



MONITORING REPORT FORM (F-CDM-MR)
Version 02.0

MONITORING REPORT



Title of the project activity	Rwanda Electrogaz Compact Fluorescent Lamp (CFL) distribution project
Reference number of the project activity	3404
Version number of the monitoring report	01.0
Completion date of the monitoring report	18/09/2012
Registration date of the project activity	30/05/2010
Monitoring period number and duration of this monitoring period	First Monitoring Period: 30/05/2010 – 31/05/2012
Project participant(s)	<ul style="list-style-type: none"> • EWSA • Netherlands' Ministry of Infrastructure and the Environment (IenM) • BASF SE • KfW • Kommunalkredit Public Consulting GmbH • Government of Canada - Ministry of Foreign Affairs and International Trade • Maersk Olie og Gas A/S • DONG Naturgas A/S • Nordjysk Elhandel A/S • Danish Ministry of Climate and Energy/Danish Energy Agency • Göteborg Energi AB • Government of Italy - Ministry for the Environment, Land and Sea • Bruxelles Environnement – IBGE • Walloon Region: Walloon Air and Climate Agency • Kingdom of Spain - Ministry of Environment and Rural and Marine Affairs & Ministry of Economy and Finance • EDP - Energias de Portugal, S.A. • Endesa Generación, S.A. • Gas Natural SDG, S.A. • Hidroeléctrica del Cantábrico, S.A. • Ruukki Metals Oy • Statoil ASA • Statkraft Carbon Invest AS • Schweizerische Rückversicherungsgesellschafts AG (Swiss RE) • Daiwa Securities Capital Markets Co., Ltd. • Fujifilm Corporation • Idemitsu Kosan Co., Ltd. • JX Nippon Oil & Energy Corporation • The Okinawa Electric Power Corporation, Inc. • Luxembourg Ministry of Sustainable Development and Infrastructure
Host Party (ies)	Rwanda



Sectoral scope(s) and applied methodology(ies)	Sectoral Scope 3: Energy demand AMS-II.J. ver. 3 - Demand-side activities for efficient lighting technologies AMS-II.C. ver. 11 - Demand-side energy efficiency activities for specific technologies
Estimated amount of GHG emission reductions or net anthropogenic GHG removals by sinks for this monitoring period in the registered PDD	52,736 tCO ₂
Actual GHG emission reductions or net anthropogenic GHG removals by sinks achieved in this monitoring period	22,057 tCO ₂



SECTION A. Description of project activity

A.1. Purpose and general description of project activity

The purpose of the Rwanda Electrogaz CFL Distribution Project is to expand the use of high-efficiency lighting technology in Rwanda's residential sector through the distribution of high-quality Compact Fluorescent Lamps.

The project activity, implemented by the national public electricity utility, EWSA¹, is designed with two components:

Component 1: Existing grid-connected customers have the opportunity to exchange incandescent lamps of a range of 25 to 100 watts for high-quality self-ballasted compact fluorescent lamps (CFLs) of up to 20 Watts.

Component 2: As part of the national electrification program, which aims to increase the grid-connected rate up to 50% by 2020, newly connected EWSA customers receive a capped number of CFLs with their new electricity meter at the time of the connection. CFLs of 15 and 20 Watts were distributed.

The CFL distribution project is implemented through 4 phases starting mid-2007. Thus far 3 phases of distribution have been completed with distribution of 379,263 bulbs. As per the PDD, the total number of CFLs to be distributed in the 4 phases is 800,000.

The total emission reductions achieved during the monitoring period from 30/05/2010 to 31/05/2012 are 22,057 tCO₂.

A.2. Location of project activity

Location: Rwanda

Region: Country-wide

City/Town/Community etc: Country-wide, mainly in urban areas, at all EWSA existing or future customers

EWSA geographic cover is divided in 7 antennas in Kigali and 14 stations in the rest of the country:

- 7 antennas: Gikondo, Kacyiru, Kanombe, Muhima, Nyamirambo, Nyarugenge, and Remera,
- 14 stations: Gicumbi, Huye, Kabaya, Karongi, Muhanga, Musanze, Ngoma, Nyagatare, Nyamagabe, Nyanza, Rubavu, Rulindo, Rusizi, and Rwamagana.

The location of each customer, existing and new, is known from the "Customer contract number" (or ID) issued by EWSA. Each number is unique to a customer and provides complete information, including address and contact information.

¹ The name of this entity is EWSA (Energy, Water and Sanitation Authority), according to Law no 43/2000 of 07/12/2010. Prior to this date the name was RECO RWASCO. Prior to 08/2009, RECO - RWASCO was officially named Electrogaz. The change does not impact project legal terms and implementation. For coherence in this document, only EWSA is used in the MR to refer to the project entity, unless there is a historical or legal reason to use an earlier name.

**A.3. Parties and project participant(s)**

Party involved (host) indicates a host Party)	Private and/or public entity(ies) project participants (as applicable)	Indicate if the Party involved wishes to be considered as project participant (Yes/No)
Rwanda (host)	EWSA	NO
Netherlands	Netherlands' Ministry of Infrastructure and the Environment (IenM)	YES
Germany	BASF SE KfW	NO
Austria	Kommunalkredit Public Consulting GmbH	NO
Canada	Government of Canada - Ministry of Foreign Affairs and International Trade	YES
Denmark	Maersk Olie og Gas A/S DONG Naturgas A/S Nordjysk Elhandel A/S Danish Ministry of Climate and Energy/Danish Energy Agency	YES
Sweden	Goteborg Energi AB	NO
Italy	Government of Italy - Ministry for the Environment, Land and Sea	YES
Belgium	Bruxelles Environnement – IBGE Walloon Region: Walloon Air and Climate Agency	YES
Spain	Kingdom of Spain - Ministry of Environment and Rural and Marine Affairs & Ministry of Economy and Finance EDP - Energias de Portugal, S.A. Endesa Generación, S.A. Gas Natural SDG, S.A. Hidroeléctrica del Cantábrico, S.A.	YES
Finland	Ruukki Metals Oy	NO
Norway	Statoil ASA Statkraft Carbon Invest AS	NO



