COMPONENT PROJECT DESIGN DOCUMENT FORM FOR SMALL-SCALE COMPONENT PROJECT ACTIVITIES (F-CDM-SSC-CPA-DD) Version 02.0

COMPONENT PROJECT ACTIVITIES DESIGN DOCUMENT (CPA-DD)

SECTION A. General description of CPA

A.1. Title of the proposed or registered PoA

SASSA Low Pressure Solar Water Heater Programme
Version Number: 4
Date: 20/12/2013

A.2. Title of the CPA

SASSA Low Pressure Solar Water Heater Programme – CPA-004

A.3. Description of the CPA

The proposed small-scale CDM Programme Activity (hereafter referred as CPA) consists of a group of SWHs under the SASSA Low Pressure Solar Water Heater Programme (hereafter referred as PoA) within the boundaries of South Africa. The CPA will install low pressure vacuum tube SWHs that have been approved by the South African Bureau of Standards (SABS). The size of the SWH may vary, but will most likely be 110-litre storage tank SWHs, in which case a CPA will include 31 500 SWHs.

The proposed CPA is a voluntary initiative taken by the coordinating and managing entity of the PoA, Solar Academy of Sub Saharan Africa (Pty) Ltd (hereafter referred to SASSA).

There are no mandatory laws that require either the installation of SWHs or replacement of electric water heaters. Warm water service is not installed as a component of low cost housing delivery in South Africa. The National Housing Code determines the minimum requirement to be a metered single standpipe[1]. Therefore, CPA-004 is a voluntary action of the CPA implementer, SASSA.

The installation will take place in low income households and will most likely replace electric kettles or electric and paraffin stoves and hence displace carbon intensive fossil fuels currently used for water heating. The CPA implementer, SASSA, will provide the SWHs free of charge for the households, with the condition that the resident cedes all rights to subsidies and carbon to the managing entity.

The proposed SSC CPA is expected to reduce 415 049 tCO_2 over the selected ten years crediting period.

The project fulfils the national sustainable development criteria determined by the Department of Minerals and Energy of South Africa and contributes to sustainable development as follows[2]:

[1] The Department of Human Settlements 2009, The National Housing Code – Technical and General Guidelines.
[2] 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

Economic Dimension

Load shedding is one of the major problems in South Africa. Current electricity supply is not enough to meet projected future demand and it is hindering the fast growing economy of the country. The proposed CPA will reduce electric water heating loads and help South Africa to correct the energy mix, with a greater focus on renewable energy. Further the project will create local job opportunities during the installation period as well as maintenance of the SWHs. It is estimated that a minimum of 40 employees are needed for installation and maintenance work of this CPA.

Environmental dimension

The program will contribute towards a sustainable low carbon economy by making use of renewable energy and reducing electricity consumption and thereby reduces the amount of greenhouse gases (GHGs) produced by fossil fuel combustion at the national electricity grid.

Social dimension

Through the programme, jobs will be created in the solar sector, with training provided for technicians to install and maintain the SWH systems. Hence the project will lead to skills and know-how development. Further the CPA implementer, SASSA, will implement an Educational Program in the target communities to increase awareness of the residents and understanding of climate change, energy efficiency and SWH. Further a community based business programme will offer training on SWHs, installation, maintenance and replacement. This training programme will increase the local entrepreneurs understanding of the opportunities within the SWH business. The provision of solar water heaters free of charge will result in improved service delivery to residents and a major social upliftment.

A.4. Entity/individual responsible for CPA

Solar Academy of Sub Saharan Africa (Pty) Ltd

A.5. Technical description of the CPA

The SWHs installed under this CPA will typically be 110 litre storage tank low pressure SWHs with a collector area of 1.08 m^2 and will have maximum of 31 500 units.

Each CPA consists of SABS tested SWH systems, which converts solar radiation into thermal energy for the heating of water. The SWHs that will be installed under this CPA may either be manufactured locally by SASSA or manufactured internationally and imported to South Africa and distributed by SASSA.

All the major apparatus of the SWHs participating in the CPA shall comply with the SABS Standard Specification for SWH systems SANS 6211-1:2003, SANS 151-2009 and SANS 1307:2003[3] to ensure that the SWHs installed are able to withstand local climatic and water quality conditions. All SWH are installed by South African companies that have the necessary qualifications, experience and training for the installation of SWH. All SWHs installed under this programme will be low pressure vacuumed tube SWHs. The installation will not have an electric backup element.

[3] Please note that the SANS test numbers are subject to changes if revised.

The figure 1 below shows a typical low pressure vacuum tube collector SWH system. The technology of the small-scale project activity installed is Solar Water Heating (SWH) technology comprising:

1. solar collectors/absorbers (evacuated tube collectors);
2. insulated hot water storage tanks;
3. pipe work;
4. support structures.

The solar collector and storage water tank is connected together, water tank on the top and collector panel on the bottom (integral). It relies on the natural circulation of waters between the collector and the water tank. As water in the vacuum tubes is heated, it rises naturally into the tank, while cool water in the tank flows down to the bottom of the vacuum tubes, causing circulation throughout the system. It is a simple and safe solution to heat water with energy from the sun.

