



---

# VERIFICATION / CERTIFICATION REPORT

---

## “SASSA LOW PRESSURE SOLAR WATER HEATER PROGRAMME” IN SOUTH AFRICA

(UNFCCC Registration Ref. No. 4302)

Monitoring Period:

REPORT No. 2013-9404

REVISION No. 03

1 January 2013 to 31 December 2013

DET NORSKE VERITAS



## MANAGING RISK

Verification/certification of project activity "SASSA Low Pressure Solar Water Heater Programme" in South Africa		DNV CLIMATE CHANGE SERVICES AS
For: Standard Bank Plc		Veritasveien 1 1322 Høvik, Norway
Account Ref.: Geoff Sinclair		Tel: +47 67 57 99 00 http://www.dnv.com
Date of Current Issue:	14 July 2014	ConCert Project No.: PRJC-495493-2013-CCS-ITA
Revision No.:	03	Organisation Unit: Climate Change Services
DNV Reg. No.:	NO 994 774 352 MVA	Report No.: 2013-9404
<p>Summary:</p> <p>DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions reported for the programme of activities "SASSA Low Pressure Solar Water Heater Programme" (UNFCCC Registration Ref. No. 4302) for the period 1 January 2013 to 31 December 2013. In our opinion, the GHG emission reductions reported for the programme in the monitoring report (version 04) of 28 March 2014 are fairly stated.</p> <p>The GHG emission reductions were calculated correctly on the basis of the approved monitoring methodology <i>AMS-I.C</i> (version 17) and the monitoring plan contained in the PoA Design Document version 05 of 22 May 2013.</p> <p>DNV Climate Change Services AS is able to certify that the emission reductions from the programmed activity "SASSA Low Pressure Solar Water Heater Programme" in South Africa during the period 1 January 2013 to 31 December 2013 amount to 50 194 tonnes of CO<sub>2</sub> equivalent.</p>		
Prepared by:	Verified by:	Approved by:
Francesca Feller	Felipe Lacerda Antunes	Michael Lehmann
<input checked="" type="checkbox"/> Unrestricted distribution (internal and external) <input type="checkbox"/> Unrestricted distribution within DNV <input type="checkbox"/> Limited distribution within DNV after 3 years <input type="checkbox"/> No distribution (confidential) <input type="checkbox"/> Secret		Keywords Climate Change Kyoto Protocol Validation Clean Development Mechanism
Rev. No.	Date	Reason for Issue
01	2 April 2014	First version of final verification/certification report
02	8 May 2014	Inclusion of PRC for CPA-003 and CPA-004
03	14 July 2014	Addition of references for in-person interviews
Reference to part of this report which may lead to misinterpretation is not permissible.		



## MANAGING RISK

<i><b>Table of Content</b></i>	<i><b>Page</b></i>
1 INTRODUCTION .....	1
1.1 Objective	1
1.2 Scope	1
1.3 Description of the project activity	1
1.4 Methodology for determining emission reductions	2
2 METHODOLOGY.....	3
2.1 Desk review	4
2.2 On-site assessment	4
2.3 Closing out of verification findings	7
3 VERIFICATION FINDINGS .....	9
3.1 Remaining issues, CARs, FARs from previous validation / verification	9
3.2 Post registration changes	9
3.3 Project implementation	9
3.4 Information (data and variables) provided in the monitoring report that is different from that stated in the PDD	11
3.5 Compliance of monitoring plan with monitoring methodology	11
3.6 Compliance of monitoring plan with monitoring methodology	12
3.7 Compliance of monitoring with the monitoring plan	12
3.8 Assessment of data and calculation of emission reductions	34
3.9 Quality of evidence to determine emission reductions	36
3.10 Management system and quality assurance	36
4 CERTIFICATION STATEMENT.....	37
5 REFERENCES.....	38
Appendix A Corrective action requests, clarification requests and forward action requests	
Appendix B Post registration changes	
Appendix C Curricula vitae of the verification team members	



## MANAGING RISK

### *Abbreviations*

CAR	Corrective Action Request
CDM	Clean Development Mechanism
CEF	Carbon Emission Factor
CER	Certified Emission Reduction(s)
CH <sub>4</sub>	Methane
CL	Clarification request
CO <sub>2</sub>	Carbon dioxide
CO <sub>2</sub> e	Carbon dioxide equivalent
CPA	Component project activity
CPA-DD	CDM component project activity design document
CRC	Cyclic Redundancy Check
DNV	Det Norske Veritas
DNA	Designated National Authority
FAR	Forward Action Request
GHG	Greenhouse gas(es)
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
GWP	Global Warming Potential
IPCC	Intergovernmental Panel on Climate Change
MP	Monitoring Plan
MoC	Modalities of communication
PCP	Project Cycle Procedure
PoA	Programme of Activities
PoA-DD	Programme of Activities Design Document
PS	Project Standard
SABS	South Africa Bureau of Standards
SANS	South Africa National Standards
SQL	Structured Query Language
SWH	Solar Water Heater
TCP/IP	Transmission Control Protocol/Internet Protocol
UNFCCC	United Nations Framework Convention on Climate Change
VVS	Validation and Verification Standard



## MANAGING RISK

# 1 INTRODUCTION

Standard Bank Plc has commissioned DNV Climate Change Services AS (DNV) to carry out the verification and certification of the emission reductions reported for the CDM programme of activities 4302 “SASSA Low Pressure Solar Water Heater Programme” in South Africa (the programme) for the period 1 January 2013 to 31 December 2013.

During the selected monitoring period, the CPAs with active crediting periods were CPA-001, CPA-002, CPA-003, and CPA-004. However, at the time the MR was published for the global stakeholder consultation, CPA-003 had no installations linked to monitoring sites, and CPA-004 had no installations at all. Therefore, emission reductions were only reported for CPA-001 and CPA-002 for the monitoring period 1 January 2013 to 31 December 2013, and the verification only extends to the emissions reductions attributable to CPA-001 and CPA-002.

This report contains the findings from the verification and a certification statement for the certified emission reductions.

## 1.1 Objective

Verification is the periodic independent review and *ex post* determination by a Designated Operational Entity (DOE) of the monitored reductions in GHG emissions that have occurred as a result of the registered CDM PoA during a defined monitoring period.

Certification is the written assurance by a DOE that, during a specific period in time, a PoA achieved the emission reductions as verified.

The objective of this verification was to verify and certify emission reductions reported for the “SASSA Low Pressure Solar Water Heater Programme” for the period 1 January 2013 to 31 December 2013.

## 1.2 Scope

The scope of the verification is to verify that:

- The PoA has been implemented and operated in accordance with the registered PoA-DD and CPA-DD or any approved revised PoA-DD and CPA-DDs;
- The monitoring plan complies with the monitoring methodology and the actual monitoring complies with the monitoring plan, including compliance with any guidance provided by the Board regarding deviations from the provisions of a registered monitoring plan and/or methodology;
- The data and calculation of GHG emission reductions have been assessed to correctly support the emission reductions being claimed.

The verification shall ensure that reported emission reductions are complete and accurate in order to be certified.

## 1.3 Description of the project activity

PoA Parties: South Africa (host), United Kingdom

Title of PoA:	SASSA Low Pressure Solar Water Heater Programme
UNFCCC registration No:	4302
UNFCCC registration date:	12 March 2011
Baseline and monitoring methodology	AMS-I.C (version 17)
Project Participants:	Solar Academy of Sub Saharan Africa (Pty) Ltd; Standard Bank Plc; International Carbon Ltd Ltd; Eneco Energy Trade B.V.
Location of the PoA:	Republic of South Africa
PoA's crediting period:	12 March 2011 to 11 March 2021
Period verified in this verification:	1 January 2013 to 31 December 2013

#### 1.4 Methodology for determining emission reductions

According to the applied methodology AMS-I.C, 17, the emission reductions for the PoA are determined as the difference between the baseline emissions, project emissions and leakage:

$$ER_y = BE_y - PE_y - LE_y$$

$PE_y$  and  $LE_y$  are considered as to be zero as stated in the registered PoA-DD, CPA-DD and validation report. Therefore, the emission reductions are accounted as:

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

where  $EF_{CO2}$  is the emission factor of the grid to which the installations that are part of the PoA are connected, and has been calculated following AMS-I.D. version 16 as the weighted average emissions (in tCO<sub>2</sub>/MWh) of the generation mix of the year in which the generation occurs.

$EG_{BL, y}$  is the energy baseline in year y, which is determined by SABS test as follows:

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

Where:

Q = Energy output in MJ

H = The energy input i.e. irradiation in MJ per m<sup>2</sup>

$T_a$  = The ambient air temperature and

$T_c$  = Incoming cold water temperature

$\alpha_1$  = H coefficient determined in the SABS test,

$\alpha_2$  = Delta T coefficients determined in the SABS test,

$\alpha_3$  = Intercept coefficients determined in the SABS test.



## MANAGING RISK

Both the baseline energy generation and the grid emission factor are monitored.

## 2 METHODOLOGY

DNV has assessed and determined that the implementation and operation of the PoA, and the steps taken to report emission reductions comply with the CDM criteria /61/ /62/ and relevant guidance provided by the Board.

The assessment involved a desk review of relevant documentation as well as an on-site visit(s).

The verification of the emission reductions has assessed all factors and issues that constitute the basis for emission reductions from the PoA. These include:

- i) Review of programme documentation /1//3//4//5//9//60/;
- ii) The energy baseline which is multiplied with a monitored grid emission factor of 0.9996 tCO<sub>2</sub>e/MWh /9/;
- iii) The actual installed capacity of the low pressure solar water heaters installed as part of the PoA to ensure the conformance with the descriptions in the registered PoA-DD and, CPA-DDs /10/.

### Verification team

Role	Last Name	First Name	Country	Type of involvement					
				Desk review	Site visit	Reporting	Supervision of work	Technical review	TA 1.2 competence
Team leader (Verifier)	Feller	Francesca	Italy	✓		✓			✓
Technical reviewer	Antunes	Felipe	Brazil					✓	✓

### Duration of verification

Monitoring report publication:	30 January 2014
Desk review:	31 January 2014 to 31 January 2014
On-site assessment:	17 February 2014 to 18 February 2014
Reporting, calculation checks and QA/QC:	18 February 2014 to 2 April 2014
Resubmission in response to issues raised in completeness check of UNFCCC	8 May 2014
Resubmission in response to issues raised in requests for review	14 July 2014



## MANAGING RISK

### 2.1 Desk review

In addition to the monitoring report /1/ (version 02 dated 28 January 2014 and version 04 dated 28 March 2014), DNV reviewed:

- The registered PoA-DD and CPA-DDs /3//4//5/;
- The validation report and previous verification reports /57//59//60/;
- The emission reduction calculation template for a generic CPA /6/;
- The emission reduction estimation for CPA-001 and CPA-002 /7//8/;
- The emission reduction calculations for the third monitoring period /2/;
- Baseline and monitoring methodology AMS-I.C, version 17 /65/;
- Baseline and monitoring methodology AMS-I.D version 16 /68/;
- The Programme's online database /9/.

The monitoring report, version 02 dated 28 January 2014, has been made publicly available on the CDM website. In addition to the monitoring report /1/ (version 02 dated 28 January 2014 and version 04 dated 28 March 2014), the verification has been performed based on the review of the following documentation provided by the project participants:

- The PoA-DD and CPA-DDs /3//4//5/, including the monitoring plan and the corresponding validation report /57/;
- The approved baseline and monitoring methodology AMS-I.C, 17 /65/ applied by the programme;
- Relevant decisions, clarifications and guidance from the CMP and the CDM Executive Board;
- Other information and references relevant to the PoA resulting emission reductions.

During the desk review, DNV has applied standard auditing techniques to assess the quality of information provided. The following activities were performed:

- A review of the data and information presented to verify their completeness;
- A review of the monitoring plan and monitoring methodology, paying particular attention to the frequency of measurements, the quality of metering equipment including calibration requirements, and the quality assurance and quality control procedures; and
- An evaluation of data management and the quality assurance and quality control system in the context of their influence on the generation and reporting of emission reductions.

### 2.2 On-site assessment

From 17 February 2014 to 18 February 2014 DNV performed an on-site assessment. The key personnel of the programme were interviewed or assisted the verification team.





## MANAGING RISK

During the on-site assessment, DNV has applied standard auditing techniques to assess the quality of information provided. The following aspects of the CDM programme of activities have been verified:

- The implementation and operation of the CDM PoA;
- The information flow for generating, aggregating and reporting of the monitoring parameters; and
- The operational and data collection procedures are implemented in accordance with the monitoring plan in the PoA-DD and CPA-DD.

Further, the following activities were performed:

- A cross-check between information provided in the monitoring report /1/ and data from other sources /9/ - /56/;
- A check of the monitoring equipment including calibration performance /11/ - /49/ and observations of monitoring practices against the requirements of the PoA-DD and CPA-DD and the selected methodology /65/;
- A review of calculations and assumptions made in determining the GHG data and emission reductions /2/; and
- A review of the quality control and quality assurance procedures in place to prevent or identify and correct any errors or omissions in the reported monitoring parameters.

