



**Monitoring report form**  
**(Version 05.1)**

*Complete this form in accordance with the Attachment "Instructions for filling out the monitoring report form" at the end of this form.*

**MONITORING REPORT**

|  |  |
|--|--|
| <b>Title of the project activity</b>                                   | Rwanda Electrogaz Compact Fluorescent Lamp (CFL) distribution project  |
| <b>UNFCCC reference number of the project activity</b>                 | 3404   |
| <b>Version number of the monitoring report</b>                         | 4  |
| <b>Completion date of the monitoring report</b>                        | 23/03/2017   |
| <b>Monitoring period number and duration of this monitoring period</b> | Second Monitoring Period: 01/08/2012 – 31/03/2014  |
| <b>Project participant(s)</b>  | <p><b>Rwanda:</b> Rwanda Energy Group Ltd (REG Ltd);</p> <p><b>Netherlands:</b> Netherlands' Ministry of Infrastructure and the Environment (IenM);</p> <p><b>Germany:</b> BASF SE; KfW;</p> <p><b>Austria:</b> Kommunalkredit Public Consulting GmbH;</p> <p><b>Denmark:</b> Maersk Olie og Gas A/S; Dong Energy Salg &amp; Service A/S; Nordjysk Elhandel A/S; Danish Ministry of Climate, Energy and Building/Danish Energy Agency; Aalborg Portland A/S;</p> <p><b>Sweden:</b> Goteborg Energi AB;</p> <p><b>Italy:</b> Government of Italy - Ministry for the Environment, Land and Sea;</p> <p><b>Belgium:</b> Bruxelles Environnement – IBGE; Walloon Region: Walloon Air and Climate Agency;</p> <p><b>Spain:</b> Kingdom of Spain - Ministry of Agriculture, Food and Environment and Ministry of Economy and Competitiveness; EDP - Energias de Portugal, S.A.; Endesa Generación, S.A.; Gas Natural SDG, S.A.; Hidroeléctrica del Cantábrico, S.A.;</p> <p><b>Finland:</b> Ruukki Metals Oy;</p> <p><b>Norway:</b> Statoil ASA; Statkraft Carbon Invest AS;</p> <p><b>Switzerland:</b> Schweizerische Rückversicherungsgesellschafts AG (Swiss RE);</p> <p><b>Japan:</b> Daiwa Securities Co., Ltd.; Fujifilm Corporation; Idemitsu Kosan Co., Ltd.; JX Nippon Oil &amp; Energy Corporation; The Okinawa Electric Power Corporation, Inc.;</p> <p><b>Luxembourg:</b> Ministry of Sustainable Development and Infrastructure</p> |

|  |  |   |
|--|--|---|
|  | <b>Bilateral and Multilateral Funds:</b> International Bank for Reconstruction and Development (IBRD) as Trustee of the Community Development Carbon Fund (CDCF) |   |
| <b>Host Party</b>  | Rwanda   |   |
| <b>Sectoral scope(s)</b>   | Sectoral Scope 3: Energy demand  |   |
| <b>Selected methodology(ies)</b>   | AMS-II.J. ver. 7 - Demand-side activities for efficient lighting technologies  |   |
| <b>Selected standardized baseline(s)</b>   | -  |   |
| <b>Estimated amount of GHG emission reductions or net GHG removals by sinks for this monitoring period in the registered PDD</b> | 45,714   |   |
| <b>Total amount of GHG emission reductions or net GHG removals by sinks achieved in this monitoring period</b>                   | GHG emission reductions or net GHG removals by sinks reported up to 31 December 2012   | GHG emission reductions or net GHG removals by sinks reported from 1 January 2013 onwards |
|  | 3,682  | 10,910  |

## SECTION A. Description of project activity

### A.1. Purpose and general description of project activity

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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 Rwanda Energy Group, Ltd (REG Ltd)<sup>1</sup>, 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 36% by 2020, newly connected REG 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. Distribution of 4 phases was completed as of May 2014, with distribution of nearly 700,000 lamps. Emission reductions achieved from lamps distributed under Phase 4 have not been claimed in this monitoring report.

The total emission reductions achieved during the monitoring period from 01/08/2012 to 31/03/2014 are 14,592 tCO<sub>2</sub>.

### A.2. Location of project activity

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Location: Rwanda

Region: Country-wide

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

REG 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 REG. Each number is unique to a customer and provides complete information, including address and contact information.

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<sup>1</sup> The name of this entity is REG (Rwanda Energy Group) according to Law no 87/03 of 16/08/2014. Prior to this data the name was EWSA (Energy, Water and Sanitation Authority). Prior to 07/12/2010 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 REG 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 whether the Party involved wishes to be considered as project participant (yes/no) |
|---|---|---|
| Rwanda (host)   | Rwanda Energy Group (REG)   | No  |
| Netherlands   | Netherlands' Ministry of Infrastructure and the Environment (IenM)  | Yes   |
| Germany   | BASF SE; KfW  | No  |
| Austria   | Kommunalkredit Public Consulting GmbH   | No  |
| Denmark   | Maersk Olie og Gas A/S; Dong Energy Salg & Service A/S; Nordjysk Elhandel A/S; Danish Ministry of Climate, Energy and Building/Danish Energy Agency; Aalborg Portland A/S   | 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 Agriculture, Food and Environment and Ministry of Economy and Competitiveness; 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 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   |
| Netherlands, Belgium, Spain, Luxembourg, Austria, Finland | International Bank for Reconstruction and Development (IBRD) as Trustee of the Community Development Carbon Fund (CDCF)   | Yes   |

**A.4. Reference of applied methodology and standardized baseline**

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AMS-II.J. "Demand-side activities for efficient lighting technologies" (Version 7) - <http://cdm.unfccc.int/methodologies/DB/GIIF3094709KR4YEEJXX72UY39L6Y4>

"Tool to calculate the emission factor for an electricity system" (Version 2) - <https://cdm.unfccc.int/methodologies/PAmethodologies/tools/am-tool-07-v2.pdf>

#### A.5. Crediting period of project activity

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Fixed crediting period

Start Date: 30/05/2010

Length: 10 years 0 months

#### A.6. Contact information of responsible persons/entities

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### SECTION B. Implementation of project activity

#### B.1. Description of implemented registered project activity

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The project is implemented in 4 phases, all of them completed as of the completion of this monitoring report.

