inspection
Value of data applied for the purpose of calculating expected emission reductions in	95%. The ex-ante emission reduction calculation is based on the fact that during the first six years all the SWHs are covered by a maintenance plan. Beyond the first six years it is assumed that 50% of the SWHs are maintenance-free. This is conservative since the most popular models are maintenance-free. The details of

section B.5	the calculation are included in the "Emission Reduction Calculation" spreadsheet.
Description of measurement methods and procedures to be applied:	Calculated based on equation (2a). • $P_{plan,y} = \sum_m I_{m,y}$
QA/QC procedures to be applied:	Not applicable
Any comment:	

Data / Parameter:	**$P_{noplan,y}$**
Data unit:	%
Description:	Probability that a SWH that requires maintenance and is not covered by a maintenance plan is operating and in compliance with manufacturer-required maintenance procedures
Source of data to be used:	Calculated based on results of biannual inspection
Value of data applied for the purpose of calculating expected emission reductions in section B.5	50%
Description of measurement methods and procedures to be applied:	Calculated based on equation (2b). • $P_{noplan,y} = \sum_l I_{l,y}$
QA/QC procedures to be applied:	Not applicable
Any comment:	

Data / Parameter:	**YRD_i**
Data unit:	No dimension
Description:	Confirmation whether the SWH application has hot water consumption demand year-round
Source of data to be used:	Customer Participation Agreement
Value of data applied for the purpose of calculating expected emission reductions in section B.5	1, if SWH application has year-round demand 0, if SWH application does not have year-round demand For the emission reduction calculation it is assumed that 99% of the installed SWH are in applications that have year-round hot water consumption demand.
Description of measurement methods and procedures to be applied:	The Customer Participation Agreement contains a clause whether the application is a primary residence. If so, then it is assumed to have year-round hot water consumption demand.
QA/QC procedures to	

be applied:	
Any comment:	

Monitoring procedure for a CPA

One-time monitoring at the time of installation
(1) Collector area
(2) Tank size
(3) Household size
(4) Type of existing water heating system
(5) Confirmation of permanent dismantling of the existing water heating system
(6) Confirmation that SWH has successfully passed SABS testing
(7) Confirmation that SWH is installed in a residential application
(8) Year-round hot water consumption demand or not
(9) Tilt and orientation of the SWH
(10) Confirmation that there is no shading on SWH

One-time monitoring at the time of the acceptance test
(6) Confirmation that acceptance test was successfully passed

Bi-annual inspection
(7) Confirmation that SWH was operational at the time of the inspection
(8) Confirmation that SWH complied with maintenance requirements

According to paragraph 14 of AMS I.J, not all of the SWHs have to undergo bi-annual inspection. Instead a sampling approach can be used to determine the percentage of systems operating and in compliance with manufacturer-required maintenance procedures. According to paragraph 15 of AMS I.J "when biennial inspection is chosen a 95% confidence interval and 5% margin of error shall be achieved for the sampling parameter. A common sampling plan is undertaken for the whole PoA, i.e. the populations of all CPAs are clubbed together, sample size is determined and a single survey is undertaken to collect data. This is justified because the PoA is homogeneous, i.e. has a high degree of standardization across CPAs. The same types of SWHs are installed across all CPAs and the same warranty and maintenance plans are offered. As a result the parameter of interest, the share of SWHs that remains operational and in compliance with the maintenance procedures, is not expected to change over the short or medium term.[10]

The statistical properties of the sample results are assumed to follow the characteristics of the binomial distribution.

The assumption of a binomial distribution is valid under the following conditions:
(a) an experiment is repeated a fixed number of times

[10] The conditions of the draft standard for sampling and surveys for CDM Project Activities and Programme of Activities (paragraphs 18-22) are met. See http://cdm.unfccc.int/public_inputs/2011/eb63_05/draft_standard_sampling.pdf

(b) each trial of the experiment has two possible outcomes
(c) the probability of success is the same for each trial
(d) the trials are statistically independent

The assumption is justified due to the following reasons:

(a) The experiment is whether a certain SWH passes the inspection. The experiment is repeated n times, where n is the sample size.
(b) There are two possible outcomes, either the SWH passes the inspection or it does not pass.
(c) Each SWH is covered by a 10-year warranty and a 6-year maintenance plan, unless a SWH type is completely maintenance-free. If a SWH fails to operate it will be repaired. The probability of a successful inspection is therefore likely to be very similar across SWH, with the exception of SWHs, which require maintenance and where the maintenance plan has expired after year 6.
(d) The ability of one SWH to operate is independent from other SWHs.