Figure 1. Low pressure vacuum tube collector SWH system

Worldwide SWH technology is well-established in terms of technological development. Standard specifications have been available since 1980, to support the wider adoption of the technology. In countries where SWH systems have been installed, they have been shown to have effective operating lifetimes in excess of ten years. There is a small local, South African, production capacity which serves the small existing market mainly in high income household. By the end of 2009 less than 5 000 SWH has been installed in South Africa under the Eskom programme[4]. This capacity can be scaled up significantly to supply a bigger market.

The project activity will stimulate the increase in local content (manufacture, supply, installation and maintenance) of solar water heating systems. The technology requires re-skilling and training of employees as well as plumbers and installation contractors to supply, install and maintain the technology.

[4] Eskom Distribution 2010, Solar Water Heating Programme, Monthly Status Report March 2010

A.6. Party(ies)

Name of Party involved (host) indicates a host Party)	Private and/or public entity(ies) CPA implementer(s) (as applicable)	Indicate if the Party involved wishes to be considered as CPA implementer (Yes/No)
Republic of South Africa (host)	Solar Academy of Sub Saharan Africa (Pty) Ltd	No
United Kingdom	Standard Bank Plc	No
United Kingdom	International Carbon Ltd	No
United Kingdom	Eneco Energy Trade B.V	No

A.7. Geographic reference or other means of identification

The physical boundary of CPA-004 is the SWHs in the individual households that have received a SWH under this PoA and have ceded all their subsidy and carbon rights to managing entity. The geographical boundary of CPA-004 is that of:

- Nelson Mandela Bay Metropolitan Municipality - Eastern Cape Province (symbol N)[5];
- City of Johannesburg Metropolitan Municipality and - Province of Gauteng (symbols J and EK);
- Moqhak[6] and Manganung[7] Municipalities - Free State Province (FSP) (symbols M and 20);
- eThekwini Metropolitan Municipality and KwaDukuza Local Municipality - KwaZulu Natal Province (symbol eT and 29);
- Dr Kenneth Kaunda District Municipality[8] - North West Province (symbol 40);
- Govan Mbek, Victor Khanye and Emakhazeni Municipalities - Mpumalanga Province (symbols 30 and 38)
- Elias Motsoaledi Municipality - Limpopo (symbol 47)
- Umsombomvu Local Municipality – Northern Cape (symbol 7)

in South Africa.

The CPA-004 consists of municipalities/provinces that have signed MoUs with the managing entity, or the negotiations are at an advanced stage. The Figure 2 maps show the provinces and districts in South Africa indicating the municipalities and provinces included within the geographical boundary of CPA-004. As the uptake is subject to household's willingness to take a SWH, the uptake in one of the areas can be poorer than in another, in which case the CPA may include lesser areas (municipalities and/or provinces). However the number of SWHs installed will remain the same 31 500 units. The future CPAs may also include installations in the above mentioned areas, if the demand is high enough.

[5] The number refers to the districts in the map below.
[6] Also referred as Kroonstad
[7] Also referred as Bloemfontein
[8] Cities of Potchefstroom and Klerksdorp

All installations within the CPA-004 can be uniquely identified by the combination of CPA number, serial number, , Street Address, and GPS coordinates.

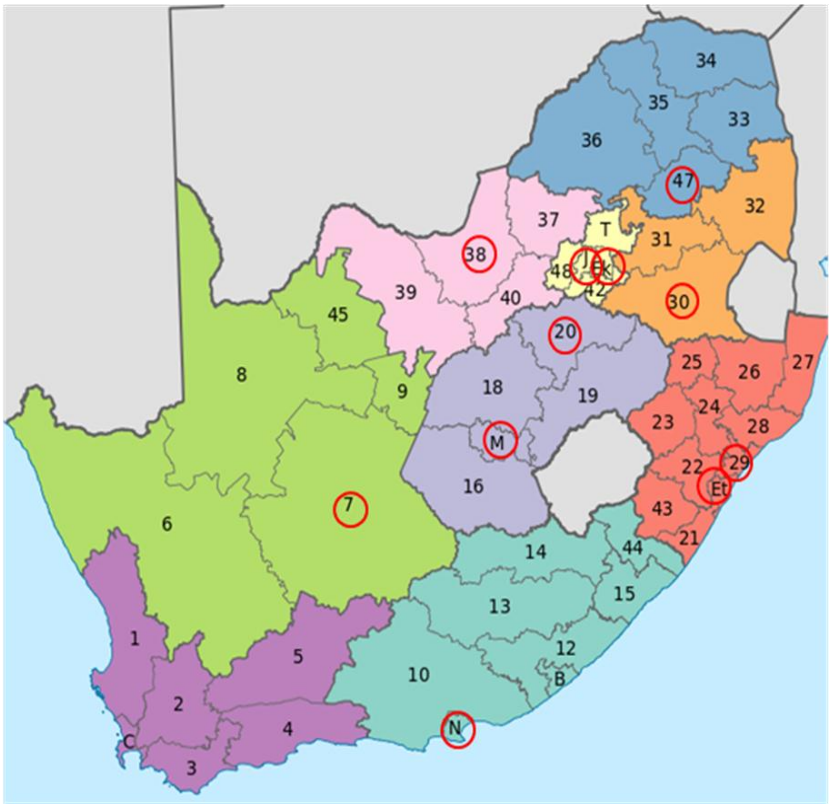

Figure 2. Geographical boundary of CPA-004

A.8. Duration of the CPA
A.8.1. Start date of the CPA

The starting date of the CPA-004 is 01/07/2013 which is the estimated date for the signing of the first residential agreement for the SWH installation and ceding of the carbon rights under the CPA-004.