The data presented in the monitoring report was assessed through a review of the detailed PoA documentation and production records, as well as by interviews with personnel at the CME and at the database management company, observation of collection of measurements, observation of established monitoring and reporting practices and assessment of the reliability of monitoring equipment.

Given the large amount of data to be verified, DNV adopted an acceptance sampling approach. The verification of the PP's sampling was based on the requirements of the Standard for Sampling and Surveys for CDM project activities and programme of activities /64/ and consisted in the following steps:

A sample of households was selected out of the PP's records. The sample was selected randomly from the PP's database so to comprise installations from different geographical areas within the boundaries of CPA-001 and CPA-002. The sample size was calculated to have a 10% chance to wrongly reject the PP's record and a 10% to wrongly accept the PP's record, considering a conservative acceptable quality level of 0.5% and unacceptable quality level of 10 %. According to the tables provided in the Standard for Sampling and Surveys, the resulting minimum sample size was 38 systems. In total, 54 systems were checked – since this number is higher than 38, the sample size was considered acceptable. In order to verify the full range of information relevant to the calculation of emissions reductions, DNV chose to apply the following methods of field/onsite checks to the selected sample:

- a. Check of database entries for the selected 54 households against documental evidence stored at the CME office in Johannesburg, South Africa: this method of verification allowed DNV to check the data that are relevant to the calculation of emissions reductions, as well as the PoA's management system. Information verified through this method included the number of systems installed, operational during the monitoring period, and linked to a monitoring site, information on solar irradiation, ambient air temperature and incoming water temperature recorded for the monitoring period,



## MANAGING RISK

installation and calibration of monitoring equipment, and all agreements and relevant documentation signed by the recipient family. For all selected households DNV verified the data contained in the ER calculation spreadsheet against the database.

- b. Check whether SWH had been received and installed by the CME for the selected 54 households whether they were functioning correctly, and whether there was any maintenance issue to report: This check was performed as a combination of household visits and telephone interviews with households. As each method has different strengths and weaknesses, these methods provided DNV with the information needed for the applied acceptance sampling approach.
  - i) Household visit (in person): this method of verification allowed DNV to observe the installed system in a limited geographical area, gather approximate information on when the system was installed from the residents (the memories of the residents, however, proved to be rather unreliable in this respect), and occasionally check if maintenance had been performed and whether relevant documentation had been received by the residents (in case the family had kept the documentation);
  - ii) Telephone interviews: this method of verification allowed DNV to check a purely random sample of households, covering the entire geographical scope of the PoA, and check whether a SWH had been received and installed by the CME, whether it was functioning correctly, and whether there was any maintenance issue to report;

DNV performed household visits to 11 households (installed in the Alexandra suburb of Johannesburg). DNV visited the household where the system had been installed, and performed in person interviews with users concerning the programme's management system (documents they filled out, response time in case of failures, etc.) /117/ to /126/.

For the remaining 43 households the accuracy of the information contained in the database was verified through telephone interviews (/74/ to /116/).

Moreover, it should also be noted that at the time of writing this report DNV has performed in total three field/onsite checks to verify emission reductions reported for this PoA:

Date	Calculated minimum sample size	Actual sample size	Field/onsite checks		
			Database checks	Household visit	Telephone interviews
22-24 Jan 2013	54	66	66	20	46
7-9 Aug 2013	54	109	109	35	74
17-18 Feb 2014	38	54	54	11	43
Total:			229	66	163

DNV checked the acceptability of the data for each record in the PPs sample record. Based on the sample size selected, the acceptability level was calculated to be 1 – meaning that the sample had to be rejected if 1 inconsistency with the PPs records was found.



## MANAGING RISK

For the samples selected by DNV during the three field/onsite checks performed, the database checks, household visits and telephone interviews found that the observed information was in agreement with the PPs records. Hence, DNV concluded that the PP's records are acceptable.

This has enabled the verification team to assess the accuracy and completeness of reported monitoring results; to verify the correct application of the approved monitoring methodology and the determination of the emission reductions.

In addition, all parameters required by the monitoring methodology AMS-I.C, version 17, and the management system were assessed during the site visit.

DNV performed an additional site visit in May 2014 and visited in person 103 households in the proximity of the cities of Johannesburg, Cape Town, Port Elizabeth, Durban and Kroonstad. The questions asked to residents were the same as those previously asked by phone. The sample of communities was selected considering proximity to airports and was limited to areas which were considered as safe for DNV staff to visit. However once suitable communities were selected, the individual households in these communities were selected randomly for interviews. Details of the additional households visited are listed in section 5 of this report. The additional site visit resulted in a total of 169 households visited, compared to a calculated sample of 146. The additional household visits confirmed the earlier reached conclusion that the solar water heaters had been received and installed, and that maintenance was being performed as described in the registered PoA-DD.

### 2.3 Closing out of verification findings

The objective of this phase of the verification was to resolve any issues which needed be clarified prior to DNV's conclusion that i) the programme has been implemented and operated in accordance with the registered PoA-DD and CPA-DD or any approved revised PoA-DD and CPA-DDs, ii) the monitoring plan complies with the monitoring methodology and the actual monitoring complies with the monitoring plan and iii) the data and calculation of GHG emission reductions are correct.

A corrective action request (CAR) is issued, where:

- i. Non-conformities with the monitoring plan or methodology are found in monitoring and reporting and has not been sufficiently documented by the project participants, or if the evidence provided to prove conformity is insufficient;
- ii. Modifications to the implementation, operation and monitoring of the registered PoA has not been sufficiently documented by the project participants;
- iii. Mistakes have been made in applying assumptions, data or calculations of emission reductions that will impact the quantity of emission reductions;
- iv. Issues identified in a FAR during validation/or previous verification to be verified during verification that have not been resolved by the project participants.

A clarification request (CL) shall be raised if information is insufficient or not clear enough to determine whether the applicable CDM requirements have been met.

A forward action request (FAR) is issued for actions if the monitoring and reporting require attention and/or adjustment for the next monitoring period.

The verification identified two CARs and three CLs, but no FARs. The CARs and CLs were satisfactorily addressed by the project participants by among other revising the monitoring report (please refer to Appendix A for further details). In addition to the changes made to the



## MANAGING RISK

monitoring report as a result of the verification findings, no further changes to the monitoring report (version 04 dated 28 March 2014) were made compared to the initial version of the monitoring report received for verification (version 02 dated 28 January 2014).



## MANAGING RISK

### 3 VERIFICATION FINDINGS

This section summarises the findings from the verification of the emission reductions reported for the “SASSA Low Pressure Solar Water Heater Programme” for the period 1 January 2013 to 31 December 2013.

#### 3.1 Remaining issues, CARs, FARs from previous validation / verification

The validation report /57/ recorded no FARs to be addressed during following verifications. The first and second verifications undertaken for this programme identified no FARs /59/.

#### 3.2 Post registration changes

The post registration changes described in Appendix B were identified by DNV during this verification. These post registration changes were assessed by DNV.

Some of the post registration changes requested do not require prior approval by the CDM EB in accordance with Appendix 1 to the CDM Project Standard. The assessment of the changes (in the form of a duly completed “Post-registration changes request form” (F-CDM-PRC and DNV’s assessment opinion on the changes) is submitted together with the revised CPA-DD for CPA-003 (version 04 of 20 December 2013) and CPA-004 (version 04 of 20 December 2013) for approval by the CDM EB as part of the request for issuance for this monitoring period.

Part of the post registration changes requested, i.e. permanent changes from the registered monitoring plan, require prior approval by the CDM EB in accordance with Appendix 1 to the CDM Project Standard. These permanent changes from the registered monitoring plan made to the PoA-DD obtained approval by the CDM EB on 13 October 2013 prior to the request for issuance of the first monitoring period. In order to update the registered CPA-DD for CPA-003 and CPA-004, an additional request for post-registration changes is submitted to the UNFCCC with this request for issuance in which the changes approved on 13 October 2013 were applied to the CPA-DDs for CPA-003 and CPA-004.

The assessment of compliance with the programme description and the monitoring plan contained in the PDD, as described in the following sections, is based on the revised PoA-DD and CPA-DD for CPA-001 (version 05 of 22 May 2013), and on the CPA-DD for CPA-003 (version 04 of 20 December 2013) and the CPA-DD for CPA-004 (version 04 of 20 December 2013).

#### 3.3 Project implementation

As part of the site visit DNV was able to confirm that the programme implementation is in accordance with the programme description contained in the revised PoA-DD /3/ and CPA-DD (CPA-001 version 05 of 22 May 2013 /4/, and CPA-002 version 04 of 20 December 2013/5/).

Programme component	Implementation in accordance with PDD	Description of how implementation was assessed by verification team
Installed SWH	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Check of database entries for the selected sample of 54 systems against documental evidence stored at the CME office in



## MANAGING RISK

Programme component	Implementation in accordance with PDD	Description of how implementation was assessed by verification team
		Johannesburg, South Africa Moreover, a sample of 169 systems were visited by DNV in person in the areas of Johannesburg, Cape Town, Port Elizabeth, Durban, and Kroonstad, and were found to be compliance with the description contained in the PoA and CPA-DDs. Moreover, 43 users nationwide were interviewed by phone to check whether their system was operational, and to check maintenance records /74/ - /126/. Lastly, one monitored site was visited in person /73/.
Monitoring equipment	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Calibration certificates for all monitoring equipment were checked, and found to be compliance with the description contained in the PoA and CPA-DDs /11/ - /31//37//44/ - /46/.
On-line database	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	The online database /9//70//71//72/ was accessed by DNV, who conducted random checks on the information recorded to test consistency between various programme documents. The database was found to be compliance with the description contained in the PoA and CPA-DDs.
Hard copies of documents related to the programme management system	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No	Maintenance records were checked by DNV against the database /9/. No inconsistencies were found.

The verification team confirmed through visual inspection and document review that all physical features of the proposed CDM programme of activities including data collection systems and storage systems have been implemented in accordance with the registered PoA and CPA-DDs. DNV confirmed during the on-site visit that both CPA-001 and CPA-002 are operational, while CPA-003 has completed the installation of 2 663 SWH which have however not yet been assigned to monitored sites, and that no installation have yet taken place under CPA-004. Since only 59 000 installations under CPA-001 and 24 495 installations under CPA-002 were active and linked to monitoring sites during the second monitoring period, the scope of this second verification consists of 83 495 systems.

The programme consists of the installation of low pressure solar water heaters on residential buildings throughout South Africa.

Installations under CPA-001 started on 1 July 2010, and continued until December 2011. Installations under CPA-002 started on 9 October 2010. CPA-001 was included on 12 March 2011, and therefore systems installed under this CPA can claim ER for the entire monitoring period. CPA-002 was included on 29 March 2012, and can also claim ER for the entire monitoring period. The selected monitoring period 1 January 2013 to 31 December 2013 is within the first crediting period of 12 March 2011 to 11 March 2021.

The programme implementation during the second monitoring period experienced delays





## MANAGING RISK

related to the installation under CPA-002 not being assigned to monitored sites in the database. The reasons for the delays are explained in section A.1 of the Monitoring Report.

### **3.4 Information (data and variables) provided in the monitoring report that is different from that stated in the PDD**

The equivalent energy baseline reported in this monitoring period is 50 216 MWh in the period from 1 January 2013 to 31 December 2013 (i.e. 365 days). In terms of comparing the estimated carbon reductions with the actual ones, it was estimated at the time of validation that the programme would have reduced carbon emissions by 163 854 tCO<sub>2</sub>, while in 2013 it only achieved 50 194 tCO<sub>2</sub>. The variation is deemed to be within a reasonable range due to the following reasons:

- i) Some monitored sites experience vandalism during the monitoring period, and were not in operation, resulting in households within a 50 km radius not being able to calculate and claim ER;
- ii) Ex-ante estimations were based on the daily thermal capacity of the SWH and as per SABS test results the highest water consumption the SWH is able to deliver (110 L), while the actual water consumption recorded was lower. Moreover, the thermal energy was accounted for only up to the SABS capacity (i.e. the heating capacity of the systems as per SABS tests was applied even if actual capacities were higher for some days);
- iii) Due to the sudden Eskom subsidy restrictions, the installation figures are less than initially predicted. SASSA is currently installing approximately 1,000 units per month which is 5,000 units less than its installation capacity.

The causes for the overall output being lower than estimated listed above were confirmed on site through interviews with staff /70//71//72/. As a result of lower electricity generation, actual emission reductions are lower than the emission reductions estimated in the CPA-DD.

### **3.5 Compliance of monitoring plan with monitoring methodology**

According to AMS-I.C (version 17) /65/ monitoring shall consists of:

- i) The number of systems operating; and
- ii) Estimating the annual hours of operation of the average system.