Switzerland	Schweizerische Rückversicherungsgesellschafts AG (Swiss RE)	NO
Japan	Daiwa Securities Capital Markets Co., Ltd. Fujifilm Corporation Idemitsu Kosan Co., Ltd. JX Nippon Oil & Energy Corporation The Okinawa Electric Power Corporation, Inc.	NO
Luxembourg	Ministry of Sustainable Development and Infrastructure	YES

A.4. Reference of applied methodology

AMS-II.J. “Demand-side activities for efficient lighting technologies” (Version 3)

AMS-II.C. “Demand-side energy efficiency activities for specific technologies” (Version 11)

“Tool to calculate the emission factor for an electricity system” (Version 2)

A.5. Crediting period of project activity

Fixed crediting period

Start Date: 30/05/2010

Length: 10 years 0 months

SECTION B. Implementation of project activity

B.1. Description of implemented registered project activity

The project is implemented in 4 phases. The first three phases of distribution are completed. The procurement for the purchase of 400,000 CFLs for phase 4 is finalized. The CFLs are in EWSA’s warehouse since December 2011. Their distribution started in July 2012.

The table below provides the number of CFLs distributed under each phase, as accounted for and double-checked as per the PDD requirements.

Table 1: CFL distribution project status

Phase	Procured/Estimated Number of CFLs	Actual Distributed CFL	Distribution Timeline in the registered PDD	Actual End date of distribution
Phase 1	50,000	48,827	August - September 2007	December 2007
Phase 2	150,000	147,681	September 2008 - March 2009	August 2009
Phase 3	200,000	182,755	Mid 2009	December 2010
Phase 4	400,000	N/A	Mid 2010 to early 2011 (monthly recorded)	(Strated in July)

The deviation between the number of CFLs procured and the number of CFLs distributed is due to the following:

- Some lamps were found faulty during the distribution,
- Others were broken, and
- Some losses were noted during the lamps distribution.

The overall timeline of the project was lengthened compared to the projection in the PDD due to two major factors, as follows:

- The distribution pace for existing customers (Component 1: Phase 1, Phase 2 and partly Phase 3) slowed down at the second half of Phase 2 and during Phase 3 as the coverage of existing customers increased, reducing the target population.
- Each phase is associated with a specific lamp purchase contract. The procurement process and the contract implementation (up to the lamp delivery) for the 3rd phase took more time than expected, leading to a delay of about 6 months. The planned supply of phase 4 of 400,000 CFLs in mid-2010 was delivered in December 2011 and their distribution started in July 2012.

In exchange for each CFL distributed in Component 1, the customers provide an incandescent lamp (ICL). All the incandescent lamps were shipped to the central warehouse in Kigali for storage before destruction. Prior to the destruction of the incandescent lamps, an Environmental study needs to be conducted to provide guidance on the proper way to dispose of the lamps (as required by REMA). The Rwanda National University has been selected to conduct the study. The contract has been signed, and it is expected that the study will be finalized in November 2012.

Table 2: Quantity and Rated power of the collected ICLs, ex-post monitored

ICL Power rate (W)	Number of ICL in Component 1		
	Phase 1	Phase 2	Phase 3
20	186	0	0
25	953	0	0
40	11,369	3,931	21,897
60	11,285	52,835	34,512
65	0	883	0
75	7,900	17,295	14,249
80	0	3,806	6
100	6,364	59,200	19,682

For Component 1, the number of distributed CFLs and received ICL should be equal; however, for unknown reasons, losses of ICLs resulted during the shifting of lamps from the branches to the central storage location in Kigali. The lamp numbers presented in the table above represent those that have been verified physically in the central storage location.

The number of lamps distributed per household was restricted in each Phase of the distribution. Phase 1 distribution was limited to 2 per household. Phase 2 was limited to 5 per household. Phase 3 was limited to 4 per household. The number of lamps distributed per household was always fewer than six.

B.2. Post registration changes**B.2.1. Temporary deviations from registered monitoring plan or applied methodology**

NA

B.2.2. Corrections

NA

B.2.3. Permanent changes from registered monitoring plan or applied methodology

NA

B.2.4. Changes to project design of registered project activity

NA

B.2.5. Changes to start date of crediting period

NA

B.2.6. Types of changes specific to afforestation or reforestation project activity

NA

SECTION C. Description of monitoring system**Data Collection Procedures****Data collection procedures applicable for both Component 1 (AMS-II.J) and Component 2 (AMS-II.C)***Recording of lamp distribution data*

Data	<ul style="list-style-type: none">• Date of CFL distribution• Customer identification (EWSA customer ID, which allows for unambiguous identification of the recipient of the equipment).• Number of CFLs provided and wattage.• Number of ICLs exchanged for each type (for Component 1 only).
Data generation	Customer provides unique identification to EWSA employee (e.g. EWSA bill, prepaid purchase or voucher). Component 1 only: Customer provides ICL(s) to EWSA employee. EWSA provides CFL(s) to customer.
Responsible	EWSA employees
Location	EWSA Antennas and Stations
Data recording	Phase 1: Data entered in a handwritten register Phase 2 & 3: Data entered into an electronic form in an in-house software Note: For Phase 1, paper records were not retained by most of EWSAs Antennas and Stations. Paper records were retained at the KARONGI branch, only.
Data aggregation	Phase 1: Data from handwritten registers aggregated in an excel spreadsheet Phase 2 & 3: Data aggregated directly in the in-house software
Archiving	All electronic data are stored until two years after the end of the crediting period

Note on ICL destruction: The ICLs were collected and stored at the distribution outlets, then shipped to EWSA central warehouse in Kigali. These lamps will be destroyed. Prior to the destruction of the incandescent lamps, an Environmental study needs to be conducted to provide guidance on the proper way to dispose of the lamps, to fulfil the requirements of REMA. The study has been contracted and is expected to be finalized in November 2012, after which it will be possible to destroy the stored ICLs.