A.8.2. Expected operational lifetime of the CPA

15 years

The lifetime of SWHs have proven to be in excess of 10 years, typically between 15 to 30 years.[9] SASSA will ensure training and maintenance of the SWHs with in a CPA for ten years.

A.9. Choice of the crediting period and related information

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

Fixed crediting period of ten years.

A.9.1. Start date of the crediting period

01/07/2013

The starting date of the crediting period is 01/07/2013, or the date of the PoA is registered and the CPA-004 is included into the registered PoA.

A.9.2. Length of the crediting period

1 July 2013 – 30 June 2023.

A.10. Estimated amount of GHG emission reductions

Emission reductions during the crediting period	
Years	**Annual GHG emission reductions (in tonnes of CO_2e) for each year**
2013 (1st July- 31st December)	11 850
2014	42 442
2015	42 442
2016	42 442
2017	42 442
2018	42 442
2019	42 442
2020	42 442
2021	42 442
2022	42 442
2023 (1st January – 30th June)	21 221
Total number of crediting years	**10**
Annual average GHG emission reductions over the crediting period	**41 504**
Total estimated reductions (tonnes of CO_2e)	**415 049**

A.11. Public funding of the CPA

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

A.12. Debundling of small-scale component project activities

In accordance with paragraph 9, Annex 32 "Guidelines on assessment of de-bundling for SSC project activities" of the EB 36, if each of the independent subsystems/measures (e.g. solar home system)

included in the CPA of a PoA is no greater than 1% of the small scale thresholds defined by the methodology applied, than the CPA or PoA is exempted from performing de-bundling check i.e. considered as not being a de-bundled component of a large scale activity.

The CPA-004 does not include systems that are not greater than 1 % of the 64 000 m^2 SSC limit i.e. typical installation is likely to be the 110-litre SWH, which has an absorber area of 1.08 m^2. The maximum collector area for SASSA SWHs is 1.8 m^2 (200 litre SWH), and the maximum collector area for 300 litre storage tank SWHs is 4 m^2 which is less than 0.007 % of the small scale threshold.

A.13. Confirmation for CPA

CPA-004 has not been registered as an individual CDM project activity. Prior to registering of the CPA, the coordinating entity has checked the CDM project database to ensure that the installation is not a part of another CPA under the PoA. As the coordinating entity SASSA is the CDM implementer, and the households included in the CPA and the PoA are uniquely identified and they cede the rights of the carbon to coordinating entity, it can be assured that the individual installations have not be registered as part of a another PoA.

SECTION B. Environmental analysis

B.1. Analysis of the environmental impacts

× Please tick if this information is provided at the PoA level: the environmental regulation and impacts have been analysed in the PoA level.

SECTION C. Local stakeholder comments

C.1. Solicitation of comments from local stakeholders

× Please tick if this information is provided at the PoA level: the environmental regulation and impacts have been analysed in the PoA level.

C.2. Summary of comments received

Not applicable.

C.3. Report on consideration of comments received

Not applicable.

SECTION D. Eligibility of CPA and Estimation of emissions reductions

D.1. Title and reference of the approved baseline and monitoring methodology(ies) selected:

The CPAs under this PoA will apply the small scale methodology AMS-I.C. “Thermal energy production with or without electricity”, version 17. With respect to AMS-I.C paragraph 17, the baseline for displacement of electricity shall be calculated as per the procedures detailed in AMS-I.D. AMS-I.D determines that the baseline emissions are the product of electrical energy baseline expressed in kWh

produced by the renewable generating unit multiplied by an emission factor, and gives the option to use the weighted average emissions of the current generation mix as emission factor.

D.2. Application of methodology(ies)

Baseline Emissions

AMS-I.D determines that the baseline emissions are the product of electrical energy baseline expressed in kWh produced by the renewable generating unit multiplied by an emission factor:

$BE_y = EG_{BL,y} * EF_{CO2}$

Where,

Symbol	***Description***	***Value Applied***
BE_y	= Baseline Emissions in year *y*, tCO_2e	41 504 (annual average)
$EG_{BL,y}$	= Energy baseline in year *y*, MWh	42 476 (annual average)
EF_{CO2}	= CO_2 Emission factor, tCO_2/MWh.	0.977

The Emission Factor is the weighted average emissions (in tCO2/MWh) of the current generation mix as determined in AMS.I.D and described in section E.4. and E.6.2 of the PoA-DD. The Energy Baseline is the energy output determined by SABS test[10], which has been calculated as follows:

$Q = \alpha_1 H + \alpha_2 (T_a - T_c) + \alpha_3$

Where,

Symbol	***Description***	***Value Applied***
Q	= Energy output in MJ SABS test	13.6
H	= The energy input i.e. irradiation in MJ per m^2 SABS test	16
ΔT_a	= The ambient air temperature ($\Delta T = T_a - T_{c)}$	10
α_1	= Specific coefficient determined in the SABS test	0.843
α_2	= Specific coefficient determined in the SABS test	0.115
α_3	= Specific coefficient determined in the SABS test	-1.067

The determination of $Q_{i,y}$ complies with the SANS 6211-1: 2003 test[11] for the solar absorption efficiency of a domestic solar water heating system.