Operationality of systems has been addressed in the monitoring plan through a provision for visiting 1% of households to check whether the system is operational.

The number of operating hours in the case of solar water heaters is calculated based on the energy output  $EG_{BL,y}$  and the capacity of the SWH as per SABS tests:

$$h = EG_{BL,y} [kwh] / Q [kw]$$

The monitoring plan therefore complies with the provisions of the methodology.

DNV is able to confirm that the monitoring plan contained in the revised PoA and CPA-DDs (CPA-001 version 05 of 22 May 2013, and CPA-002 version 04 of 20 December 2013) is in accordance with the approved methodology applied by the programme of activities, i.e. AMS-I.C (version 17).



## MANAGING RISK

### 3.6 Compliance of monitoring plan with monitoring methodology

DNV is able to confirm that the monitoring plan contained in the PDD (version 05 of 22 May 2013) is in accordance with the approved methodology applied by the project activity, i.e. AMS-I.C (17).

### 3.7 Compliance of monitoring with the monitoring plan

The monitoring has been carried out in accordance with the monitoring plan contained in the revised PoA-DD /3/ and CPA-DD (CPA-001 version 05 of 22 May 2013 /4/, and CPA-002 version 04 of 20 December 2013 /5/). All parameters stated in the validated monitoring plan are monitored and reported appropriately. The monitoring report lists each parameter required by the monitoring plan and the information flow (i.e. from data generation, aggregation, to recording, calculation and reporting) for these parameters is provided in the monitoring report. The information flow for the each parameter is further verified in the following sections.

#### 3.7.1 Monitoring parameters

According to the monitoring plan of the registered PoA-DD /3/, there are 8 parameters to be monitored:

- N – Number of SWH operating in the year;
- $Q_y$  – Solar energy output by the SWH in the year y, MWh;
- $H_{year}$  – Annual average irradiation;
- $T_{a,year}$  – The average annual ambient air temperature;
- $T_{c,year}$  – The average annual Cold Water Temperature;
- V – Volume of daily cold water flow;
- $Q_{on-site}$  – Solar energy output by the SWH in the years y, MWh
- $EF_{grid}$  – The emission factor for the electricity system

The below tables describe for each parameter, which is to be measured according to the monitoring plan, how DNV has verified that i) the actual monitoring complies with the monitoring plan and that ii) data have been assessed to correctly support the emission reductions being claimed.

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	<b>N – Number of SWH operating in the year</b>
Measuring frequency:	Annual sample
Reporting frequency:	Annual sample
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> )  No monitoring frequency is indicated in the registered PoA-DD, and the PP selected to take annual samples and indicated this in the MR. In addition to the annual sample, the parameter is monitored continuously based on failure reporting.





## MANAGING RISK

Type of monitoring equipment:	Visual and technical checks performed in person, as well as failure reporting by users.
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	<p>The accuracy of the measurement meets the requirements indicated in the monitoring plan. The PoA-DD indicates that in order to confirm the number of operating systems 1% of the installations in each CPA are to be sampled for functionality. This sample size was selected because the PP demonstrated at the time of registration that the sample was sufficient to meet the required 90/10 confidence/precision level. 1% of 83 495 (systems belonging to the population being verified) is equal to 835 installations to be checked. The PP visited 995 households for this purpose.</p> <p>The details of the sample visited and calculation of the final parameter's value are included in Appendix 1 /2/: since 993 out of 995 systems were found to be functioning, 99.82% of the total population was considered operational.</p>
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Not applicable: visual checks do not have a measuring range.
Calibration frequency /interval:	Not applicable: no monitoring equipment is used, but monitoring is carried out through visual checks.
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications (if local/national standards or the manufacturer's specifications are not available, international standards may be used)?	Not applicable: no monitoring equipment is used, but monitoring is carried out through visual checks.
Is the calibration of measuring equipment carried out by an accredited person or institution?	Not applicable: no monitoring equipment is used, but monitoring is carried out through visual checks.
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not applicable: no monitoring equipment is used, but monitoring is carried out through visual checks.
Is(are) calibration(s) valid for the whole reporting period?	Not applicable: no monitoring equipment is used, but monitoring is carried out through visual checks.
If applicable, has the reported data been cross-checked with other available data?	Not applicable: no monitoring equipment is used, but monitoring is carried out through visual checks.
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Not applicable: no monitoring equipment is used, but monitoring is carried out through visual checks.
How were the values in the monitoring report verified?	The values were verified on site against a randomly selected sample of operationality checks forms,



## MANAGING RISK

	including archived logsheets from storeroom /51/ - /56/ and found to be correct.
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL/FAR</i> ) <i>Comments (as necessary):</i>  Safe storage of hard copies, CD's backups and electronic backups are eventually stored in an external drive kept in a safe. In its final form, the data management ensure correct transfer of data and reporting of emission reductions and the necessary QA/QC processes are in place.
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	<input checked="" type="checkbox"/> Parameter was monitored fully in accordance with monitoring plan <input type="checkbox"/> Only partial data was available  The calculation of the proportion of systems that were operational during the monitoring period was based on a complete sample of 995 households.  The starting date of the operability check was October 2013, and was selected towards the end of the monitoring period in order to be conservative, as the probability of failure increases over time due to usage.

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	<b>Q,y – Solar energy output by the SWH in the year y, MWh</b>
Measuring frequency:	Daily
Reporting frequency:	Daily
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> )  The monitoring plan does not indicate the monitoring and reporting frequency. Since this parameter is calculated based on other parameters monitored directly and discussed below, and that the data relevant to these parameters is measured every 5 minutes and aggregated daily, the monitoring and reporting frequency is considered acceptable
Type of monitoring equipment:	Not applicable: this parameter is calculated.
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with	Not applicable: this parameter is calculated



## MANAGING RISK

local/national standards, or as per the manufacturer's specification?	
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Not applicable: this parameter is calculated
Calibration frequency /interval:	Not applicable: this parameter is calculated
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications (if local/national standards or the manufacturer's specifications are not available, international standards may be used)?	Not applicable: this parameter is calculated
Is the calibration of measuring equipment carried out by an accredited person or institution?	Not applicable: this parameter is calculated
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not applicable: this parameter is calculated
Is(are) calibration(s) valid for the whole reporting period?	Not applicable: this parameter is calculated
If applicable, has the reported data been cross-checked with other available data?	Not applicable: this parameter is calculated
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	Not applicable: this parameter is calculated
How were the values in the monitoring report verified?	The values reported in the MR were verified against the ER calculations /2/, as well as against the database where measurements are recorded /9/.
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p>The data management system ensures correct transfer of data and reporting of emission reductions, and necessary QA/QC processes are in place /50/.</p> <p>In fact, the logged information is sent via GSM (GPRS) via TCP/IP protocol to the company responsible for the management and maintenance of the database. The propriety protocol takes care of all handshaking and CRC checks to make sure no data is lost and arrives in the correct order.</p> <p>All data is written to a SQL database with its own proprietary driver. The database has been designed specifically for this PoA based on the monitoring requirements of the CDM methodology, and the monitoring plan described in the PoA-DD. The database is designed in such a way that Tables that require human input have an "audit" function, to identify and address mistakes, and values that are not in the correct format are not saved by the system, but give an error message.</p>



## MANAGING RISK

In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	<input type="checkbox"/> Parameter was monitored fully in accordance with monitoring plan <input checked="" type="checkbox"/> Only partial data was available  Data sourced from other measured parameters is not available for all households for the entire monitoring period. ER have been calculated based on the data available, and households for which data are not available on a specific day have not been included in the calculations. This approach meets the requirements of Appendix 1 of the Project Standard in that no ER have been claimed for household that could not be fully monitored during the monitoring period.
---	---

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	$H_{\text{year}}$ – Annual average irradiation
Measuring frequency:	Data is recorded every 5 minutes.
Reporting frequency:	Data is aggregated daily.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> )  The measuring and reporting frequency is indicated in the registered PoA-DD, and the applicable methodology does not give indications on the minimum monitoring frequency, as this parameter is not explicitly contemplated by the methodology, but it is used to calculate parameter $Q_{\text{on-site}}$ .
Type of monitoring equipment:	Pyranometer – Li-COR Sensors “LI 200”. A total of 21 pyranometers were used during this monitoring period, having the following serial numbers:  PY 67126 PY 69976 PY 71636 PY 71635 PY 71637 PY 71638 PY 71639 PY 71645 PY 71640 PY 71632 PY 71633 PY 79120 PY 67482 PY 79118 PY 79121



## MANAGING RISK

	PY 79119 PY 79124 PY 79123 PY 79122 PY 79125 PY 79132
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	<p>Accuracy: +/- 5% maximum +/- 3% typical</p> <p><input type="checkbox"/> Yes, accuracy is as per monitoring plan</p> <p><input checked="" type="checkbox"/> monitoring plan does not specify the accuracy, but the accuracy represents good monitoring practise</p> <p><input type="checkbox"/> No, accuracy is not as per monitoring plan or does not represent good monitoring practise (<i>If No, raise a CAR/CL</i>)</p> <p>This is the accuracy indicated by the instruments' technical specifications issued by the manufacturer /32/.</p>
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	<p><input checked="" type="checkbox"/> Yes, accuracy is valid for the entire measuring range</p> <p><input type="checkbox"/> No, different accuracy levels apply</p> <p>Considering the manual /32/ specifies the range of operating temperature, and that temperatures recorded during the monitoring period fall well within this range, the values recorded are considered acceptable.</p>
Calibration frequency /interval:	<p>The instruments have been calibrated by the manufacturer at the time of commissioning, and replacement or recalibration will be needed after 4 years of service in the field /34/ At the end of the 4 years period in the field the PP intends to replace the pyranometers.</p>
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications (if local/national standards or the manufacturer's specifications are not available, international standards may be used)?	<p><input type="checkbox"/> Yes, frequency is per monitoring plan</p> <p><input checked="" type="checkbox"/> monitoring plan does not specify the frequency, but the frequency represents good monitoring practise</p> <p><input type="checkbox"/> No, frequency is not as per monitoring plan or does not represent good monitoring practise (<i>If No, raise a CAR/CL</i>)</p> <p>The monitoring plan does not specify the frequency of calibration. The PP submitted a letter issued and signed by the manufacturer indicating that the instruments have been calibrated by the manufacturer at the time of commissioning, and replacement or recalibration will be needed after 4 years of service in the field /34/. At the end of the 4</p>



## MANAGING RISK

	<p>years period the PP intends to replace the pyranometers.</p> <p>The installation dates of the monitoring equipment used to indicate the expiry date in the MR were crosschecked against the database and found correct.</p>
Is the calibration of measuring equipment carried out by an accredited person or institution?	<p><i>Name of institution / person:</i> The calibration has been performed by Inteltronics Instrumentation, which is the entity performing all accredited calibration for Campbell Scientific Africa (the Manufacturer). A statement stating this and signed by Campbell Scientific Africa has been submitted to DNV /36/.</p> <p><input checked="" type="checkbox"/> Yes, institution / person is accredited by South African National Accreditation System</p> <p><input type="checkbox"/> No, institution / person is not accredited (<i>If No, raise a CAR/CL - only applicable to SSC projects</i>)</p> <p>Inteltronics Instrumentation is a calibration laboratory accredited by the South African National Accreditation System for meteorological instrument calibration. A certificate of accreditation has been submitted to DNV. Since it is valid from 31 July 2011 and expires on 31 July 2016 it is considered valid for the duration of the second monitoring period.</p>
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	<p><input checked="" type="checkbox"/> Yes</p> <p><input type="checkbox"/> No (<i>If No, raise a CAR/CL</i>)</p>
Is(are) calibration(s) valid for the whole reporting period?	<p><i>Validity of calibration(s):</i> 4 years</p> <p><input checked="" type="checkbox"/> Yes, valid for the whole reporting period</p> <p><input type="checkbox"/> No, not valid for the whole reporting period (<i>If No, raise a CAR/CL</i>)</p> <p>The validity of the calibration certificates /11/ - /31/ extends to 2015 or 2016 depending on the commissioning dates /9//72/. For this reason the calibration of all pyranometers is considered valid for the entire duration of the monitoring period.</p>
If applicable, has the reported data been cross-checked with other available data?	<p><i>Has data been cross-checked with other available data:</i></p> <p><input type="checkbox"/> Yes</p> <p><input checked="" type="checkbox"/> No</p>
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	<p><input checked="" type="checkbox"/> Yes</p> <p><input type="checkbox"/> No (<i>If No, raise a CAR/CL/FAR</i>)</p>



## MANAGING RISK

	The calibration procedure for the LI-COR pyranometers /34/ indicates that that pyranometers are calibrated under the outdoor horizontal global sky conditions for which they were designed.
How were the values in the monitoring report verified?	Data were verified against the database /9/
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL/FAR</i> )  <p>The data management system ensures correct transfer of data and reporting of emission reductions, and necessary QA/QC processes are in place /50/.</p> <p>In fact, the logged information is sent via GSM (GPRS) via TCP/IP protocol to the company responsible for the management and maintenance of the database. The propriety protocol takes care of all handshaking and CRC checks to make sure no data is lost and arrives in the correct order.</p> <p>All data is written to a SQL database with its own proprietary driver. The database has been designed specifically for this PoA based on the monitoring requirements of the CDM methodology, and the monitoring plan described in the PoA-DD. The database is designed in such a way that Tables that require human input have an “audit” function, to identify and address mistakes, and values that are not in the correct format are not saved by the system, but give an error message.</p>
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	<input type="checkbox"/> Parameter was monitored fully in accordance with monitoring plan <input checked="" type="checkbox"/> Only partial data was available  <p>Data on irradiation is not available for all households for the entire monitoring period. ER have been calculated based on the data available, and households for which data are not available on a specific day have not been included in the calculations. This approach meets the requirements of Appendix 1 of the Project Standard in that no ER have been claimed for household that could not be fully monitored during the monitoring period.</p>

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	Ta <sub>year</sub> – The average annual ambient air temperature
Measuring frequency:	Data is recorded every 5 minutes.