**Data collection procedures applicable for Component 1 (AMS-II.J)**

Ex post monitoring surveys carried out within the first year after installation and once for every 30% of the elapsed rated lifetime (or every 3 years) to confirm installation and operation of the CFLs

The CFLs distributed in Phases 1 to 3 have a rated lifetime of 6,000 hours or 4.7 years, considering a daily use of 3.5 hours. Based upon this, and the requirement that the first survey be carried out within the first year after installation, the following schedule of the ex-post monitoring surveys was implemented.

Phase	Distribution End Date	Time Elapsed from 1st ex-post survey				Dates of ex-post surveys		
		30% of rated life	60% of Rated Life	90% of Rated Life	100% of rated life	First	Second	Third
Phase 1	Dec-07	28-Aug-09	24-Jan-11	21-Jun-12	10-Dec-12	Apr-08	Oct-09	Jun-11
Phase 2	Aug-09	27-Feb-11	25-Jul-12	21-Dec-13	11-Jun-14	Oct-09	Jun-11	NA
Phase 3	Dec-10	27-Oct-12	25-Mar-14	21-Aug-15	9-Feb-16	Jun-11	NA	NA

Data	<ul style="list-style-type: none"> Check whether each CFL distributed under the project activity is installed (based on records on the type/number of efficient lamps distributed to each individual household) Record whether CFLs distributed under the project activity are operational Determine whether defective CFLs were replaced by the end-user and, if so, with what type/wattage of lamp. <p><i>General Information:</i> <i>Interviewer</i> <i>Date of interview</i> <i>Name and Address (or description of location of dwelling)</i> <i>Ownership status (owner/tenant/other).</i></p>
Data generation	Door-to-door surveys of a sample of CFLs, with a sample size no less than 100 or 0.1% of the population
Responsible	EWSA
Location	Installation locations of distributed CFLs
Data recording	Data are recorded in a central database, or in a spread sheet and then in the database
Data aggregation	The data analysis results are provided in the survey report
Archiving	The survey report is stored until two years after the end of the crediting period

Data collection procedures applicable for Component 2 (AMS-II.C)

Annual checks of a sample of non-metered systems to ensure that they are still operating

The percentage of CFLs that are still operating is captured through annual surveys on a sample of non-metered lamps. The percentage of functioning non-metered CFLs will be used to discount the energy savings and thus emission reductions.

This information is already captured in the ex-post surveys that monitor installation and operation of the CFLs for the purpose of component 1. Samples are performed simultaneously with the ex-post surveys for Component 1. The relevant survey for this monitoring period was undertaken in June 2011.

This is only applicable for phase 3 (as phases 1 and 2 has only component 1). The third ex-post survey, which was finalized in June 2011, is used to determine the percentage of CFLs that are still operating for phase 3

Data	<ul style="list-style-type: none">Record whether CFLs distributed under the project activity are operational <i>General Information:</i> <i>Interviewer</i> <i>Date of interview</i> <i>Name and Address (or description of location of dwelling)</i> <i>Ownership status (owner/tenant/other).</i>
Data generation	Door-to-door surveys of a sample of CFLs, with a sample size no less than 100 or 0.1% of the population
Responsible	EWSA
Location	Installation locations of distributed CFLs
Data recording	Data are recorded in a central database, or in a spread sheet and then in the database
Data aggregation	The data analysis results are provided in the survey report
Archiving	The survey report is stored until two years after the end of the crediting period

Recording the “power” of the device installed using nameplate data or bench tests of a sample of the units installed

Samples are performed simultaneously with the ex-post surveys for Component 1. The relevant survey for this monitoring period was undertaken in June 2011.

Data	<ul style="list-style-type: none">CFLs distributed under the project activity that are installed and their name plate “power” (rated Wattage)Whether CFLs distributed under the project activity are operational
Data generation	Door-to-door surveys of a sample of CFLs, with a sample size no less than 100 or 0.1% of the population
Responsible	EWSA
Location	Installation locations of distributed CFLs
Data recording	Data are recorded in a central database, or in a spread sheet and then in the database
Data aggregation	The data analysis results are provided in the survey report
Archiving	The survey report is stored until two years after the end of the crediting period

Metering a sample of the units installed for their operating hours using run time meters

Data	<ul style="list-style-type: none">Average daily operating hours of project lamps
Data generation	Run-time meters with index set at zero installed on a sample of the total number of project CFLs; date of installation recorded On index recording date, index of the run time meter is noted The index is divided by the number of days of the monitored period to determine the operating hours per day of the monitored CFL The mean is calculated based on the observed values for the monitored CFLs
Responsible	EWSA
Location	Installation locations of distributed CFLs



Data recording	Data recorded on paper or electronically
Data aggregation	Data are aggregated in an excel spread sheet
Archiving	The database of monitoring results is stored until two years after the end of the crediting period

Organizational Structure

EWSA, the implementer of this project activity, conducts monitoring of the lamp distribution data through its antennas and stations or through private retailers; and collection, storage and destruction of ICLs.