[10] The SABS test results determine also the level of Eskom subsidy.
[11] South African National Standard as published by the South African Bureau of Standards (www.sabs.co.za)

Grid Factor

The grid emission factor is calculated according to the methodology AMS-I.D. version 16, in paragraph 12, option b. Please see PoA-DD as well as the revised calculation in the emission reduction sheet of the CPA-004-DD[12].

Project Emissions

According AMS.I.C the project emissions consist of CO_2 emissions from onsite fossil fuel consumption. As this PoA does not include an electric backup system, there are no emissions related to the project activity. The managing entity could not identify any other emission sources associated to the project implementation. Hence project emissions in year y is zero ($PE_y = 0$) under the CPA-004.

Leakage

According AMS.I.C. leakage shall be considered if the SWH is transferred from another activity, or the PoA includes replacement of existing equipment. As the PoA takes place in low income households that currently lack proper water heating equipment, and hence the SWH is rather seen as new installation opposite to replacement of an existing equipment (see section E.4 for suppressed demand justification). Leakage ($LE_{,y}$) is considered to be zero under this the CPA-004.

Emission Reductions

$ER_y = BE_y – PE_y - LE_y$

For more detailed information please see the appendix IIII (ER CPA-004).

D.3. Sources and GHGs

As defined in AMS.I.C, the project boundary is the physical, geographical site of the renewable energy generation including the residential facility consuming the thermal energy produced. Hence the boundary for the CPA-004 comprises the physical site of each SWH within the CPA as well as the South African grid system, as the SWH will replace grid electricity. The GHG reduced through the CPAs is CO^2. The reduction takes place through the avoidance of fossil fuels (predominantly coal) used in the production of electricity to heat water, in the absence of the CPAs.

D.4. Description of the baseline scenario

With respect to AMS-I.C Version 17 paragraph 17, the baseline for the displacement of electricity shall be calculated as per the procedures detailed in AMS-I.D. This further state that the baseline emissions are the product of electrical energy baseline expressed in kWh produced by the renewable generating unit multiplied by an emission factor and refers further to "Tool to calculate the emission factor for an electricity system", or the weighted average emissions of the current generation mix. In South Africa, the power plants are older than 10 years and the generation capacity from registered CDM projects that are

[12] The revised calculation based on the latest information available on the Eskom website: http://www.eskom.co.za/live/content.php?Item_ID=4226&Revision=en/3

providing power to the grid is insignificantly small. Hence, BM cannot be calculated according to the 'Tool to calculate the emission factor for an electricity system, version 02' and the option b is selected. The section E.6.2 shows the equations used to calculate the baseline.

South Africa has one of the most favourable conditions for harvesting the energy from the sun. Most areas in the country have more than 2 500 hours of sunshine per year, and the solar-radiation levels range between 4.5 and 6.5kWh/m^2 per day. Regardless of the favourable climate conditions and subsidy program (see section E.5.) only a few SWHs are in the market. The current total installed capacity in households is 330 000 m^2, which means that less than 3 % of the households in South Africa heats water with a SWH. The 3 % estimation is very conservative, as it is calculated with a 1 m^2 collector are, which is typical for 110 litre SWH. It is most likely that the installed SWHs are in high income households, which typically use 200-300 litre SWHs which have significantly bigger collector area (up to 4 m^2).[13,14]

In South Africa, hot water is predominantly heated by electric water heating systems. The domestic sector uses about 13 % from the total electricity consumption in the country and about 40 % of it is used for water heating. There are approximately 11 million households in the country of which the high and middle income households use electric geysers to heat water. More than 76 % of these income groups have an electric geyser. In the low income and poor segment households the penetration level of electric geysers is 21 %. In this income group there are over five million households that have an electricity connection, but cannot afford a geyser. These households heat up the water with kettles and stoves that use electricity or paraffin.[15,15]

Suppressed demand for energy services refers to a state where current levels of access to energy services, before any CDM intervention, are inadequate because of income or infrastructure constraints, thus not reflecting real demand for energy services by energy poor households. The paragraph 46 of the CDM Modalities and Procedures state that "the baseline may include a scenario where future anthropogenic emissions by sources are projected to rise above current levels, due to the specific circumstances of the host Party." Hence the baseline refers to a situation that would be occur, if suppressed demand did not exist.