## MANAGING RISK

Reporting frequency:	Data is aggregated daily.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> )  <p>The measuring and reporting frequency is indicated in the registered PoA-DD, and the applicable methodology does not give indications on the minimum monitoring frequency, as this parameter is not explicitly contemplated by the methodology, but used to calculate parameter <math>Q_{on-site}</math>.</p>
Type of monitoring equipment:	<p>Temperature is measured by means of a temperature probe. A total of 21 temperature probes were used during this monitoring period, having the following serial numbers:</p> <p>T-01-1001  T-03-1001  T-05-1001  TE-02-1101  TE-04-1101  TE-06-1101  TE-08-1101  TE-10-1101  TE-12-1101  TE-14-1101  TE-16-1101  TE-02-1102  TE-04-1102  TE-06-1102  TE-08-1102  TE-10-1102  TE-12-1102  TE-14-1102  TE-16-1102  TE-18-1102  TE-20-1102</p>
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	<p><i>Accuracy:</i> The temperature probes have a maximum accuracy of <math>\pm 0.15</math> °C at 0 °C, and <math>\pm 0.35</math> °C at 100 °C</p> <input type="checkbox"/> Yes, accuracy is as per monitoring plan <input checked="" type="checkbox"/> monitoring plan does not specify the accuracy, but the accuracy represents good monitoring practise <input type="checkbox"/> No, accuracy is not as per monitoring plan or does not represent good monitoring practise ( <i>If No, raise a CAR/CL</i> )  <p>This is the accuracy indicated by the instruments' technical specifications issued by the manufacturer</p>





## MANAGING RISK

	/40/.
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	<input type="checkbox"/> Yes, accuracy is valid for the entire measuring range <input checked="" type="checkbox"/> No, different accuracy levels apply  <p>The temperature probes have a maximum accuracy of <math>\pm 0.15</math> °C at 0 °C, and <math>\pm 0.35</math> °C at 100 °C. Moreover, the technical information sheet produced by the manufacturer /40/ indicates a tolerance range of <math>\pm 0.30 + 0.0050</math> °C across a temperature range of -196 °C to +600 °C.</p>
Calibration frequency /interval:	The instruments have been calibrated by the manufacturer at the time of commissioning. The instruments cannot be re-calibrated, but it is recommended that a function test is performed every 4 to 5 years /41/. At the end of this period the PP intends to replace the probes.
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications (if local/national standards or the manufacturer's specifications are not available, international standards may be used)?	<input type="checkbox"/> Yes, frequency is per monitoring plan <input checked="" type="checkbox"/> monitoring plan does not specify the frequency, but the frequency represents good monitoring practise <input type="checkbox"/> No, frequency is not as per monitoring plan or does not represent good monitoring practise ( <i>If No, raise a CAR/CL</i> )  <p>The monitoring plan does not specify the frequency of calibration. The PP submitted a letter issued and signed by the manufacturer indicating that the instruments have been calibrated by the manufacturer at the time of commissioning, and that a function test should be performed every 4 to 5 years /41/. At the end of this period the PP intends to replace the probes.</p>
Is the calibration of measuring equipment carried out by an accredited person or institution?	<p><i>Name of institution / person:</i> The calibration has been performed by Wika Instruments, the manufacturer</p> <input checked="" type="checkbox"/> Yes, institution / person is accredited by the South African National Accreditation System <input type="checkbox"/> No, institution / person is not accredited ( <i>If No, raise a CAR/CL - only applicable to SSC projects</i> )  <p>A certificate of accreditation dated 22 December 2008 and expiring on 21 December 2013 has been submitted to DNV /42/.</p>
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> )
Is(are) calibration(s) valid for the whole	<i>Validity of calibration(s):</i> 4 to 5 years



## MANAGING RISK

reporting period?	<input checked="" type="checkbox"/> Yes, valid for the whole reporting period <input type="checkbox"/> No, not valid for the whole reporting period ( <i>If No, raise a CAR/CL</i> )  The validity of the calibration certificates /37/ - /39/ extends to 2015 or 2016 depending on the commissioning dates /71/. For this reason the calibration of all temperature probes is considered valid for the entire duration of the monitoring period.
If applicable, has the reported data been cross-checked with other available data?	<i>Has data been cross-checked with other available data:</i> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL/FAR</i> )  The calibration certificates provided /37/ - /39/ indicate that the test was conducted on a temperature range = PT100. The technical specifications for the model used /40/ indicate that the resistance thermometer meets the characteristics of PT100 and has a temperature range of -30° to +300°. The range for which measurements have been carried out does not exceed the range indicated in the technical specifications.
How were the values in the monitoring report verified?	Data were verified against the database /9/.
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL/FAR</i> )  The data management system ensures correct transfer of data and reporting of emission reductions, and necessary QA/QC processes are in place /50/. In fact, the logged information is sent via GSM (GPRS) via TCPIP protocol to the company responsible for the management and maintenance of the database. The propriety protocol takes care of all handshaking and CRC checks to make sure no data is lost and arrives in the correct order. All data is written to a SQL database with its own proprietary driver. The database has been designed specifically for this PoA based on the monitoring requirements of the CDM methodology, and the monitoring plan described in the PoA-DD. The database is designed in such a way that Tables that require human input have an “audit” function, to identify and address mistakes, and values that are



## MANAGING RISK

	not in the correct format are not saved by the system, but give an error message.
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	<input type="checkbox"/> Parameter was monitored fully in accordance with monitoring plan <input checked="" type="checkbox"/> Only partial data was available  <p>Data on ambient air temperature is not available for all households for the entire monitoring period. ER have been calculated based on the data available, and households for which data are not available on a specific day have not been included in the calculations. This approach meets the requirements of Appendix 1 of the Project Standard in that no ER have been claimed for household that could not be fully monitored during the monitoring period.</p>

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	T <sub>c,year</sub> – The average annual cold water temperature
Measuring frequency:	Data is recorded every 5 minutes.
Reporting frequency:	Data is aggregated daily.
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> )  <p>The measuring and reporting frequency is indicated in the registered PoA-DD, and the applicable methodology does not give indications on the minimum monitoring frequency, as this parameter is not explicitly contemplated by the methodology, but used to calculate parameter Q<sub>on-site</sub>.</p>
Type of monitoring equipment:	<p>Temperature is measured by means of a temperature probe. A total of 21 temperature probes were used during this monitoring period, and their serial numbers are as follows:</p> <p>T-02-1001  T-04-1001  TE-01-1101  TE-03-1101  TE-05-1101  TE-07-1101  TE-09-1101  TE-11-1101  TE-13-1101  TE-15-1101</p>



## MANAGING RISK

	TE-01-1102 TE-03-1102 TE-05-1102 TE-07-1102 TE-09-1102 TE-11-1102 TE-13-1102 TE-15-1102 TE-17-1102 TE-19-1102 TE-21-1102
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	<p><i>Accuracy:</i> The temperature probes have a maximum accuracy of <math>\pm 0.15</math> °C at 0 °C, and <math>\pm 0.35</math> °C at 100 °C</p> <p><input type="checkbox"/> Yes, accuracy is as per monitoring plan</p> <p><input checked="" type="checkbox"/> monitoring plan does not specify the accuracy, but the accuracy represents good monitoring practise</p> <p><input type="checkbox"/> No, accuracy is not as per monitoring plan or does not represent good monitoring practise (<i>If No, raise a CAR/CL</i>)</p> <p>This is the accuracy indicated by the instruments' technical specifications issued by the manufacturer /40/.</p>
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	<p><input type="checkbox"/> Yes, accuracy is valid for the entire measuring range</p> <p><input checked="" type="checkbox"/> No, different accuracy levels apply</p> <p>The temperature probes have a maximum accuracy of <math>\pm 0.15</math> °C at 0 °C, and <math>\pm 0.35</math> °C at 100 °C. Moreover, the technical information sheet produced by the manufacturer /40/ indicates a tolerance range of <math>\pm 0.30 + 0.0050</math> °C across a temperature range of -196 to +600 °C.</p>
Calibration frequency /interval:	<p>The instruments have been calibrated by the manufacturer at the time of commissioning. The instruments cannot be calibrated, but it is recommended that a function test is performed every 4 to 5 years /41/. At the end of this period the PP intends to replace the probes.</p>
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications	<p><input type="checkbox"/> Yes, frequency is as per monitoring plan</p> <p><input checked="" type="checkbox"/> monitoring plan does not specify the frequency, but the frequency represents good monitoring practise</p> <p><input type="checkbox"/> No, frequency is not as per monitoring plan or does not represent good monitoring practise (<i>If No,</i></p>



## MANAGING RISK

(if local/national standards or the manufacturer's specifications are not available, international standards may be used)?	<p><i>raise a CAR/CL</i></p> <p>The monitoring plan does not specify the frequency of calibration. The PP submitted a letter issued and signed by the manufacturer indicating that the instruments have been calibrated by the manufacturer at the time of commissioning, and that a function test should be performed every 4 to 5 years /41/. At the end of this period the PP intends to replace the probes.</p>
Is the calibration of measuring equipment carried out by an accredited person or institution?	<p><i>Name of institution / person:</i> The calibration has been performed by Wika Instruments, the manufacturer</p> <p><input checked="" type="checkbox"/> Yes, institution / person is accredited by the South African National Accreditation System  <input type="checkbox"/> No, institution / person is not accredited (<i>If No, raise a CAR/CL - only applicable to SSC projects</i>)</p> <p>A certificate of accreditation dated 22 December 2008 and expiring on 21 December 2013 has been submitted to DNV /42/.</p>
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	<p><input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No (<i>If No, raise a CAR/CL</i>)</p>
Is(are) calibration(s) valid for the whole reporting period?	<p><i>Validity of calibration(s):</i> 4 to 5 years  <input checked="" type="checkbox"/> Yes, valid for the whole reporting period  <input type="checkbox"/> No, not valid for the whole reporting period (<i>If No, raise a CAR/CL</i>)</p> <p>The validity of the calibration certificated extends to 2015 or 2016 depending on the commissioning dates /9//72/. For this reason the calibration of all temperature probes is considered valid for the entire duration of the monitoring period.</p>
If applicable, has the reported data been cross-checked with other available data?	<p><i>Has data been cross-checked with other available data:</i>  <input type="checkbox"/> Yes  <input checked="" type="checkbox"/> No</p>
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	<p><input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No (<i>If No, raise a CAR/CL/FAR</i>)</p> <p>The calibration certificates provided /37/ - /39/ indicate that the test was conducted on a temperature range = PT100. The technical specifications for the model used /40/ indicate that the resistance thermometer meets the characteristics of PT100 and has a temperature range of -30° to +300°C. The range for which measurements have</p>



## MANAGING RISK

	been carried out does not exceed the range indicated in the technical specifications.
How were the values in the monitoring report verified?	Data were verified against the database /9/
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p><input checked="" type="checkbox"/> Yes  <input type="checkbox"/> No (<i>If No, raise a CAR/CL/FAR</i>)</p> <p>The data management system ensures correct transfer of data and reporting of emission reductions, and necessary QA/QC processes are in place /50/.</p> <p>In fact, the logged information is sent via GSM (GPRS) via TCP/IP protocol to the company responsible for the management and maintenance of the database. The propriety protocol takes care of all handshaking and CRC checks to make sure no data is lost and arrives in the correct order.</p> <p>All data is written to a SQL database with its own proprietary driver. The database has been designed specifically for this PoA based on the monitoring requirements of the CDM methodology, and the monitoring plan described in the PoA-DD. The database is designed in such a way that tables that require human input have an “audit” function, to identify and address mistakes, and values that are not in the correct format are not saved by the system, but give an error message.</p>
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	<p><input type="checkbox"/> Parameter was monitored fully in accordance with monitoring plan  <input checked="" type="checkbox"/> Only partial data was available</p> <p>Data on ambient air temperature is not available for all households for the entire monitoring period. ER have been calculated based on the data available, and households for which data are not available on a specific day have not been included in the calculations. This approach meets the requirements of Appendix 1 of the Project Standard in that no ER have been claimed for household that could not be fully monitored during the monitoring period.</p>