The needed sample size is determined by the required 95% confidence interval (α = 0,05) and the 5% margin of error (e = 0,05), where $e = | \theta - p |$ is the absolute value of the difference between the observed probability (p) in the sample and the true probability. The z-value for the 95% confidence interval is z = 1.96, according to the table for the binomial distribution.

The confidence interval depends on the probability of success (p) and is determined reliably by the Wilson Score Interval [11]

$$\{p + 1 / (2 * n) * z^2 \pm z * [(p * (1 - p)) / n + z^2 / (4 * n^2)]^{(1/2)}\} / (1 + (1 / n) * z^2)$$

Using this formula it can be determined whether a certain sample size (n) is sufficient depending on the observed probability of success (p) and the maximum error margin (e). The below sample sizes are sufficient, since they meet the condition that the margin of error (e) is below 5%:

$$\{p + 1 / (2 * n) * z^2 \pm z * [(p * (1 - p)) / n + z^2 / (4 * n^2)]^{(1/2)}\} / (1 + (1 / n) * z^2) - p < e, \text{ with } e = 5\%$$

P	0.5	0.2	0.1	0.05	0.02	0.01	0.005
N	400	300	200	150	125	100	100
e	4,88%	4,89%	4,94%	4,75%	4,24%	4,45%	4,11%

Table 5: Required sample size for different probabilities in the binomial distribution

At least 150 randomly chosen SWH will be monitored. If the sample size turns out not to be sufficient because the share of failed inspections exceeds 5%, then further random sampling will be done in steps of at least 50 SWH until the required sample size is reached.

[11] The Wilson Score Interval has better statistical properties than the Normal Approximation Interval. http://en.wikipedia.org/wiki/Binomial_proportion_confidence_interval. The excellent performance of the Wilson Score Interval method is also emphasized in a paper by Sean Wallis of the University College of London:

http://www.ucl.ac.uk/english-usage/staff/sean/resources/binomialpoisson.pdf

SWHs that are not either maintenance-free or covered by a free maintenance program will be sampled separately, since the failure rate (inability to demonstrate compliance with maintenance requirements) is expected to be higher. The sampling size for this group of SWH is 400, which is sufficient for any failure rate. As long as the numbers for such SWHs is small, PPs may choose not to conduct sampling on these SWHs and forego the related emission reductions.

All SWHs have to pass an acceptance test in order to receive their Certificate of Compliance. As a result no sampling is required during the first two years, i.e. year ___ and year ___. The values for $P_{plan,\_\_}$, $P_{plan,\_\_}$, $P_{noplan,\_\_}$, $P_{noplan,\_\_}$ are 1. The first sampling will take place in year _____, and the obtained percentage will be applied to years _____ and _____. The second sampling will take place in year _____, and the obtained percentage will be applied to years _____ and _____ and so on. This is in accordance with paragraph 14 of AMS I.J.

For CPAs that do not use the Stipulated Energy Savings method:
(1) Monitoring Plan that helps to demonstrate that all applicable requirements in paragraph 10 of AMS I.J are met.
(2) Monitoring Plan according to paragraphs 13-19 of AMS I.J.

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:

☒ 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:

Not applicable, environmental analysis is undertaken at the PoA-level.

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:

Not applicable, environmental analysis is undertaken at the PoA-level.

SECTION D. Stakeholders' comments

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:

Description of stakeholder consultation process for CPA.

D.3. Summary of the comments received:

Summary of comments received for CPA.

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

Report on how comments for CPA were addressed.

Annex 1

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

NMBM ETA

Organization:	ETA Energy (Pty) Ltd.
Street/P.O.Box:	125 Ann Crescent, Strathavon, Sandton
Building:	CEF House, Block C, Upper Grayston Office Complex
City:	Johannesburg
State/Region:	Gauteng
Postfix/ZIP:	2146
Country:	Republic of South Africa
Telephone:	+27 10 201 4700
FAX:	
E-Mail:	
URL:	www.cefgroup.co.za
Represented by:	
Title:	Mr.
Salutation:	
Last Name:	Shabalala
Middle Name:	
First Name:	Jabulani
Department:	ETA Energy
Mobile:	
Direct FAX:	
Direct tel:	+2710 201 4726
Personal E-Mail:	jabulanis@cefgroup.co.za

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

The proposed CPA will not receive any public funding from Parties included in Annex I of the UNFCCC.

Annex 3

BASELINE INFORMATION

Please see section E.1 to E.4 of the PoA-DD.

The supporting spreadsheet where the carbon emission factor for grid-based electricity is calculated has been provided as a separate document to the verifier.

Annex 4

MONITORING INFORMATION

Please see section B.6

Annex 5

LOCAL STAKEHOLDER CONSULTATION

Copies of Newspaper Announcements of Local Stakeholder Consultation meetings.

- - - - -