This programme will install SWHs in the low income and poor segment households, which do not have a proper water heating system. These households heat water with electric or paraffin stoves, or electric kettles. The reason for this is that in poor communities households demand less service because they cannot afford to buy more i.e. the demand is suppressed due to income constrains or lack of access to funds. The warm water service is not installed as a component of low cost housing delivery in South Africa. The National Housing Code determines the minimum requirement to be a metered single standpipe[16].

As demonstrated above, in South Africa water is predominantly heated by electric water heating systems (medium and high income household). If the low income households could afford a prober water heating system, the most likely future scenario would be installation of an electric geyser. The suppressed demand and the increasing and preferred electricity use for water heating in low income housing can be confirmed from the following studies "NMBM Solar Water Heater Pilot Project - Social Contribution, 2009" and "Social Research Study for Kuyasa 2003". Hence the baseline for this programme is determined to be electric water heating.

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[13] O.D Dintchev 2004, Evaluation of Domestic Solar Water Heaters – Domestic Use of Energy Conference 2004.

[14] Department of Energy Website 1 May 2010: http://www.dme.gov.za/energy/renew_solar.stm.

[15] N. Magubabe 2009, Speaking Notes of the Acting Director-General of Department of Energy Ms Nelisiwe Magubabe, Johannesburg 5 November 2009.

[16] The Department of Human Settlements 2009, The National Housing Code – Technical and General Guidelines.

This programme will eliminate part, of the suppressed demand by decreasing the cost of energy services and thus increasing access to energy services whilst allowing energy poverty to decline in a carbon neutral way. During the 1999 election campaign the ANC promised to provide free electricity and water to the poorest households. Today the municipalities and metros in South Africa offer free water (six kiloliters per month) and electricity (50-75 kWh per month) for the formal housing/ registered customer. Hence the project will not lead to increased water bill. The table 2 presents the key parameters for the baseline determination.

Table 2. The salient project parameters[17].

Parameter	**Unit**	**Value**
Size	litre	110
SABS Test No	-	09S097 b
Energy Output per day (Q)	MJ	13.6
Energy Output per day (Q)	kWh	3.778
SABS test period	h	6
Power Rating of a SWH	kW	0.633889
Absorber Area	m^2	1.08

D.5. Demonstration of eligibility for a CPA

The SSC 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.

Eligibility criteria for inclusion of a SSC CPA-004 in the PoA

No	Criteria	Analysis
1	The CPA to be included in SWHs PoA shall meet the applicability requirements of the CDM methodology AMS.I.C- Thermal energy production with or without electricity, version 17.	Yes the CPA is solar water heating and hence fulfils the conditions of AMS.I.C.
2	The CPA to be included in SWHs PoA shall meet SSC additionality, leakage and debundling rules, relevant to PoAs.	Yes. Please see below, section D.6.3 and A.12.
3	All installations shall take place in residential buildings within the geographical boundaries of South Africa.	Yes. The installations will take place in residential buildings in NMBM, EMM, eTh, CoCT, NWP, and FSP.
4	All the SWH under the SSC-CPA are comply with all relevant SABS/SANS Standard Specification for SWH systems.	Yes, all installations will fulfil the relevant SABS and SANs requirements.
5	All SWH under the SSC-CPA are low pressure (also called as non pressurised) systems without an electric backup system.	Yes. All installations are low pressure system feed storage solar water heaters.
6	Each CPAs shall be uniquely identified and defined by way of the unique identifying numbers (series numbers) attached to each SWH to, ensure that all CPAs under its PoA are neither registered as an	Yes. From each installation serial number, GPS coordinates and address are recorded into the database.

[17] Please note that the size, SABS test number, and output may vary, if different SWHs/upgrades are applied. However, this will be indicated in the CPA-DDs, if relevant.

	individual CDM project activity nor included in another registered PoA .	
7	All households joining the programme shall cede the rights to the subsidy and carbon to SASSA.	Yes. This is a condition for joining the CPA. Each household shall sign a residence agreement, in which subsidy and carbon rights are ceded to SASSA in order to obtain the SWH.
8	All households joining the programme shall have electricity and water connection.	Yes. This is inspected and recorded in installation sheet. This is also a condition for Eskom subsidy.
9	All residences joining the programme shall have a proof of identity (ID).	Yes. A condition for joining. The ID is recorded in the installation sheet and database.
10	Each SSC-CPA must be approved by the coordinating entity and DOE prior to its incorporation into the PoA.	Yes.

SASSA is responsible for financing and implementation of CPA-004. Therefore, all the barriers to implementation of the SASSA Low Pressure Solar Water Heater Programme PoA, provided in detail in the PoA-DD, will also apply to CPA-004.

For the additionality of CPA-004, the "Guidelines for Demonstrating Additionality of Microscale Project Activities" is applied (previously referred to as "Guideline for demonstrating additionality of renewable energy projects = < 5 MW and energy efficiency projects with energy savings < =20GWH per year" (CDM EB 54, annex15)). According to these guidelines, renewable energy projects up to 5 MW are additional, if the independent subsystem/measure (e.g. SWH) in the project activity is smaller than or equal to 1 500 kW electrical installed capacity (previously referred to as 2 250 kW thermal installed capacity) and the end users of the subsystem or measure are households/communities/SMEs.