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	V – volume of daily cold water flow
Measuring frequency:	Continuous
Reporting frequency:	Continuous



## MANAGING RISK

<p>Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)</p>	<p><input checked="" type="checkbox"/> Yes <input type="checkbox"/> No (<i>If No, raise a CAR/CL</i>)</p> <p>The measuring frequency is in line with that indicated in the revised PoA-DD, and the applicable methodology does not give indications on the minimum monitoring frequency, as this parameter is not explicitly contemplated by the methodology, but used to calculate parameter <math>Q_{on-site}</math>.</p>
<p>Type of monitoring equipment:</p>	<p>The volume of daily cold water is measured by means of flow meters. A total of 21 flow meters were used during this monitoring period, having the following serial numbers:</p> <p>100016981 100016982 100016986 100016983 100016984 100016988 100016985 100016987 120053141 120053142 120053143 120026915 120053146 120026912 120026914 120026904 120026916 120026909 120026905 120026917 120027220</p>
<p>Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?</p>	<p>Accuracy: +/- 2%</p> <p><input type="checkbox"/> Yes, accuracy is as per monitoring plan <input checked="" type="checkbox"/> monitoring plan does not specify the accuracy, but the accuracy represents good monitoring practise <input type="checkbox"/> No, accuracy is not as per monitoring plan or does not represent good monitoring practise (<i>If No, raise a CAR/CL</i>)</p> <p>The accuracy of the flow meters is not indicated in the registered PoA-DD.</p>





## MANAGING RISK

	The flow meters have a maximum accuracy of $\pm 2\%$ . This is the accuracy indicated by the instruments' technical specifications issued by the manufacturer /47/.
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	<input checked="" type="checkbox"/> Yes, accuracy is valid for the entire measuring range <input type="checkbox"/> No, different accuracy levels apply  The manufacturer's specification present an accuracy curve which indicates that at the typical flow recorded in households in 2013 the accuracy is $\pm 2\%$ to $5\%$ . Queries run in the database show no values that are outside the measurement range.
Calibration frequency /interval:	The instruments are supplied by the manufacturer as calibrated units from the factory. It is recommended that the equipment is replaced every 5 to 7 years from the first day of operation /49/. At the end of this period the PP intends to replace the meters.
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications (if local/national standards or the manufacturer's specifications are not available, international standards may be used)?	<input type="checkbox"/> Yes, frequency is per monitoring plan <input checked="" type="checkbox"/> monitoring plan does not specify the frequency, but the frequency represents good monitoring practise <input type="checkbox"/> No, frequency is not as per monitoring plan or does not represent good monitoring practise ( <i>If No, raise a CAR/CL</i> )  The monitoring plan does not specify the frequency of calibration. The PP submitted a letter issued and signed by the manufacturer indicating that the instruments are supplied by the manufacturer as calibrated units from the factory. The manufacturer recommends that the equipment is recalibrated or replaced every 5 years from the first day of operation /49/. At the end of this period the PP intends to replace the meters.
Is the calibration of measuring equipment carried out by an accredited person or institution?	<i>Name of institution / person:</i> The calibration has been performed by Sensus, the manufacturer  <input checked="" type="checkbox"/> Yes, institution / person is accredited by South African National Accreditation System <input type="checkbox"/> No, institution / person is not accredited ( <i>If No, raise a CAR/CL - only applicable to SSC projects</i> )  Sensus is accredited by the South African National Accreditation System. An accreditation certificate dated 3 January 2011 and expiring on 2 January 2015 has been submitted to DNV /48/. Since measurements started in March 2011, the certificate is considered acceptable.





## MANAGING RISK

Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> )
Is(are) calibration(s) valid for the whole reporting period?	<i>Validity of calibration(s):</i> The validity of the calibration certificates /44/ - /46/ extends to 2016 or 2017 depending on the commissioning dates /71/  <input checked="" type="checkbox"/> Yes, valid for the whole reporting period <input type="checkbox"/> No, not valid for the whole reporting period ( <i>If No, raise a CAR/CL</i> )
If applicable, has the reported data been cross-checked with other available data?	<i>Has data been cross-checked with other available data:</i> <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL/FAR</i> )  The calibration certificates provided /44/ - /46/ clearly state the error observed at Qmin (minimum flow), Qt (transitional flow) and Qs (maximum flow).
How were the values in the monitoring report verified?	Data were verified against the database /9/
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL/FAR</i> )  The data management system ensures correct transfer of data and reporting of emission reductions, and necessary QA/QC processes are in place /50/. In fact, the logged information is sent via GSM (GPRS) via TCP/IP protocol to the company responsible for the management and maintenance of the database. The propriety protocol takes care of all handshaking and CRC checks to make sure no data is lost and arrives in the correct order. All data is written to a SQL database with its own proprietary driver. The database has been designed specifically for this PoA based on the monitoring requirements of the CDM methodology, and the monitoring plan described in the PoA-DD. The database is designed in such a way that Tables that require human input have an "audit" function, to identify and address mistakes, and values that are not in the correct format are not saved by the



## MANAGING RISK

	system, but give an error message.
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	<input type="checkbox"/> Parameter was monitored fully in accordance with monitoring plan <input checked="" type="checkbox"/> Only partial data was available  <p>Data on water flow is not available for all households for the entire monitoring period. ER have been calculated based on the data available, and households for which data are not available on a specific day have not been included in the calculations. This approach meets the requirements of Appendix 1 of the Project Standard in that no ER have been claimed for household that could not be fully monitored during the monitoring period.</p>

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	$Q_{on-site}$ – Solar energy output by the SWH in the years y, MWH
Measuring frequency:	Daily
Reporting frequency:	Daily
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> ) <p>The monitoring plan does indicate the monitoring and reporting frequency.  Since this parameter is calculated based on other parameters monitored directly and discussed above, and that the data relevant to these parameters is measured every 5 minutes and aggregated daily, the monitoring and reporting frequency is considered acceptable.</p>
Type of monitoring equipment:	Not applicable: this parameter is calculated
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	Not applicable: this parameter is calculated
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Not applicable: this parameter is calculated
Calibration frequency /interval:	Not applicable: this parameter is calculated
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications	Not applicable: this parameter is calculated



## MANAGING RISK

(if local/national standards or the manufacturer's specifications are not available, international standards may be used)?	
Is the calibration of measuring equipment carried out by an accredited person or institution?	Not applicable: this parameter is calculated
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not applicable: this parameter is calculated
Is(are) calibration(s) valid for the whole reporting period?	Not applicable: this parameter is calculated
If applicable, has the reported data been cross-checked with other available data?	Not applicable: this parameter is calculated
Is the calibration carried out for a measuring range comparable with the range for which measurements have been carried out?	<p><i>Has data been cross-checked with other available data:</i></p> <p><input type="checkbox"/> Yes</p> <p><input checked="" type="checkbox"/> No</p>
How were the values in the monitoring report verified?	The values reported in the MR were verified against the ER calculations /2/, as well as against the database where measurements are recorded /9/.
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<p><input checked="" type="checkbox"/> Yes</p> <p><input type="checkbox"/> No (<i>If No, raise a CAR/CL/FAR</i>)</p> <p>The data management system ensures correct transfer of data and reporting of emission reductions, and necessary QA/QC processes are in place /50/.</p> <p>In fact, the logged information is sent via GSM (GPRS) via TCPIP protocol to the company responsible for the management and maintenance of the database. The propriety protocol takes care of all handshaking and CRC checks to make sure no data is lost and arrives in the correct order.</p> <p>All data is written to a SQL database with its own proprietary driver. The database has been designed specifically for this PoA based on the monitoring requirements of the CDM methodology, and the monitoring plan described in the PoA-DD. The database is designed in such a way that Tables that require human input have an "audit" function, to identify and address mistakes, and values that are not in the correct format are not saved by the system, but give an error message.</p>
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	<p><input type="checkbox"/> Parameter was monitored fully in accordance with monitoring plan</p> <p><input checked="" type="checkbox"/> Only partial data was available</p> <p>Data solar energy output is not available for all households for the entire monitoring period. ER</p>



## MANAGING RISK

	have been calculated based on the data available, and households for which data are not available on a specific day have not been included in the calculations. This approach meets the requirements of Appendix 1 of the Project Standard in that no ER have been claimed for household that could not be fully monitored during the monitoring period.
--	--

	Assessment/ Observation
Data / Parameter: (as in monitoring plan):	EF <sub>grid</sub> – The emission factor for the electricity system
Measuring frequency:	Annually
Reporting frequency:	Annually
Is measuring and reporting frequency in accordance with the monitoring plan and monitoring methodology? (Yes / No)	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL</i> )  This parameter is calculated annually
Type of monitoring equipment:	Not applicable: this parameter is calculated.
Is accuracy of the monitoring equipment as stated in the monitoring plan? If the monitoring plan does not specify the accuracy of the monitoring equipment, does the accuracy of the monitoring equipment comply with local/national standards, or as per the manufacturer's specification?	Not applicable: this parameter is calculated
Is the accuracy valid for the entire measuring range or do different accuracy levels apply to different measuring ranges?	Not applicable: this parameter is calculated
Calibration frequency /interval:	Not applicable: this parameter is calculated
Is the calibration interval in line with the monitoring plan and/or methodology? If the monitoring plan does not specify the frequency of calibration, is the selected frequency in accordance with the local/national standards, or as per the manufacturer's specifications (if local/national standards or the manufacturer's specifications are not available, international standards may be used)?	Not applicable: this parameter is calculated
Is the calibration of measuring equipment carried out by an accredited person or institution?	Not applicable: this parameter is calculated
Did calibration confirm proper functioning of monitoring equipment? (Yes / No):	Not applicable: this parameter is calculated
Is(are) calibration(s) valid for the whole reporting period?	Not applicable: this parameter is calculated
If applicable, has the reported data been cross-checked with other available data?	Not applicable: this parameter is calculated
Is the calibration carried out for a measuring range comparable with the range for which	<i>Has data been cross-checked with other available data:</i>



## MANAGING RISK

measurements have been carried out?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No  <p>Yes, the value has been cross-checked against the standardized baseline for the Southern African power pool /67/ applicable to solar power generation projects (0.9801 tCO<sub>2</sub>/MWh), and although slightly higher, the difference is considered acceptable because the two results were reached following different calculations (the programme calculates the weighted average emissions of the generation mix of the selected year, while the standardized GEF is calculated following the CDM Tool to calculate the emission factor for an electricity system /68/), and the standardized GEF also includes generation from less carbon intensive grids than the South African one.</p>
How were the values in the monitoring report verified?	The values reported in the MR were verified against the ER calculations /2/, as well as against Eskom's website /58/.
Does the data management ensure correct transfer of data and reporting of emission reductions and are necessary QA/QC processes in place?	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No ( <i>If No, raise a CAR/CL/FAR</i> )  <p>The calculation of the grid emission factor relies on data from one source only (Eskom), and no QA/QC process is required for its calculation.</p>
In case project participants have temporarily not monitored the parameter, has either i) a deviation been approved by the CDM EB or ii) has the parameter been estimated as stipulated by Appendix 1 to the CDM Project Standard?	<input type="checkbox"/> Parameter was monitored fully in accordance with monitoring plan <input type="checkbox"/> Only partial data was available  <p>Not applicable: the parameter is calculated, and relies on data monitored by Eskom.</p>

Calibration records and accreditation certificates have been provided to the verification team. DNV can confirm that the meters were calibrated covering this monitoring period as per the monitoring plan.

The monitoring plan contained in the revised PoA-DD has been properly implemented and followed by the project participants.

Baseline emissions have been monitored and updated based on the parameters stated in the monitoring plan, and the responsibilities and authorities for monitoring and reporting are in accordance with the responsibilities and authorities stated in the monitoring plan. The equipment used for monitoring is in accordance with the requirements of the CDM project standard, and is controlled and calibrated in accordance with the manufacturer's specification; monitoring results are consistently recorded as per approved frequency; and the quality assurance and quality control procedures have been applied in accordance with the revised monitoring plan.



## MANAGING RISK

The revised monitoring plan is in accordance with the requirements of the applicable methodology, in that it comprises following:

- Continuous operation of the equipment/system: this is monitored through technical checks performed on 1% of the installations every year, as well as recorded system failures;
- Net quantity of thermal energy supplied by the PoA during the year y: this is measured through SABS test results and through real-time measurement of average annual solar radiation, annual average ambient temperature, inlet and outlet water temperature, and water flow for 1 every 10 000 units installed in order to adjust the energy output determined in the SABS tests for the specific SWH.
- The grid emission factor is monitored as required by AMS-I.D.

The results of these checks confirm the quality of data is acceptable.