EWSA supervises the monitoring surveys, which are undertaken by external consultants.

Initially, the project activity was partially included in EWSA's Urgent Electricity Rehabilitation Project (UERP), which closed in 2010. For the three first phases of the CDM project, the UERP implementation unit was responsible for the CFL purchase, including the procurement process. For the 4th Phase, EWSA is directly in charge of the procurement.

Training has been arranged for the relevant participants in the project monitoring:

- The EWSA CFL distribution staff was trained on the benefits of CFLs at the beginning of the project.
- The EWSA CFL distribution staff was also trained on the procedures for distribution and data recording in accordance with the requirements of the methodologies and the PDD.
- Staff using the in-house software for lamp distribution data collection was trained by the IT staff on use of the program.

Quality Control and Emergency Procedures

Recording of lamp distribution data

The EWSA station/antenna manager receives a specified number of CFLs, and the station/antenna manager acts as, or designates, a "storekeeper". The storekeeper releases a fixed number of CFLs to the lamps distributor. The distributor operates the computer, where data is entered on customer name/number, ICLs received and CFLs provided and their Wattage.

For component 1, the cashier and the customer test the ICLs and CFLs before the exchange. The storekeeper receives a specified number of ICLs from the cashier. ICLs are shipped to the EWSA warehouse in Kigali where they are stored before destruction. At the end of each phase, an independent party certifies the collection of incandescent lamps through a random sampling of the lamps in storage – the number, rating and operational condition of the ICLs, as per EWSA records. The independent certifier prepares a report, including witnessing the destruction/crushing of the ICLs in the safe disposal area.

SECTION D. Data and parameters

D.1. Data and parameters fixed ex ante or at renewal of crediting period

Data and parameters applicable for Component 1 (AMS-II.J) and 2 (AMS-II.C)

Data/Parameter	$EF_{CO_2,ELEC,y} / EF_{grid}$
Unit	kg CO ₂ e/kWh
Description	Emission factor for the national electricity grid for 2007
Source of data	The calculation is detailed in section B.6.3. of the registered PDD. All references are included in the annex to the PDD. Calculated as per Combined Margin approach from the “Tool to calculate the emission factor for an electricity system” (version 2), mentioned in ACM0002 and AMS I.D, using data from 2003 to 2008 provided by the electricity company Electrogaz (now EWSA).
Value(s) applied	0.6540
Purpose of data	Calculation of baseline emissions
Additional comment	

Data and parameters applicable for Component 1 (AMS-II.J)

Data/Parameter	TD_y
Unit	-
Description	Average annual technical grid losses in year y
Source of data	Methodology default value
Value(s) applied	0.1
Purpose of data	Calculation of baseline emissions
Additional comment	

Data/Parameter	NTG
Unit	-
Description	Net-to-gross adjustment factor
Source of data	Methodology default value
Value(s) applied	0.95
Purpose of data	Calculation of baseline emissions
Additional comment	

Data/Parameter	$P_{i,BL}$
Unit	Watts
Description	Rated power of the baseline incandescent lamps of the group of “i” lighting devices or 75W if the baseline lighting device is a 100W ICL and the project lighting device a 20W CFL
Source of data	Provided by EWSA
Value(s) applied	$P_{A,BL} = 25W, P_{B,BL} = 40W, P_{C,BL} = 60W, P_{D,BL} = 75W$
Purpose of data	Calculation of baseline emissions
Additional comment	



Data/Parameter	O_i
Unit	Hours
Description	Average daily operating hours of the lighting devices replaced by the group of “i” lighting devices
Source of data	Methodology default value
Value(s) applied	3.5
Purpose of data	Calculation of baseline emissions
Additional comment	

Data/Parameter	L_i
Unit	Years
Description	Equipment lifetime
Source of data	Technical specification set in the tender, provided by EWSA
Value(s) applied	At least 6000 hours
Purpose of data	Calculation of baseline emissions
Additional comment	

Data/Parameter	X_i
Unit	Hours
Description	Number of operating hours per year for equipment type <i>i</i>
Source of data	Methodology default value
Value(s) applied	1277.5
Purpose of data	Calculation of baseline emissions
Additional comment	The annual number of operating hours is calculated as 3.5 hours/day x 365 days/year.

Data and parameters applicable for Component 2 (AMS-II.C)

Data/Parameter	P_{i,BL}
Unit	Watts
Description	Power of the incandescent lamps in the baseline scenario
Source of data	Baseline survey conducted in April 2008
Value(s) applied	83.3
Purpose of data	Calculation of baseline emissions
Additional comment	

Data/Parameter	P_{i,PJ}
Unit	Watts
Description	Power of the CFLs installed of the group of <i>i</i> devices
Source of data	Provided by EWSA, technical specification set in the tender
Value(s) applied	P _{a,PJ} = 15W, P _{b,PJ} = 20W
Purpose of data	Calculation of project emissions
Additional comment	

**D.2. Data and parameters monitored*****Data and parameters applicable for Component 1 (AMS-II.J) and 2 (AMS-II.C)***

Data / Parameter	Customer information (for components 1 and 2)
Unit	-
Description	Customer Identification Number (unique – as per EWSA records) Name of head of household Address or description of location of household
Measured/ Calculated/ Default	Measured
Source of data	Recorded by EWSA
Value(s) of monitored parameter	Recorded information is available to the DOE; personal information not publicly released
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	Once at bulb distribution
Calculation method (if applicable)	NA
QA/QC procedures	Customer presents a EWSA bill, prepaid purchase or voucher to substantiate information (component 1) Compare to EWSA records from the Commercial Department data base (component 2)
Purpose of data	Calculation of baseline emissions
Additional comment	Components 1 and 2