All installations under this programme take place in households. Furthermore the SWHs installed under this programme have an installed capacity of 0.1574 kW and the total installed capacity of the CPA-004 is below 5 MW:

Daily Energy Output	13.6	MJ
Seconds per Day	86 400	s
Capacity	0.1574	kW
No of SWH in CPA-004	31 500	-
Total capacity of CPA-004	4.96	MW

Please see also appendix I of the CPA-004-DD.

The CPA-004 fulfils the conditions of the paragraph 2 C of the "Guidelines for Demonstrating Additionality of Microscale Project Activities" and hence is additional.

D.6. Estimation of emission reductions
D.6.1. Explanation of methodological choices

The CPAs under this PoA will apply the small scale methodology AMS-I.C. "Thermal energy production with or without electricity", version 17. With respect to AMS-I.C paragraph 17, the baseline for displacement of electricity shall be calculated as per the procedures detailed in AMS-I.D. AMS-I.D determines that the baseline emissions are the product of electrical energy baseline expressed in kWh produced by the renewable generating unit multiplied by an emission factor, and gives the option to use

the weighted average emissions of the current generation mix as emission factor. The equations used to determine the emission reduction is discussed in D.6.3.

D.6.2. Data and parameters that are to be reported ex-ante

Data / Parameter	Q
Unit	TJ
Description	Daily solar energy output by the SWH i in the day
Source of data	SABS test results
Value(s) applied	13.6
Choice of data or Measurement methods and procedures	The solar water heater system analysis is based on SANS 6211-1:2003. The SABS test determines the energy output of the SWH. The SABS test result is used for ex-ante calculation. For ex-post calculation the SABS test is adjusted based on the real-time measurements.
Purpose of data	-
Additional comment	Note that the test result is adjusted only if lower values are measured.

Data / Parameter	$\mathbf{N_{estimate}}$
Unit	Units
Description	Estimated number of units installed under the CPA
Source of data	Project design
Value(s) applied	31 500
Choice of data or Measurement methods and procedures	-
Purpose of data	-
Additional comment	Note the number is the maximum number and subject to uptake.

D.6.3. Ex-ante calculation of emission reductions

Baseline Emissions

AMS-I.D determines that the baseline emissions are the product of electrical energy baseline expressed in kWh produced by the renewable generating unit multiplied by an emission factor:

$BE_y = EG_{BL,y} * EF_{CO2}$

Where,

Symbol	*Description*	*Value Applied*

BE_y	= Baseline Emissions in year *y*, tCO_2e	41 504 (annual average)
$EG_{BL,y}$	= Energy baseline in year *y*, MWh	42 476 (annual average)
EF_{CO2}	= CO_2 Emission factor, tCO_2/MWh.	0.977

The Emission Factor is the weighted average emissions (in tCO2/MWh) of the current generation mix as determined in AMS.I.D and described in section E.4. and E.6.2 of the PoA-DD. The Energy Baseline is the energy output determined by SABS test[18], which has been calculated as follows:

$$Q = \alpha_1 H + \alpha_2 (T_a - T_c) + \alpha_3$$

Where,

Symbol	*Description*	*Value Applied*
Q	= Energy output in MJ SABS test	13.6
H	= The energy input i.e. irradiation in MJ per m^2 SABS test	16
ΔT_a	= The ambient air temperature ($\Delta T = T_a - T_{c)}$	10
α_1	= Specific coefficient determined in the SABS test	0.843
α_2	= Specific coefficient determined in the SABS test	0.115
α_3	= Specific coefficient determined in the SABS test	-1.067

The determination of $Q_{i,y}$ complies with the SANS 6211-1: 2003 test[19] for the solar absorption efficiency of a domestic solar water heating system.

Grid Factor

The grid emission factor is calculated according to the methodology AMS-I.D. version 16, in paragraph 12, option b. Please see PoA-DD as well as the revised calculation in annex I of the CPA-004-DD[20].

Project Emissions

According AMS.I.C the project emissions consist of CO_2 emissions from onsite fossil fuel consumption. As this PoA does not include an electric backup system, there are no emissions related to the project activity. The managing entity could not identify any other emission sources associated to the project implementation. Hence project emissions in year y is zero ($PE_y = 0$) under the CPA-004.

Leakage

According AMS.I.C. leakage shall be considered if the SWH is transferred from another activity, or the PoA includes replacement of existing equipment. As the PoA takes place in low income households that currently lack proper water heating equipment, and hence the SWH is rather seen as new installation

[18] The SABS test results determine also the level of Eskom subsidy.
[19] South African National Standard as published by the South African Bureau of Standards (www.sabs.co.za)
[20] The revised calculation based on the latest information available on the Eskom website: http://www.eskom.co.za/live/content.php?Item_ID=4226&Revision=en/3

opposite to replacement of an existing equipment (see section E.4 for suppressed demand justification). Leakage ($LE_{,y}$) is considered to be zero under this the CPA-004.

Emission Reductions

$ER_y = BE_y – PE_y - LE_y$

For more detailed information please see the appendix IIII (ER CPA-004).