### 3.8 Assessment of data and calculation of emission reductions

DNV confirms that appropriate methods and formulae for calculating baseline emissions, project emissions and leakage have been followed, and the assumptions, emission factors and default values that are applied in the calculation have been justified.

The calculation are performed by the SQL database managed by Real Time Energy, which collects the hard data received from the remote recording of water and air temperature, water temperature and water flow from monitored sites, and calculates the emissions reductions for each household, once this has been allocated to a CPA. The calculations are then imported to an Excel file for each request for issuance. In order to comply with CDM requirements for transparency and replicability, the PP has replicated the ER calculations so that formulas are clearly readable.

As stated in the section 1.4, the emission reductions  $ER_y$  by the programme during the monitoring period is the difference between the baseline emission, project emissions or leakage.

$$ER_y = BE_y - PE_y - LE_y$$

#### 3.8.1 Baseline emissions

Baseline emissions ( $BE_y$  in  $tCO_2$ ) are the product of the baseline emission factor ( $EF_y$  in  $tCO_2/MWh$ ) times the energy baseline ( $EG_y$  in  $MWh$ ).

$EF_{CO_2}$  is the emission factor of the South African's grid, and has been calculated following AMS-I.D. version 16 as the weighted average emissions (in  $tCO_2/MWh$ ) of the generation mix of the year in which PoA generation occurs. This is calculated based on the fuel consumption, net calorific value and emission factor for the fuel used, and electricity generation for each power plant, and in 2012 amounted to  $0.9996 tCO_2/MWh$  based on the information on fuel consumption and electricity generation published by Eskom for 2012 /58/, the most recent available. The source of data used for the calculation of the grid emission factor is consistent with the one indicated in the PoA-DD /3/, and the data were verified against Eskom's published electricity generation and fuel consumption data /58/ and found to be correct.





## MANAGING RISK

$EG_{BL,y}$  is the solar energy output ( $Q_y$ ) of SWHs, which is multiplied by the operationality ratio (i.e. number of SWHs operational,  $N$ ) and further adjusted with maintenance downtime.

The rated capacity of the SWH was calculated in accordance with the formula provided by the SABS. The specific coefficients  $\alpha_1$ ,  $\alpha_2$  and  $\alpha_3$  used were verified against the SABS test report issued to Tasol's SWH /10/, and are considered acceptable as they reflect the local environmental conditions that influence the energy output, while the values used for average ambient temperature, solar irradiation, and average cold water temperature were recorded at 8 monitored sites. Measurements were taken every 5 minutes, aggregated daily, and input in the calculations. DNV was given access to the programme's database /9/, where measurements can be observed in real time for each measured site, and where records for each monitored site are stored. Moreover, since the ER calculations are performed directly within the database, an excel spreadsheet with sample measurements was created by the project participant where the calculations are shown in a transparent way /2/.

The operationality of the systems was based on the results of the operationality survey performed in October 2013 (hence towards the end of the monitoring period). The results of the operationality check are reported in the MR, and demonstrate that the check achieved the required confidence/precision level. DNV checked a randomly selected sample of forms completed by the technicians responsible for the operationality checks and stored at SASSA's office /51/ - /56/, and found the information checked to be acceptable. The high number of operational systems recorded can be explained by the fact that maintenance is provided in all locations, and that non-operational systems are replaced by SASSA on a continuous basis. This was also confirmed by the staff responsible for maintenance on site /73/. Maintenance and downtime was calculated based on the call log kept during the monitoring period.

Hence,

$$EG_{BL,y} = Q_y * \text{Number} - \text{Maintenance and Downtime} = 50\,216 \text{ MWh}$$

$$BE_y = EF_y * EG_{BL,y} = 50\,194 \text{ tCO}_2\text{e}$$

### 3.8.2 Project emissions

The project emissions are regarded as zero according to the methodology AMS-I.C.

### 3.8.3 Leakage

There are no leakages that need to be considered in applying the methodology AMS-I.C.

### 3.8.4 Emission reductions

Therefore, the emission reductions in this monitoring period are:

$$ER_y = BE_y - PE_y - LE_y = 50\,194 - 0 - 0 = 50\,194 \text{ tCO}_2\text{e}.$$

As outlined above, the input data for calculating the emission reductions, the calculating process and the result are complete and transparent. Therefore, DNV is able to confirm the accuracy of the emission reductions.



## MANAGING RISK

### 3.9 Quality of evidence to determine emission reductions

DNV confirms that a complete set of data for this monitoring period was available to be verified and was in accordance with the registered PoA-DD /3/and CPA-DDs /4//5/.

All necessary documentation were collected, referenced and aggregated and were easily accessible in hard-copy and electronic format. Measurements are performed by calibrated equipment, and the key data were cross-checked via other sources. No assumptions are used that have any material influence on reported emission reductions.

### 3.10 Management system and quality assurance

SASSA is responsible for the operation and maintenance of the programme, the monitoring equipments and data collection. The management system for the programme has been verified to be in place by DNV on site. The organization structure with the responsibilities, personnel competencies, monitoring procedure and monitoring management have been properly identified and put into operation /71/.

DNV confirms that the responsibilities and authorities in the management and operational system for monitoring and reporting are in accordance with the responsibilities and authorities stated in the registered PoA-DD /3/ and monitoring plan.





## MANAGING RISK

### 4 CERTIFICATION STATEMENT

DNV Climate Change Services AS (DNV) has performed the verification of the emission reductions that have been reported for the CDM programme of activities 4302 “SASSA Low Pressure Solar Water Heater Programme” in South Africa for the period 1 January 2013 to 31 December 2013.

The project participants are responsible for the collection of data in accordance with the monitoring plan and the reporting of GHG emissions reductions from the programme.

It is DNV’s responsibility to express an independent verification statement on the reported GHG emission reductions from the programme of activities. DNV does not express any opinion on the selected baseline scenario or on the validated and registered PoA-DD.

DNV conducted the verification on the basis of the baseline and monitoring methodology AMS-I.C (version 17), the monitoring plan contained in the PoA-DD and CPA-DD (CPA-001 version 05 of 22 May 2013 and CPA-002 version 05 of 22 May 2013) and the monitoring report (version 04) dated 28 March 2014. The verification included i) checking whether the provisions of the monitoring methodology and the monitoring plan were consistently and appropriately applied and ii) the collection of evidence supporting the reported data.

DNV’s verification approach draws on an understanding of the risks associated with reporting of GHG emission data and the controls in place to mitigate these. DNV planned and performed the verification by obtaining evidence and other information and explanations that DNV considers necessary to give reasonable assurance that reported GHG emission reductions are fairly stated.

In our opinion the GHG emissions reductions reported for the programme of activities for the period 1 January 2013 to 31 December 2013 are fairly stated in the monitoring report (version 04) dated 28 March 2014.

The GHG emission reductions were calculated correctly on the basis of the approved baseline and monitoring methodology AMS-I.C (version 17) and the monitoring plan contained in the PoA-DD and CPA-DDs (CPA-001 version 05 of 22 May 2013 and CPA-002 version 04 of 20 December 2013).

DNV Climate Change Services AS is able to certify that the emission reductions from the CDM programme of activities “SASSA Low Pressure Solar Water Heater Programme” in South Africa during the period 1 January 2013 to 31 December 2013 amount to 50 194 tonnes of CO<sub>2</sub> equivalent.

*Venice and Oslo, 14 July 2014*

Francesca Feller  
Verifier  
DNV Venice, Italy

Michael Lehmann  
Director of Services and Technologies  
DNV Climate Change Services AS



## 5 REFERENCES

### Documentation provided by the project participants

- /1/ International Carbon Ltd: *CDM monitoring report for the programme of activities “SASSA low pressure solar water heater programme” for the monitoring period 1 January 2013 to 31 December 2013*, version 02 of 25 February 2014, and version 04 of 28 March 2014
- /2/ International Carbon Ltd: *Appendix I*, version 1 of 24 January 2014
- /3/ International Carbon Ltd: *CDM-PoA-DD for PoA “SASSA low pressure solar water heater programme”*, version 05 of 22 May 2013
- /4/ International Carbon Ltd: *CDM-CPA-DD for CPA “SASSA low pressure solar water heater programme – CPA-001”*, version 05 of 22 May 2013
- /5/ International Carbon Ltd: *CDM-CPA-DD for CPA “SASSA low pressure solar water heater programme – CPA-002”*, version 04 of 20 December 2013
- /6/ International Carbon Ltd: *Appendix 1 - Appendix III ER for generic CPA*, of 28 December 2010
- /7/ International Carbon Ltd: *Appendix I – Appendix IV Ex ante Emission for CPA001*, 12 March 2011
- /8/ International Carbon Ltd: *Appendix 1 – CPA002 Final ER calculation spread sheet*, 29 March 2012
- /9/ Real Time Energy: Solar Tracker database, available at:  
<http://www.rtenergy.co.za/RTETelemetryV1/> (accessed: August-December 2013)
- /10/ South Africa Bureau of Standards: *Mark of Approval SAS 1307\_2009*, 21 December 2011
- /11/ Li-COR: Certificate of calibration – serial number PY67126, 25 September 2009
- /12/ Li-COR: Certificate of calibration – serial number PY69976, 15 July 2010
- /13/ Li-COR: Certificate of calibration – serial number PY71632, 8 September 2010
- /14/ Li-COR: Certificate of calibration – serial number PY71633, 8 September 2010
- /15/ Li-COR: Certificate of calibration – serial number PY71635, 8 September 2010
- /16/ Li-COR: Certificate of calibration – serial number PY71636, 8 September 2010
- /17/ Li-COR: Certificate of calibration – serial number PY71637, 8 September 2010
- /18/ Li-COR: Certificate of calibration – serial number PY71638, 8 September 2010
- /19/ Li-COR: Certificate of calibration – serial number PY71639, 8 September 2010
- /20/ Li-COR: Certificate of calibration – serial number PY71640, 8 September 2010
- /21/ Li-COR: Certificate of calibration – serial number PY71645, 8 September 2010
- /22/ Li-COR: Certificate of calibration – serial number PY79118, 6 March 2012
- /23/ Li-COR: Certificate of calibration – serial number PY79119, 6 March 2012
- /24/ Li-COR: Certificate of calibration – serial number PY79120, 6 March 2012
- /25/ Li-COR: Certificate of calibration – serial number PY79121, 6 March 2012
- /26/ Li-COR: Certificate of calibration – serial number PY79122, 6 March 2012
- /27/ Li-COR: Certificate of calibration – serial number PY79123, 6 March 2012



## MANAGING RISK

- /28/ Li-COR: Certificate of calibration – serial number PY79124, 6 March 2012
- /29/ Li-COR: Certificate of calibration – serial number PY79125, 6 March 2012
- /30/ Li-COR: Certificate of calibration – serial number PY79132, 6 March 2012
- /31/ Li-COR: Certificate of calibration – serial number PY67482, 25 August 2009
- /32/ Li-COR: LI-COR Solar radiation sensors, October 2010
- /33/ Li-COR: Calibration interval of the LI-COR LI-200 pyranometer, 26 November 2012
- /34/ Li-COR: Calibration procedures for LI-COER spectroradiometers, radiation sensors & lamps, 6 September 2002
- /35/ SANAS: Certificate of accreditation, 20 December 2011
- /36/ Campbell Scientific Africa: Calibration Relationship between Campbell Scientific Africa (CS Africa) and Inteltronics Instrumentation, 23 April 2013
- /37/ Wika Instruments: Temperature conformity certificate WCT-CF-DBN-T1118, 8 March 2011
- /38/ Wika Instruments: Temperature conformity certificate WCT-CF-DBN-T1001, 15 March 2010
- /39/ Wika Instruments: Temperature conformity certificate WCT-CF-DBN-T1111, 8 March 2011
- /40/ Wika Instruments: Usage limitations and accuracies of platinum resistance thermometers (DIN EN 60751:2009) in industrial application, October 2010
- /41/ Wika Instruments: Information on calibration interval, 19 December 2012
- /42/ Wika Instruments: *Certificate of accreditation*, 22 December 2008
- /43/ Wika Instruments: *Temp VS Ohm for PT 100* , 22 December 2008
- /44/ Sensus metering systems: Meter verification certificate, calibration date: 13 June 2011
- /45/ Sensus metering systems: Meter verification certificate, calibration date: 12 June 2012,
- /46/ Sensus metering systems: Meter test report, certificate date: 2 March 2013
- /47/ Sensus metering systems: Flow meter technical specifications, 11 February 2008
- /48/ South African National Accreditation System: *Certificate of Accreditation*, 3 January 2011 (expires 2 January 2015)
- /49/ Joat sales & services: Meter lifespan, 7 March 2013
- /50/ Real Time Energy: Measurement System Architecture, 16 November 2012
- /51/ Tasol: Operationality inspection, 18 February 2012
- /52/ Tasol: Operationality inspection, 20 February 2012
- /53/ Tasol: Operationality inspection, 20 February 2012
- /54/ Tasol: Operationality inspection, 20 February 2012
- /55/ Tasol: Operationality inspection, 20 February 2012
- /56/ Tasol: Operationality inspection (all), various dates