Data / Parameter	Distribution date (Components 1 and 2)
Unit	Date
Description	Date of the CFL distribution uniquely recorded for each customer participant
Measured/ Calculated/ Default	Measured
Source of data	Recorded by EWSA
Value(s) of monitored parameter	Available to the DOE in the project distribution database
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	Once at distribution
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of emissions reductions
Additional comment	Components 1 and 2 Dates are reported monthly for the purpose of the ER calculations

***Data and parameters applicable for Component 1 (AMS-II.J)***

Data / Parameter	$Q_{PJ,i}$
Unit	-
Description	Number (quantity) of pieces of CFLs of type i distributed under the project,
Measured/ Calculated/ Default	Measured
Source of data	Recorded by EWSA
Value(s) of monitored parameter	<ul style="list-style-type: none"> For distributed CFL, $i = 15$ W Phase 3: 66,355 For distributed CFL, $i = 20$ W Phase 1: 48,827 Phase 2: 147,681 Phase 3: 22,567
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	Once at distribution
Calculation method (if applicable)	NA
QA/QC procedures	Equipment storage control system for inputs and outputs is applied at both EWSA central store at Kigali and in all antennas and stations. The IDs of the beneficiaries are compared to avoid duplication in each phase.
Purpose of data	Calculation of energy savings and emissions reductions
Additional comment	Component 1

Data / Parameter	$P_{i,PJ}$
Unit	Watts
Description	Rated power of the project CFLs of the group of “ i ” lighting devices, i
Measured/ Calculated/ Default	Default
Source of data	Technical specifications set in the tender
Value(s) of monitored parameter	Phase 1 and Phase 2 20 W Phase 3 15 W and 20 W
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	Once at distribution
Calculation method (if applicable)	NA
QA/QC procedures	For phase 3, control tests were conducted by laboratories accredited according to ISO 17025 (or equivalent standard) on the manufactured lamps that were labelled and already packed and with the witnessing of EWSA representatives.
Purpose of data	Calculation of baseline emissions
Additional comment	Component 1



Data / Parameter	Q _{BL,i}					
Unit	-					
Description	Number (quantity) of pieces of incandescent lamps (ICLs) of type <i>i</i> exchanged under the project					
Measured/ Calculated/ Default	Measured					
Source of data	Recorded by EWSA					
Value(s) of monitored parameter	ICL types		Values per Phase and CFL type			
	Parameter	(W)	Phase 1	Phase 2	Phase 3	
			20 W	20 W	15 W	20 W
	P _{ABL}	25	953	0	0	0
	P _{BBL}	40	11,369	3,931	21,897	0
	P _{CBL}	60	11,285	53,718	34,512	0
	P _{DBL}	75	14,264	80,301	0	22,567
Monitoring equipment	NA					
Measuring/ Reading/ Recording frequency	Once at CFL distribution					
Calculation method (if applicable)	NA					
QA/QC procedures	A third party conducts controls of the ICLs stock to ensure consistency between the stock and the database. The sampling methodology is based on the Spanish standard UNE 66020-1: 2001 (equivalent to International Standard ISO 2859-1: 1999).					
Purpose of data	Calculation of energy savings and emissions reductions					
Additional comment	For Component 1 only. Collected ICLs are matched to distributed project CFLs on a 1 to 1 basis. 20 W collected ICLs are excluded from consideration.					
	ICL with rated power equal or above 75W are conservatively counted as 75W ICLs in the baseline.					
	65W ICL are conservatively counted as 60W ICL in the baseline.					
	The emission reduction calculations apply the minimum number of bulbs between ICLs collected and CFLs distributed.					

Data / Parameter	P _{i,BL}																																													
Unit	Watts																																													
Description	Rated power of the baseline incandescent lamps (ICLs) of the group of “i” lighting devices or 75W if the baseline lighting device is a 100W ICL and the project lighting device a 20W CFL																																													
Measured/ Calculated/ Default	Default																																													
Source of data	Recorded by EWSA using lamp marking																																													
Value(s) of monitored parameter	<table><tr><td></td><td colspan="8">Collected ICL Wattage and number</td></tr><tr><td></td><td>20W</td><td>25W</td><td>40W</td><td>60W</td><td>65W</td><td>75W</td><td>80W</td><td>100W</td></tr><tr><td>Phase 1</td><td>186</td><td>953</td><td>11,369</td><td>11,285</td><td>0</td><td>7,900</td><td></td><td>6,364</td></tr><tr><td>Phase 2</td><td></td><td></td><td>3,931</td><td>52835</td><td>883</td><td>17,295</td><td>3,806</td><td>59200</td></tr><tr><td>Phase 3</td><td></td><td></td><td>21897</td><td>34512</td><td>0</td><td>14249</td><td>6</td><td>19682</td></tr></table>		Collected ICL Wattage and number									20W	25W	40W	60W	65W	75W	80W	100W	Phase 1	186	953	11,369	11,285	0	7,900		6,364	Phase 2			3,931	52835	883	17,295	3,806	59200	Phase 3			21897	34512	0	14249	6	19682
	Collected ICL Wattage and number																																													
	20W	25W	40W	60W	65W	75W	80W	100W																																						
Phase 1	186	953	11,369	11,285	0	7,900		6,364																																						
Phase 2			3,931	52835	883	17,295	3,806	59200																																						
Phase 3			21897	34512	0	14249	6	19682																																						
Monitoring equipment	NA																																													
Measuring/ Reading/ Recording frequency	Once at CFL distribution																																													
Calculation method (if	NA																																													



applicable)	
QA/QC procedures	A third party conducts controls of the ICLs stock to ensure consistency between the stock and the database. The sampling methodology is based on the Spanish standard UNE 66020-1: 2001 (equivalent to International Standard ISO 2859-1: 1999).
Purpose of data	Calculation of energy savings and emissions reductions.
Additional comment	Component 1 The numbers of ICL per wattage of baseline devices are consolidated as shown in the previous table.