D.6.4. Summary of the ex-ante estimates of emission reduction

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
2013 (1st July-31st Dec)	0	11 850	0	11 850
2014	0	42 442	0	42 442
2015	0	42 442	0	42 442
2016	0	42 442	0	42 442
2017	0	42 442	0	42 442
2018	0	42 442	0	42 442
2019	0	42 442	0	42 442
2020	0	42 442	0	42 442
2021	0	42 442	0	42 442
2022	0	42 442	0	42 442
2023 (1st Jan – 30th June)	0	21 221	0	21 221
Total (tCO_2 e)	**0**	**415 049**	**0**	**415 049**
Total number of crediting years	**10**			
Annual average over the crediting period	**0**	**41 505**		**41 505**

D.7. Application of the monitoring methodology and description of the monitoring plan
D.7.1. Data and parameters to be monitored

Data / Parameter	N
Unit	-
Description	Number of SWH operating in the year
Source of data	Site visits: visual and technical checks, as well as failure reporting
Value(s) applied	100 %
Measurement methods and procedures	1 in 100 randomly selected sites will be inspected, the installation will be checked for data capture accuracy and if system functionality. The database will annually allocate the 1 in 100 sites for inspection by an automated random number generator, which will be set to never select the same site for inspection over the 10 year period. Therefore 10 percent of all the installations will be inspected over the 10 year monitoring period. Furthermore all reported failures will be recoded into the data capturing system.
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	-
Additional comments	100% applied for ex-ante. For ex-post will be reduced based on the results of the sample and reported failures.

Data / Parameter	Q,y
Unit	MWh
Description	Solar energy output by the SWH in the year *y*, MWh
Source of data	Calculation
Value(s) applied	-
Measurement methods and procedures	The calculation bases on the SABS test results, which is adjusted with the real-time measurement results.
Monitoring frequency	-
QA/QC procedures	Sample group (1/10 000) and confirmation of the applied irradiation and average temperature values with university / weather station data.
Purpose of data	-
Additional comments	=

Data / Parameter	H_{year}
Unit	MJ/m^2 or TJ/m^2
Description	Annual average irradiation
Source of data	Measured on-site
Value(s) applied	-
Measurement methods and procedures	One (1) in ten thousand (10,000) installations will be measured and monitored real time so as to perform comprehensive measurement and verification. The data at each of the metered sites is recorded every 5 minutes and integrated daily. Pyranometer is used to determine the solar irradiation.
Monitoring frequency	=
QA/QC procedures	The measured irradiation is cross-checked with irradiation figures from local universities and weather stations, if available. The equipment is calibrated according manufacturers recommendation.
Purpose of data	=
Additional comments	Used to adjust the energy output determined in the SABS test.

Data / Parameter	$Ta_{, year}$
Unit	Celsius or Kelvin
Description	The average annual ambient air temperature
Source of data	Measured on-site
Value(s) applied	-
Measurement methods and procedures	One (1) in ten thousand (10,000) installations will be measured and monitored real time so as to perform comprehensive measurement and verification. The data at each of the metered sites is recorded every 5 minutes and integrated daily. Each measured site will have one ambient temperature probe, which is measured with a transducer.
Monitoring frequency	=
QA/QC procedures	The measured temperature is cross-checked with irradiation figures from local universities or weather stations, if available. The equipment is calibrated according manufacturers recommendation.
Purpose of data	=
Additional comments	Used to adjust the energy output determined in the SABS test.

Data/Parameter	Tc_{year}
Unit	Celsius or Kelvin
Description	The average annual Cold Water Temperature
Source of data	Measured on-site
Value(s) applied	-
Measurement methods and procedures	One (1) in ten thousand (10,000) installations will be measured and monitored real time so as to perform comprehensive measurement and verification. Each measured site will have one ambient temperature probe, which is measured with transducers. The data at each of the metered sites is recorded every 5 minutes and integrated daily.
Monitoring frequency	=
QA/QC procedures	=
Purpose of data	=
Additional comments	Used to adjust the energy output determined in the SABS test.

Data / Parameter	V
Unit	Litres
Description	Volume of daily cold water flow
Source of data	Measured
Value(s) applied	-
Measurement methods and procedures	One (1) in ten thousand (10,000) installations will be measured and monitored real time so as to perform comprehensive measurement and verification of the amount of energy displaced. These SWHs are measured for irradiation, ambient air temperature, for water inlet and outlet temperature and water flow. Continuous measurement i.e. when water withdrawn by household.
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	-
Additional comments	The volume is used to calculate mass (m) of water

Data / Parameter	$Q_{on\text{-}site}$
Unit	MWh
Description	Solar energy output by the SWH in the year *y*, MWh
Source of data	Measured on-site
Value(s) applied	-
Measurement methods and procedures	One (1) in ten thousand (10,000) installations will be measured and monitored real time so as to perform comprehensive measurement and verification of the amount of energy displaced. These SWHs are measured for irradiation, ambient air temperature, for water inlet and outlet temperature and water flow. The data at each of the metered sites is recorded every 5 minutes and integrated daily.
Monitoring frequency	-
QA/QC procedures	-
Purpose of data	-
Additional comments	The measured SWHs are used to adjust the energy output determined in the SABS test.