### Other programme documents or documents used by DNV to verify the information provided by the project participants

- /57/ Japan Consulting Institute (JCI): PoA validation report, 4 March 2011
- /58/ Eskom: CDM calculations, available at: <http://www.eskom.co.za/c/article/236/cdm->



## MANAGING RISK

[calculations/](#) (accessed in August 2013)

- /59/ DNV: Verification/Certification Report for the “SASSA low pressure solar water heater programme” in Africa, 25 November 2013
- /60/ DNV: Verification/Certification Report for the “SASSA low pressure solar water heater programme” in Africa, 17 January 2014

### Methodologies, tools and other guidance by the CDM Executive Board

- /61/ CDM Executive Board: *Clean Development Mechanism Validation and Verification Standard*, version 05.0
- /62/ CDM Executive Board: *Clean Development Mechanism Project Standard*, version 05.0
- /63/ CDM Executive Board: *Clean Development Mechanism Project Cycle Procedure*, version 05.0
- /64/ CDM Executive Board: *Sampling and surveys for CDM project activities and programme of activities*, version 04.0
- /65/ CDM Executive Board: *Baseline and monitoring methodology AMS-I.C*, version 17
- /66/ CDM Executive Board: *Baseline and monitoring methodology AMS-I.D*, version 16
- /67/ CDM Executive Board: *Standardized baseline – Grid emission factor for the Southern African power pool*, version 01.0
- /68/ CDM Executive Board: *Tool to calculate the emission factor for an electricity system*, version 2.2.1
- /69/ CDM Executive Board: General guidelines for sampling and surveys for SSC project activities, version 01

### Persons interviewed during the verification

	<b>Date / Type of interview</b>	<b>Name / Organization</b>	<b>Topic</b>
/70/	17-18 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Olivia Tuchten International Carbon	<ul style="list-style-type: none"> <li>• PoA design, ER calculations, application of methodology</li> </ul>
/71/	17-18 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Leandi Streeter SASSA	<ul style="list-style-type: none"> <li>• Operations, data collection and storage, management system</li> </ul>
/72/	17-18 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office	Shaun Worthmann Real Time Energy	<ul style="list-style-type: none"> <li>• Data collection and storage, measurement equipment, database design and management, ER</li> </ul>



## MANAGING RISK

	<input type="checkbox"/> Telephone		calculations	
	<input type="checkbox"/> E-mail			
/73/	17 February 2014	Tsepo Dire, monitored household in Alexandria	• Monitoirng equipment	
	<input checked="" type="checkbox"/> On-site			
	<input type="checkbox"/> Face-to-face at office			
	<input type="checkbox"/> Telephone			
	<input type="checkbox"/> E-mail			
/74/	17-18 February 2014	Robert Diko, user	• Operationality, maintenance	
	<input type="checkbox"/> On-site			
	<input type="checkbox"/> Face-to-face at office			
	<input checked="" type="checkbox"/> Telephone			
	<input type="checkbox"/> E-mail			
/75/	17-18 February 2014	Phindile Gladman Dasa, user	• Operationality, maintenance	
	<input type="checkbox"/> On-site			
	<input type="checkbox"/> Face-to-face at office			
	<input checked="" type="checkbox"/> Telephone			
	<input type="checkbox"/> E-mail			
/76/	17-18 February 2014	Mzwandile Richard Ntoni, user	• Operationality, maintenance	
	<input type="checkbox"/> On-site			
	<input type="checkbox"/> Face-to-face at office			
	<input checked="" type="checkbox"/> Telephone			
	<input type="checkbox"/> E-mail			
/77/	17-18 February 2014	Jane Nonzwakazi Mtoba, user	• Operationality, maintenance	
	<input type="checkbox"/> On-site			
	<input type="checkbox"/> Face-to-face at office			
	<input checked="" type="checkbox"/> Telephone			
	<input type="checkbox"/> E-mail			
/78/	17-18 February 2014	Mbuyiseli Joel Mantile, user	• Operationality, maintenance	
	<input type="checkbox"/> On-site			
	<input type="checkbox"/> Face-to-face at office			
	<input checked="" type="checkbox"/> Telephone			
	<input type="checkbox"/> E-mail			
/79/	17-18 February 2014	Monde France Kirindo, user	• Operationality, maintenance	
	<input type="checkbox"/> On-site			
	<input type="checkbox"/> Face-to-face at office			
	<input checked="" type="checkbox"/> Telephone			
	<input type="checkbox"/> E-mail			
/80/	17-18 February 2014	Xoliswa Terresa Lolwana, user	• Operationality, maintenance	
	<input type="checkbox"/> On-site			



## MANAGING RISK

	<input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail		
/81/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Stanford Monde Ndziba, user	• Operationality, maintenance
/82/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Shakespeare Nobongoza, user	• Operationality, maintenance
/83/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Sindiswa Bella Siggqolo, user	• Operationality, maintenance
/84/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Mandisa Laurentina Belesi, user	• Operationality, maintenance
/85/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Nonkululeko Voilet Makhumsha, user	• Operationality, maintenance
/86/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Agnes Notawusi Sikondo, user	• Operationality, maintenance
/87/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Mampe Cecilia Sehlabo, user	• Operationality, maintenance



## MANAGING RISK

/88/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Disebo Sinah Mahoete, user	• Operationality, maintenance
/89/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Disemela Suzan Modise, user	• Operationality, maintenance
/90/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Puleng Anna Mafa, user	• Operationality, maintenance
/91/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Motshegwa Elizabeth Monyane, user	• Operationality, maintenance
/92/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Mmereteng William Mpakathi, user	• Operationality, maintenance
/93/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Kobomg Isaaka Rasilile, user	• Operationality, maintenance
/94/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Lambata John Lambatha, user	• Operationality, maintenance
/95/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office	Kedisaletse Elizabeth Ntelele, user	• Operationality, maintenance





## MANAGING RISK

	<input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail		
/96/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Sekano Gilbert Phetoe, user	• Operationality, maintenance
/97/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Kolo Elisa Molefe, user	• Operationality, maintenance
/98/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Nchebe Kingsley Moeti, user	• Operationality, maintenance
/99/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Mantoa Maria Meli, user	• Operationality, maintenance
/100/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Moick Motaung, user	• Operationality, maintenance
/101/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	John Ramelamu Mohoje, user	• Operationality, maintenance
/102/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Makgaketsa Johannes Motaunyana, user	• Operationality, maintenance



## MANAGING RISK

/103/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Maria Moroesi Plank, user	• Operationality, maintenance
/104/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Elias Leburu, user	• Operationality, maintenance
/105/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Moipone Granie Mahlatsi, user	• Operationality, maintenance
/106/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Disebo Eveline Mosolodi, user	• Operationality, maintenance
/107/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Mantoea Elizabeth Molebatsi, user	• Operationality, maintenance
/108/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Molahlehi Adam Mokhele, user	• Operationality, maintenance
/109/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Mamoliehi Lydia Thekiso, user	• Operationality, maintenance
/110/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office	Mpho William Duiker, user	• Operationality, maintenance



## MANAGING RISK

	<input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail		
/111/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Torosi George Kotoane, user	• Operationality, maintenance
/112/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Mampeko Agnes Moholo, user	• Operationality, maintenance
/113/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Mosidi Maria Mashabe, user	• Operationality, maintenance
/114/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Teboho Eric Mollo, user	• Operationality, maintenance
/115/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Zweni George Fungu, user	• Operationality, maintenance
/116/	17-18 February 2014 <input type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input checked="" type="checkbox"/> Telephone <input type="checkbox"/> E-mail	D M Sotshange, user	• Operationality, maintenance
/117/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Nancy Ndamase street, house 505	• Operationality, maintenance, project documentation.
/118/	17 February 2014 <input checked="" type="checkbox"/> On-site	Resident, Klipfontainview, Nancy Ndamase street, house 504	• Operationality, maintenance, project



## MANAGING RISK

	<input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail		documentation.
/119/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Nancy Ndamase street, house 503	<ul style="list-style-type: none"> <li>Operationality, maintenance, project documentation.</li> </ul>
/120/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Nancy Ndamase street, house 63	<ul style="list-style-type: none"> <li>Operationality, maintenance, project documentation.</li> </ul>
/121/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Nancy Ndamase street, house 82	<ul style="list-style-type: none"> <li>Operationality, maintenance, project documentation.</li> </ul>
/122/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Nancy Ndamase street, house 60	<ul style="list-style-type: none"> <li>Operationality, maintenance, project documentation.</li> </ul>
/123/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Siyaphumla street, house 141	<ul style="list-style-type: none"> <li>Operationality, maintenance, project documentation.</li> </ul>
/124/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Siyaphumla street, house 142	<ul style="list-style-type: none"> <li>Operationality, maintenance, project documentation.</li> </ul>
/125/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Mafikeng street, house 194	<ul style="list-style-type: none"> <li>Operationality, maintenance, project documentation.</li> </ul>



## MANAGING RISK

/126/	17 February 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident, Klipfontainview, Mafikeng street, house 22	<ul style="list-style-type: none"> <li>Operationality, maintenance, project documentation.</li> </ul>
/127/	26 May 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident of house 1544, Impumelelo, Deven	Operationality, maintenance
/128/	26 May 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident of house 1505, Impumelelo, Deven	Operationality, maintenance
/129/	26 May 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident of house 1675, Impumelelo, Deven	Operationality, maintenance
/130/	26 May 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident of house 1997, Impumelelo, Deven	Operationality, maintenance
/131/	26 May 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident of house 2174, Impumelelo, Deven	Operationality, maintenance
/132/	26 May 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident of house 2208, Impumelelo, Deven	Operationality, maintenance
/133/	26 May 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone <input type="checkbox"/> E-mail	Resident of house 2184, Impumelelo, Deven	Operationality, maintenance
/134/	26 May 2014 <input checked="" type="checkbox"/> On-site <input type="checkbox"/> Face-to-face at office <input type="checkbox"/> Telephone	Resident of house 2164, Impumelelo, Deven	Operationality, maintenance



## MANAGING RISK

/135/	<input type="checkbox"/> E-mail	Resident of house 2166, Impumelelo, Deven	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/136/	26 May 2014	Resident of house 2247, Impumelelo, Deven	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/137/	26 May 2014	Resident of house 3671, 24 <sup>th</sup> Street, Etwatwa	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/138/	26 May 2014	Resident of house 3588, 25 <sup>th</sup> Street, Etwatwa	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/139/	26 May 2014	Resident of house 6345, Bee-eater Street, Etwatwa	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/140/	26 May 2014	Resident of house 8355, Sparrow Street, Etwatwa	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/141/	26 May 2014	Resident of house 7894, Sparrow Street, Etwatwa	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/142/	26 May 2014	Resident of house 7772, Guinea Fowl Street, Etwatwa	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/143/	26 May 2014	Resident of house 7743, Lovebird Street, Etwatwa	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		



## MANAGING RISK

/144/	<input type="checkbox"/> E-mail	Resident of house 7621, Shrike Street, Etwatwa	Operationality, maintenance
	26 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/145/	<input type="checkbox"/> E-mail	Resident of house 7620, Shrike Street, Etwatwa	Operationality, maintenance
	26 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/146/	<input type="checkbox"/> E-mail	Resident of house 7721, Kingfisher Street, Etwatwa	Operationality, maintenance
	26 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/147/	<input type="checkbox"/> E-mail	Resident of house 11, Gould Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/148/	<input type="checkbox"/> E-mail	Resident of house 14, Gould Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/149/	<input type="checkbox"/> E-mail	Resident of house 27, Gould Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/150/	<input type="checkbox"/> E-mail	Resident of house 24, Copper Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/151/	<input type="checkbox"/> E-mail	Resident of house 18, Copper Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/152/	<input type="checkbox"/> E-mail	Resident of house 44, Iwster Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		





## MANAGING RISK

/153/	<input type="checkbox"/> E-mail	Resident of house 7, Nickel Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/154/	<input type="checkbox"/> E-mail	Resident of house 32, Mika Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/155/	<input type="checkbox"/> E-mail	Resident of house 32, Mangwan Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/156/	<input type="checkbox"/> E-mail	Resident of house 17, Mangwan Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/157/	<input type="checkbox"/> E-mail	Resident of house 8, Mangwan Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/158/	<input type="checkbox"/> E-mail	Resident of house 10, Mbanze Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/159/	<input type="checkbox"/> E-mail	Resident of house 56, Mbanze Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/160/	<input type="checkbox"/> E-mail	Resident of house 58, Mbanze Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
/161/	<input type="checkbox"/> E-mail	Resident of house 98, Mbanze Street, Vredenburg	Operationality, maintenance
	27 May 2014		
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		