Data / Parameter	N _{sample,s}
Unit	-
Description	Number of sampled CFLs during the post installation survey <i>s</i>
Measured/ Calculated/ Default	Measured
Source of data	Survey reports
Value(s) of monitored parameter	1 st ex-post monitoring survey: Phase 1: 100 2 nd ex-post monitoring survey: Phase 1: 100, Phase 2: 200 3 rd ex-post monitoring survey: Phase 1: 110, Phase 2: 125, Phase 3: 120
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	As per AMS-II.J, ex-post surveys are conducted: – Once in the first year of installation, and – Once every 3 years, or once for every 30% of elapsed rated lifetime (whichever is shorter) 1 st ex-post monitoring survey: April, 2008 2 nd ex-post monitoring survey: October, 2009 3 rd ex-post monitoring survey: June, 2011
Calculation method (if applicable)	NA
QA/QC procedures	As per AMS-II.J, the sampling size is determined by minimum 90% confidence interval and the 10% maximum error margin; the size of the sample shall be no less than 100. Using the calculation method for a normal distribution, the sample size would be 68, which is lower than the minimum size allowed by the methodology. Hence, the minimum size of the sample is 100 for each population (or phase).
Purpose of data	Calculation of baseline emissions
Additional comment	Component 1

Data / Parameter	N _{OK,s}
Unit	-
Description	Number of sampled CFLs which are functional during the post installation survey <i>s</i>
Measured/ Calculated/ Default	Measured
Source of data	Survey reports
Value(s) of monitored parameter	1 st ex-post monitoring survey: Phase 1: 84 2 nd ex-post monitoring survey: Phase 1: 88; Phase 2: 160 3 rd ex-post monitoring survey: Phase 1: 58; Phase 2: 74; Phase 3: 77
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	As per AMS-II.J, ex-post surveys are conducted: – Once in the first year of installation, and – Once every 3 years, or once for every 30% of elapsed rated



	lifetime (whichever is shorter) 1 st ex-post monitoring survey: April, 2008 2 nd ex-post monitoring survey: October, 2009 3 rd ex-post monitoring survey: June, 2011
Calculation method (if applicable)	NA
QA/QC procedures	NA
Purpose of data	Calculation of baseline emissions
Additional comment	Component 1

Data and parameters applicable for Component 2 (AMS-II.C)

Data / Parameter	N_i
Unit	-
Description	Number (quantity) of pieces of CFLs of type i distributed under the project
Measured/ Calculated/ Default	Measured
Source of data	Recorded by EWSA
Value(s) of monitored parameter	<ul style="list-style-type: none"> For distributed CFL, $i = 15$ W Phase 3: 23,482 For distributed CFL, $i = 20$ W Phase 3: 70,351
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	Once at distribution
Calculation method (if applicable)	NA
QA/QC procedures	Equipment storage control system for inputs and outputs is applied at both EWSA central store at Kigali and in all antennas and stations.
Purpose of data	Calculation of baseline emissions
Additional comment	Component 2

Data / Parameter	$P_{i,PJ}$
Unit	Watts
Description	Rated power of the project CFLs of the group of “ i ” lighting devices
Measured/ Calculated/ Default	Default
Source of data	Technical specifications set in the tender
Value(s) of monitored parameter	Phase 3 15 W and 20 W
Monitoring equipment	NA
Measuring/ Reading/ Recording frequency	Once at distribution
Calculation method (if applicable)	NA
QA/QC procedures	For phase 3, control tests were conducted by laboratories accredited according to ISO 17025 (or equivalent standard) on the manufactured lamps that were labelled and already packed and with the witnessing of EWSA representatives.
Purpose of data	Calculation of project emissions
Additional comment	Component 2



Data / Parameter	$O_{k,d,m}$
Unit	Hours
Description	Operating hours of the distributed CFL k on day d as given by valid meter m
Measured/ Calculated/ Default	Measured from a sample
Source of data	Readings of measuring instruments
Value(s) of monitored parameter	Mean Value: 4.7 Individual values available in an excel spreadsheet
Monitoring equipment	Run-time meters installed at sample of CFLs
Measuring/ Reading/ Recording frequency	At least once annually
Calculation method (if applicable)	On recording date, index of the run time meter is noted. The index is divided by the number of days of the monitored period to determine the operating hours per day of the monitored CFL. The mean is calculated based on the observed values for the monitored sample CFLs.
QA/QC procedures	Meter technology and calibration and metering procedures was to have been described by the manufacturer at the time of purchase. Validity and reliability of meters are evaluated. The run-time meter manufacturer did not provide any calibration procedures. EWSA uses the equipment from the Electricity Technical Control Bureau operating with the time measuring device to test the accuracy of metering.
Purpose of data	Calculation of energy savings and emissions reductions
Additional comment	Component 2

D.3. Implementation of sampling plan

(1) Data and parameters determined by a sampling approach: Component 1:

$N_{\text{sample},s}$ Number of sampled CFLs during the post installation survey s & $N_{\text{OK},s}$ Number of sampled CFLs which are functional during the post installation survey s

Implemented sampling design

The sampling objective was to determine the ex-post Lamp Failure Rate for adjustment of the net electricity savings and emission reduction calculations. As per AMS-II.J, the sampling size was determined by minimum 90% confidence interval and 10% maximum error margin; and the size of the sample was to be no less than 100. The target population is the distributed CFLs under Phase 1 through Phase 3. The sampling method was applied to each Phase separately. The number of households is determined by dividing the sample size by the number of CFLs distributed per household in each phase. Cluster sampling was applied where clusters corresponded to EWSA branches, which are located in various administrative entities called sectors and districts, and clusters were randomly selected. 5 households are visited in each EWSA branch. Thus, the number of clusters (branches) is determined.