Data / Parameter	EF_{grid}
Unit	tCO2e/MWh
Description	The emission factor for the electricity system.
Source of data	Calculated
Value(s) applied	0.977 tCO_2e/MWh (ex ante)
Measurement methods and procedures	As per AMS.I.D option b. Will be updated during each issuance.
Monitoring frequency	Annually
QA/QC procedures	-
Purpose of data	Calculation of Baseline Emissions
Additional comments	Please see Appendix 1 - Appendix IV Ex-ante Emission for CPA-004.

D.7.2. Description of the monitoring plan

As described in the PoA DD, and with respect of AMS-I.C, the monitoring of the CPA-004 will consist of the following:

1. Confirmation of operation of the systems, through a technical inspection (1 % of the sample) as well as recorded system failures (continues data capturing)
2. SABS test result
3. Real-time measurements: annual average solar radiation, annual average ambient temperature, inlet and outlet water temperature and water flow (1/10000 measurement group)

To confirm the number of operating systems 1 % of the installations in each CPA are sampled for functionality, as well as to check the data capture accuracy. The database will annually allocate the 1 in 100 sites for inspection by an automated random number generator, which will be set to never select the same site for inspection over the 10 years period. Therefore 10 percent of all the installations will be inspected over the 10 years monitoring period.

However, not all residents will be home during inspections and therefore, two criterions have been developed to mitigate time delays and to accommodate this social phenomenon, which is beyond the control of the project developer. These criteria included:

1. If access can be gained to the SWH unit, without breeching Health and Safety regulations or causing damage to property and the unit can be inspected without the home owner being present, then the unit shall be inspected according to the operationality checklist.

2. If the home owner is not home and there is no access to the unit and it cannot be inspected, the house in closest proximity (next door), to the random sample house where the home owner is present shall be inspected according to the operationality checklist. This incident would be indicated and declared on the operationality checklist to manage quality control

The results are used to adjust the ex-post emission reduction calculation (i.e. % of SWHs operational). Please see Annex 4 for more details on sample size.

1 of 10 000 SWHs are measured real-time for annual average solar radiation, annual average ambient temperature, inlet and outlet water temperature and water flow. This data is used to adjust the energy output determined in the SABS for the specific SWH (calibrated simulation approach). This is done in a way that each SWH is liked in the data base to the nearest measurement point (maximum distance 50 km). In case the measured daily energy output is less than 13.6 MJ (SABS test result), the daily energy output of all the SWHs linked to that specific measurement point are reduced accordingly. No adjustments are done if measurement results giver higher daily energy outputs. This is a conservative approach. The data at each of the metered sites is recorded every 5 minutes and integrated daily. At midnight every day, the simulation is executed on each household/SWH based on the daily measured values. As a cross check measure the measurement results are compared to measurements from universities or weather stations

The SASSA Monitoring and Verification Plan determines the detail measures for sampling and measurement, as well as calibration of the measurement equipment. The pyranometer, the ambient temperature probe and the cold-water temperature probe will at all times have a valid calibration certificate. The calibration expiry period will be programmed into the on-line database and monitoring system which will warn the relevant responsible person that the calibration expiry period is approaching. One month prior to the expiry period a new works order will be issued and the relevant instrumentation will be replaced with a calibrated unit and the removed item either recalibrated for future use or disposed of.

The managing entity SASSA will subcontract a specialised company for record keeping and maintaining of the data. The following data is recorded in the database for monitoring purposes from each CPA:

- Unique identification the SWH (series number);
- Installation date of the SWH system;
- System specifications including size, collector area and SABS test results;
- Number of systems operating based on the sample group;
- System problems: the reason for any system problems and dates when system stops operation and restarts operation;

- Real-time measurement results: daily solar irradiation, daily ambient air temperature, daily water flow and inlet and outlet temperatures (for sample group).

The database to be used is a SQL database that is hosted in a secure hosted environment. The information can be easily drawn from the database and utilized for reporting. Data will be archived for two years once the 10 year crediting period has lapsed. Relevant data capture, verification and storage procedures will be followed in maintaining the data to ensure its accuracy, validity and completeness. Please see section A.4.4.1 of the PoA-DD for more details on the data capturing.

International Carbon will assist the coordinating entity to produce a monitoring report for each monitoring period in order to verify the information related to the emission reductions contained in the CPA.

SECTION E. Approval and authorization

The Letters of Approvals and Authorizations have been received as follows:

South Africa: 11/11/2010
United Kingdom of Great Britain and Northern Ireland: 02/12/2010 and 19/01/2012

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Appendix 1: Contact information on entity/individual responsible for the CPA

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Appendix 2: Affirmation regarding public funding

No public funding will be used or required for this CPA

Appendix 3: Applicability of the selected methodology(ies)

n/a

Appendix 4: Further background information on ex ante calculation of emission reductions

n/a

Appendix 5: Further background information on monitoring plan

n/a

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History of the document

Version	Date	Nature of revision(s)
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the component project design document form for small-scale component project activities" (EB 66, Annex 17).
01	EB33, Annex44 27 July 2007	Initial adoption.
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