## MANAGING RISK

	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/162/	27 May 2014	Resident of house 96, Mbanze Street, Vredenburg	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/163/	27 May 2014	Resident of house 31, Jonga Street, Vredenburg	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/164/	27 May 2014	Resident of house 16, Kanze Street, Vredenburg	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/165/	27 May 2014	Resident of house 15, Kanze Street, Vredenburg	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/166/	27 May 2014	Resident of house 11, Kanze Street, Vredenburg	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/167/	28 May 2014	Resident of house 34, Schauder Street, Holland Park, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/168/	28 May 2014	Resident of house 82, Schauder Street, Holland Park, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/169/	28 May 2014	Resident of house 35, Maple Square, Holland Park, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/170/	28 May 2014	Resident of house 18, Maple Square, Holland Park, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		



## MANAGING RISK

	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/171/	28 May 2014	Resident of house 36, Maple Square, Holland Park, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/172/	28 May 2014	Resident of house 21, Jameson Rd, Shoulder Road area, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/173/	28 May 2014	Resident of house 161, Jameson Rd, Shoulder Road area, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/174/	28 May 2014	Resident of house 49, Phyllis Street, Shoulder Road area, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/175/	28 May 2014	Resident of house 5, Brown St, Shoulder Road area, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/176/	28 May 2014	Resident of house 35, Brown St, Shoulder Road area, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/177/	28 May 2014	Resident of house 26, Brown St, Shoulder Road area, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/178/	28 May 2014	Resident of house 313, Matanzima Road, Motherwell, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/179/	28 May 2014	Resident of house 305, Matanzima Road, Motherwell, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		



## MANAGING RISK

	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/180/	28 May 2014	Resident of house 156, Gaba Street, Motherwell, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/181/	28 May 2014	Resident of house 53, Qhude Road, Motherwell, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/182/	28 May 2014	Resident of house 31, Mbabala Road, Motherwell, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/183/	28 May 2014	Resident of house 28, Mbabala Road, Motherwell, Port Elizabeth	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/184/	28 May 2014	Resident of house 56, Dembu Crescent, Greenfields, Uitenhage	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/185/	28 May 2014	Resident of house 15, Dembu Crescent, Greenfields, Uitenhage	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/186/	28 May 2014	Resident of house 4, Kingfisher Street, Rosendale, Uitenhage	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/187/	28 May 2014	Resident of house 71, Kingfisher Street, Rosendale, Uitenhage	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/188/	28 May 2014	Resident of house 66, Kingfisher Street, Rosendale, Uitenhage	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		



## MANAGING RISK

	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/189/	29 May 2014	Resident of house 3653, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/190/	29 May 2014	Resident of house 3637, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/191/	29 May 2014	Resident of house 3627, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/192/	29 May 2014	Resident of house 3629, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/193/	29 May 2014	Resident of house 3598, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/194/	29 May 2014	Resident of house 3601, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/195/	29 May 2014	Resident of house 4183, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/196/	29 May 2014	Resident of house 4188, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/197/	29 May 2014	Resident of house 4217, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		



## MANAGING RISK

	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/198/	29 May 2014	Resident of house 4218, Kingsborough, eThekweni	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/199/	29 May 2014	Resident of house 4373, Graceland Road, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/200/	29 May 2014	Resident of house 4864, Sarva Road, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/201/	29 May 2014	Resident of house 4283, Sarva Road, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/202/	29 May 2014	Resident of house 4288, Sarva Road, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/203/	29 May 2014	Resident of house 2968, Isoleni Close, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/204/	29 May 2014	Resident of house 2969, Isoleni Close, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/205/	29 May 2014	Resident of house 2973, Isoleni Close, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/206/	29 May 2014	Resident of house 2960, Isoleni Close, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		



## MANAGING RISK

	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/207/	29 May 2014	Resident of house 789, Highland Ridge, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/208/	29 May 2014	Resident of house 694, Highland Ridge, Welbedacht	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/209/	31 May 2014	Resident of house 11726, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/210/	31 May 2014	Resident of house 11858, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/211/	31 May 2014	Resident of house 11886, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/212/	31 May 2014	Resident of house 11726986, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/213/	31 May 2014	Resident of house 986, George Street, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/214/	31 May 2014	Resident of house 29, Colbert Street, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/215/	31 May 2014	Resident of house 12183, David Street, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		





## MANAGING RISK

	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/216/	31 May 2014	Resident of house 5192, Sicily Street, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/217/	31 May 2014	Resident of house 5527, Serroto Street, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/218/	31 May 2014	Resident of house 5473, Serroto Street, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/219/	31 May 2014	Resident of house 1486, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/220/	31 May 2014	Resident of house 10897, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/221/	31 May 2014	Resident of house 14052, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/222/	31 May 2014	Resident of house 13956, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/223/	31 May 2014	Resident of house 13906, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/224/	31 May 2014	Resident of house 13855, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		



## MANAGING RISK

	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/225/	31 May 2014	Resident of house 14913, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/226/	31 May 2014	Resident of house 14901, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/227/	31 May 2014	Resident of house 14854, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/228/	31 May 2014	Resident of house 15087, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		
/229/	31 May 2014	Resident of house 15444, Snake Park, Kroonstad	Operationality, maintenance
	<input checked="" type="checkbox"/> On-site		
	<input type="checkbox"/> Face-to-face at office		
	<input type="checkbox"/> Telephone		
	<input type="checkbox"/> E-mail		

- oOo -

## **APPENDIX A**

---

### **CORRECTIVE ACTION REQUESTS, CLARIFICATION REQUESTS AND FORWARD ACTION REQUESTS**

### Corrective action requests

<b>CAR ID</b>	<b>Corrective action request</b>	<b>Response by Project Participants</b>	<b>DNV's assessment of response by Project Participants</b>
CAR 1	The starting date of the operationality check indicated in the MR is not correct. The PP is requested to correct the information provided in the MR.	The references to the start date of the operationality check have been amended in the MR.	<p>The starting date of the operationality check indicated in the MR has been corrected. The date is now in line with the information collected on site through interviews /70//71/.</p> <p>CAR 1 is closed.</p>
CAR 2	Page 13 of the MR mentions a graph showing the accuracy of the flow meters that has not been included. The PP is requested to include the graph mentioned in the MR.	The graph has been included in the amended MR.	<p>The graph showing the accuracy of the flow meters now shows correctly in the MR.</p> <p>CAR 2 is closed.</p>

## Clarification requests

CL ID	Clarification request	Response by Project Participants	DNV's assessment of response by Project Participants
CL 1	The PP is requested to clarify whether the systems installed as part of CPA-003 that have been assigned in February 2014 to a monitoring site are to be considered for the current request for issuance.	<p>Installations under CPA-003 will not be included in the 2013 Verification.</p> <p>On looking at the latest figures, the amount of assigned figures remains (83 495) as indicated in the Monitoring Report. Therefore installations under CPA-003 cannot be considered operational yet (even though we have now established a start date) because they have not yet been assigned to monitoring equipment.</p>	<p>The population of SWH that constitutes the scope of the current verification consists of CPA-001 and CPA-002. The information presented in the MR is consistent with the calculation of ER submitted.</p> <p>CL 1 is closed.</p>
CL 2	The crediting period for CPA-004 starts on 1 July 2013, and is therefore already active during the monitoring period currently being verified. It was discussed during the site visit whether the PP intended to request an approval of changes in the crediting period for CPA-004. The PP is requested to clarify if such request for approval will be submitted as part of the current request for issuance.	The PPs have decided not to undertake any requests for post registration changes at this point in time.	<p>The population of SWH that constitutes the scope of the current verification consists of CPA-001 and CPA-002. The information presented in the MR is consistent with the calculation of ER submitted.</p> <p>CL 2 is closed.</p>
CL 3	The PP is requested to clarify where the equations applied to demonstrate that the sample surveyed as part of the operationality check achieved the required confidence/precision level have been	The equations used were the same as those applied in the 2011 and 2012 verifications and were based on the draft version of the best practice sampling examples, which was the valid guideline before the current guideline	Although the guidelines used are now superseded, the application of the "General guidelines for sampling and surveys for SSC project activities" /69/ constitutes the indications available at

	sourced from.	<p>for Sampling and surveys for CDM project activities and programmes of activities was adopted. The confidence calculation in the Appendix-I has been updated to follow the equation 7 (para 35) of the current guideline Appendix 2:</p> $\text{Confidence Interval}$ $= p \pm 1.96 \times \sqrt{1 - \frac{n}{N}}$ $\times \sqrt{\frac{p(1-p)}{n}}$ $= p \pm 1.96 \times \sqrt{\frac{N-n}{N}} \times \sqrt{\frac{p(1-p)}{n}}$	<p>the time of registration of the PoA, as confirmed by the validation report. For this reason, the use of the guidelines is considered acceptable.</p> <p>CL 3 is closed.</p>
--	---------------	---	--

### Forward action requests from previous verification

FAR ID	Forward action request	Summary of how FAR has been addressed in this reporting period	Assessment of how FAR has been addressed
	No FAR have been identified as part of the previous verification.		

### Forward action requests from this verification

FAR ID	Forward action request	Response by Project Participants
	No FAR have been identified as part of the current verification	

## **APPENDIX B**

---

### **POST REGISTRATION CHANGES**



Type of post registration change	Description of post registration change*	Is prior approval by CDM EB required?	In case prior approval by CDM EB is required, when was post registration change approved?
Corrections	<p>The CPA-DDs for CPA-003 and CPA-004 have been updated to incorporate the corrections made to the PoA-DD and the CPA-DD for CPA-001. The corrections made are:</p> <ul style="list-style-type: none"> <li>- The list of information to be recorded in the database has been modified to exclude the confirmation that the dwelling has electricity and water connection, since this is a pre-requisite for installation by SASSA. Moreover, the PoA-DD now indicates that households are identified in the database based on street address, GPS coordinates, and an additional unique ID number allocated to each system in the database, since the PP realized during the implementation of the programme that ERF numbers were not univocal</li> <li>- In the CPA-DD, parameter EF grid was moved to the monitoring plan. In the CPA-DD template version available at the time of inclusion this parameter was listed among the data and parameters available at validation, but the registered monitoring plan clearly indicated the parameter has to be updated at the time of each issuance. The correction therefore makes it more clear that the parameter is monitored</li> </ul>	<input type="checkbox"/> Yes <input checked="" type="checkbox"/> No <input type="checkbox"/> Not applicable	Not applicable
Temporary deviations from the registered monitoring plan and/or monitoring methodology	Not applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable	Not applicable
Permanent changes from the registered monitoring plan or applied methodology	The CPA-DDs for CPA-003 and CPA-004 have been updated to apply the post registration changes approved by the CDM EB on 13 October 2013.	<input checked="" type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> Not applicable	13 October 2013
Changes to the project design of a registered project activity	Not applicable	<input type="checkbox"/> Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> Not applicable	Not applicable

\* For further details refer to the "Post-registration changes request form" (F-CDM-PRC) and DNV's assessment opinion on the changes

## **APPENDIX C**

---

### **CURRICULA VITAE OF THE VERIFICATION TEAM MEMBERS**

***Francesca Feller***

Francesca started working in 2004 on the introduction of sustainable development and corporate responsibility best practices in Italy, to promote the adoption by national firms of the most recent sustainability strategies emerging from the international sustainability discourse. She subsequently moved on to work on climate change mitigation and adaptation in the urban environmental in London, taking part to a large urban regeneration project. The role combined achieving carbon reductions and climate-proof urban planning through interventions on existing structures as well as embedding sustainability in the design of new ones. In 2009 Francesca moved to a company specialised in taking part to tenders financed by the United Nations, the World Bank, the European Union and the Italian Ministry of Foreign Affairs for development programmes. Her role as Project Manager focused on the supply of off-grid renewable energy technologies for rural electrification and improved access to energy. She currently works as Senior Climate Change Consultant for DNV Accredited Climate Change Services, where her position involves executing and managing CDM/JI validation and verification assignments, verification under voluntary schemes, and third party services within the institutional climate change department, providing advisory services on climate change adaptation and mitigation to institutional customers, charing DNV's community of practice on Programmes of Activities under the UNFCCC, managing relations with large customers, and providing global support and training in the relevant specialized technical areas within the DNV global Climate Change Services team.

***Felipe Antunes***

Felipe Antunes holds a Master's Degree in Production Engineering (Quality) and a Post Graduate Diploma in Environmental Management and Industrial Waste Management and Treatment. Possesses an International experience of more than 10 years in the field of quality and environmental auditing, working two years as the responsible of the QMS of Rede Metrológica RS and since 1999 as a QMS and EMS auditor in DNV.

He has experience of more than 3 years in validation and verification of numerous CDM projects in DNV, both in South America & abroad. He has also been actively involved in Management System Audits such as ISO 9001, ISO 140001 and OHSAS 18001 standards in various industrial sectors for more than 10 years in DNV.

His qualification and experience in CDM demonstrate him sufficient sectoral competence in energy generation from renewable energy sources, waste handling and disposal, and animal waste management.