The following method was used to select the cluster and the households to be surveyed based on the number of CFLs to be covered by the survey:

1. Make a list of antennas
2. Establish a sample selection interval
3. Pin point the distributed lamps named population
4. Calculate cumulative population
5. Choose randomly a number which is a starting point
6. Add the sampling interval for moving to the next step and select the cluster within which the number falls. For example, for Phase 1, the sampling interval is 4,366 (48023/11). First selected number (starting point) was 321 which falls into Gikondo Branch and the next branch corresponds number 4,687 (321+4,366), which is also Gikondo Branch. The following branch has number 9,053 (4,687+4,366), which corresponds to Muhima Branch, etc.
7. Within the cluster the households to be surveyed are randomly selected.

The number of samples for the survey relevant for this monitoring report is presented in the below table. The survey date is June 2011, which corresponds to the third survey for Phase 1, second survey for Phase 2 and first survey for Phase 1.

Sampling Frame	Final Sample Size (number of CFLs)	Number of CFLs per household	Number of households surveyed	Number of clusters (branches surveyed)
Phase 1 CFLs	110	2	55	11
Phase 2 CFLs	125	5	25	5
Phase 3 CFLs	120	4	30	6
Total	355	-	110	-

Collected Data

The collected data is summarized in the survey report.

Analysis of the collected data

	$N_{OK,s}$	$N_{Sample,s}$	$LFR_{i,y}$
Phase 1	58	110	0.473
Phase 2	74	125	0.408
Phase 3	77	120	0.358

(2) Data and parameters determined by a sampling approach: Component 2:

$O_{k,d,m}$ Operating hours of the distributed CFL k on day d as given by valid meter m

Implemented sampling design

Run-time meters were correctly installed on a sample of 61 of the total number of CFLs installed under Phase 3, Component 2 of the project activity. To assure a random selection and to base the measurement on different lighting locations per household, meters were installed on each of the CFLs distributed to every 1000th new customer who benefits from the project, in each of the antennas / stations (i.e. 1, 1001, 2001, etc.). Thirty-four (34) households were included in the sample. The first run-time meters were installed with Phase 3 CFLs from November 2009 to December 2010. The hour meters were reinstalled, or read if they had been installed correctly initially, in July- August 2011. The second reading took place in April – July 2012.

Collected Data

Collected data is provided in the attached spreadsheet.

Analysis of the collected data

61 valid readings were obtained from the sample of meters. This range represents the clear majority of the results, excludes results that seem unrealistic based on common usage times and results in an O_i of 4.7 hours. To ensure that the mean operating hours value obtained is representative of the population, the error margin is calculated from the readings. Descriptive statistics of the collected data are described here.

<i>Parameter</i>	<i>Value</i>	<i>Description</i>
Population	93,833	CFL bulbs
Sample meters	61	Meter readings
Mean operating hours	4.7	Hours
Standard Deviation	2.16	
Confidence Interval Radius	0.54	
Margin of error	11.5%	

Demonstration on whether the required confidence/precision has been met

The PDD monitoring plan requires confidence / precision of 95/15 for this parameter. The actual achieved confidence / precision was 95/11.5. Therefore, the requirement has been met.

Checks of a sample of non-metered systems to ensure that they are still operating*Implemented sampling design*

The sampling objective was to determine the percentage of systems that are still operating, to apply to Component 1. The sample was the same as that for Component 1, Phase 3 to determine the ex-post Lamp Failure Rate for that component. For the two components, the bulbs and time of distribution are identical; hence, the sample is appropriate. The target population is the distributed CFLs under Phase 3. Cluster

sampling was applied where clusters corresponded to EWSA branches, which are located in various administrative entities called sectors and districts, and clusters were randomly selected.

Moreover, 5 households are visited in each EWSA branch. Thus, the number of clusters is determined. The following method was used to select the cluster and the households to be surveyed based on the number of CFLs to be covered by the survey:

1. Make a list of antennas
2. Establish a sample selection interval
3. Pin point the distributed lamps named population
4. Calculate cumulative population
5. Choose randomly a number which is a starting point
6. Add the sampling interval for moving to the next step and select the cluster within which the number falls.
7. Within the cluster the households to be surveyed are randomly selected.

The number of samples for the survey relevant for this monitoring report was as follows. Survey date: June 2011.

Sampling Frame	Final Sample Size (number of CFLs)	Number of CFLs per household	Number of households surveyed	Number of clusters (branches surveyed)
Phase 3 CFL	120	4	30	6

Collected Data

The collected data is summarized in the survey report.

Analysis of the collected data

	Systems operational	Systems sampled	<i>Percentage of systems that are still operating</i>
Phase 3	77	120	64%

SECTION E. Calculation of emission reductions or GHG removals by sinks

E.1. Calculation of baseline emissions or baseline net GHG removals by sinks

Component 1

As per AMS-II.J, the emissions reduction by the project activity in year y is calculated directly as follows.

$$ER_y = NES_y * EF_{CO_2,ELEC,y}$$

Where:

$EF_{CO_2,ELEC,y}$ = Emission factor in year y calculated in accordance with the provisions in AMS I.D (tCO₂/MWh)

ER_y = Emission reductions in year y (tCO₂e)

$$NES_y = \sum Q_{PJ,i} * (1 - LFR_{i,y}) * ES_i * NTG / (1 - TD_y)$$

$$ES_i = (P_{i,BL} - P_{i,PJ}) * O_i * 365/1000$$

Where:

NES_y = Net electricity saved in year y (kWh)

$Q_{PJ,i}$ = Number (quantity) of pieces of equipment of type i distributed under the project activity (units)

i = Counter for equipment type

ES_i = Estimated annual electricity savings for equipment of type i , for the relevant technology (kWh)

$LFR_{i,y}$ = Lamp Failure Rate for equipment type i in year y (fraction)

TD_y = Average annual technical losses (transmission and distribution) in year y

NTG = Net-to-gross adjustment factor, a default value of 0.95 to be used unless a more appropriate value based on a lighting use survey from the same region and not older than 2 years is available

$P_{i,BL}$ = Rated power of the baseline lighting devices of the group of “ i ” lighting devices (Watts) or 75W if the baseline lighting device is a 100W ICL and the project lighting device a 20W CFL²

$P_{i,PJ}$ = Rated power of the project lighting devices of the group of “ i ” lighting devices (Watts)

O_i = Average daily operating hours of the lighting devices replaced by the group of “ i ” lighting devices

The Lamp Failure Rate (LFR_y), the % of lamps that have failed, is calculated based on the results of the ex-post surveys as follows:

$$LFR_y = 1 - (N_{OK,x} / N_{Sample,s})$$

Ex-post survey 3, June 2011

	$N_{OK,x}$	$N_{Sample,s}$	LFR_y
Phase 1	58	110	0.473
Phase 2	74	125	0.408
Phase 3	77	120	0.358

With respect to $Q_{PJ,i}$, since the quantity of collected ICLs and distributed CFLs do not match (fewer ICLs than CFLs), the ER calculation considers only as many CFLs as correspond to a collected ICL, to ensure conservativeness.

The detailed CERs calculation for component 1 is in the attached calculation spreadsheet.

Component 2

As per AMS-II.C, the emissions reduction by the project activity in year y is calculated directly as follows.

$$ER_y = (E_{BL} - E_{PJ}) * EF_{grid} * (\% \text{ in operation})$$

Where:

ER_y = Annual reduction of GHG emissions

BE_y = Annual GHG emissions in baseline scenario

PE_y = Annual GHG emissions in project scenario

E_{BL} = Annual electricity consumption by the ICLs in the baseline scenario

E_{PJ} = Annual electricity consumption by the CFLs in the project scenario

EF_{grid} = Emission Factor of the connected grid

² For conservativeness, and as agreed by the EB following with a request for deviation of AMS-II.J, when a 100W ICL is replaced by a 20W CFL, it is considered in the electricity savings calculations “that 20 W CFL is replacing a 75 W incandescent bulb (which is the next available standard wattage of incandescent bulb for which the light output of 20 W CFL will be equivalent or higher)”.

% in operation = percent of sampled CFLs which are functional (based on ex-post survey)

$$E_{BL \text{ or } PJ} = \sum (N_i * P_{i,BL \text{ or } PJ} * O_i) / (1 - l_y)$$

Where:

$E_{BL \text{ or } PJ}$ = annual energy baseline (BL) or project (PL) in kWh per year

N_i = the number of devices installed of the group i devices

$P_{i,BL \text{ or } PL}$ = the power of the device installed of the group i devices (either recorded for CFLs or assumed for ICLs)

O_i = the average annual operating hours of the devices

l_y = Average annual technical grid losses (transmission and distribution) during year y for the grid serving the locations where the devices are installed, expressed as a fraction.

The percentage of functioning non metered CFLs (64%, as demonstrated in Section D).is used to discount the energy savings and thus emission reductions.

Full calculations for all project components, for the entire monitoring period, are demonstrated in the attached spreadsheet.

E.2. Calculation of project emissions or actual net GHG removals by sinks

NA

E.3. Calculation of leakage

NA

E.4. Summary of calculation of emission reductions or net anthropogenic GHG removals by sinks

Item	Baseline emissions or baseline net GHG removals by sinks (tCO ₂ e)	Project emissions or actual net GHG removals by sinks (tCO ₂ e)	Leakage (tCO ₂ e)	Emission reductions or net anthropogenic GHG removals by sinks (tCO ₂ e)
Total	22,057	0	0	22,057

E.5. Comparison of actual emission reductions or net anthropogenic GHG removals by sinks with estimates in registered PDD

Item	Values estimated in ex-ante calculation of registered PDD	Actual values achieved during this monitoring period
Emission reductions or GHG removals by sinks (tCO₂e)	52,736	22,057

E.6. Remarks on difference from estimated value in registered PDD

There is no increase in the actual GHG emission reductions achieved during this monitoring period as compared to estimates in the registered PDD. The main reason for the achievement of fewer emission reductions than estimated in the registered PDD, is:

- the delay in the distribution of the CFLs, especially those of Phase 4, which represent 50% of the bulbs to be distributed under the project.
- The lower number of verified collected ICL compared to the estimate in the PDD.



History of the document

Version	Date	Nature of revision
02.0	EB 66 13 March 2012	Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).
01	EB 54, Annex 34 28 May 2010	Initial adoption.
Decision Class: Regulatory Document Type: Form Business Function: Issuance		