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 <sup>2</sup> | Distribution Timeline in the registered PDD | Actual End date of distribution |
|---------------------|-----------------------------------|-------------------------------------|---|---------------------------------|
| Phase1              | 50,000                            | 43,119                              | August - September 2007                     | December 2007                   |
| Phase2              | 150,000                           | 132,351                             | September 2008 - March 2009                 | June 2009                       |
| Phase3              | 200,000                           | 185,453                             | Mid 2009                                    | December 2010                   |
| Phase4 <sup>3</sup> | 400,000                           | 308,306                             | Mid 2010 to early 2011 (monthly recorded)   | May 2014                        |

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:

<sup>2</sup> The number of lamps used for ER calculation is taken conservatively by comparing the number of CFLs distributed with the number of ICLs collected.

<sup>3</sup> Phase 4 have not been considered in this monitoring report, which comprise the period 1/08/2012 to 31/3/2014. Phase 4 distribution was completed in May 2014.

- 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 3<sup>rd</sup> phase took more time than expected, mainly due to procurement delays, 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 was only completed as of May 2014.

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 Rwanda Environmental Management Authority - REMA). The Rwanda National University has prepared the study. The report has been sent to the Rwanda Development Board (RDB) which is entitled to approve EIAs in Rwanda, and the project participants are awaiting the response from RDB, prior to implementing the recommendation of the report on ICL disposal.

**Table 2: Quantity and Rated power of the collected ICLs, ex-post monitored<sup>4</sup>**

| ICL Group (W) | Power rate | Number of ICL in Component 1 |         |         |
|---------------|------------|------------------------------|---------|---------|
|               |            | Phase 1                      | Phase 2 | Phase 3 |
| 25            |            | 953                          | 0       | 0       |
| 40            |            | 12,330                       | 1,068   | 22,059  |
| 60            |            | 11,961                       | 51,266  | 34,667  |
| 75            |            | 15,084                       | 79,708  | 33,970  |
| <b>Total</b>  |            | 40,328                       | 132,042 | 90,696  |

For Component 1, the number of distributed CFLs and received ICL should be equal; however, losses of ICLs occurred 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. Also, broken ICLs were not accounted for.

The number of lamps distributed per household was restricted in each Phase of the distribution. Phase 1 distribution was limited to two (2) per household. Phase 2 was limited to five (5) per household. Phase 3 was limited to four (4) per household. The number of lamps distributed per household was always fewer than six (6).

## **B.2. Post-registration changes**

### **B.2.1. Temporary deviations from registered monitoring plan, applied methodology or applied standardized baseline**

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N/A

### **B.2.2. Corrections**

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A request for corrections was submitted via a request for post-registration change on 27/09/2016 and approved as of 02/12/2016. In the approved revised PDD dated 27/10/2016 (version 14), the following corrections were included:

- The name of the project participant was changed to REG Ltd. from Electrogaz throughout (This change was notified to the UNFCCC on 30 April 2015).
- The list of project participants was corrected in line with the list on the UNFCCC webpage

<sup>4</sup> Refer to project databases. The number of lamps used for ER calculation is taken conservatively by comparing the number of CFLs distributed with the number of ICLs collected.

- The parameter fixed ex ante “Percentage of lamps of type i operating at the rated lifetime (Ri)” was included as it was not listed in the original registered PDD. It is a default value provided by applied methodology AMS.II.J version 07.
- The list of parameters fixed ex ante and parameters to be monitored were updated as some of the parameters were included in the wrong sections.

(Details are available at <http://cdm.unfccc.int/PRCContainer/DB/prcp447598078/view>)

### B.2.3. Changes to start date of crediting period

>>  
N/A

### B.2.4. Inclusion of a monitoring plan to the registered PDD that was not included at registration

>>  
N/A

### B.2.5. Permanent changes from registered monitoring plan, applied methodology or applied standardized baseline

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A request for permanent change from the registered monitoring plan and applied methodology was submitted via a request for post-registration change on 27/09/2016 and approved as of 02/12/2016. In the approved revised PDD dated 27/10/2016 (version 14), the following permanent changes were made:

- All the requirements of methodology AMS-II.J version 07 were adopted to Component 1 and Component 2 as it was recommended by the UNFCCC Small Scale Working Group (SSCWG) during its 50th meeting;
- A description of the sampling plan according to the Standard: Sampling and surveys for CDM project activities and programme of activities” version 05.0 was included

### B.2.6. Changes to project design of registered project activity

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N/A

### B.2.7. Types of changes specific to afforestation or reforestation project activity

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N/A

## SECTION C. Description of monitoring system

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### Data Collection Procedures

### Data collection procedures applicable for both Component 1 (AMS-II.J, Version 07) and Component 2 (AMS-II.J, Version 07)

#### *Recording of lamp distribution data*

|             |   |
|-------------|---|
| <b>Data</b> | Date of CFL distribution<br>Customer identification (REG customer ID, which allows for unambiguous identification of the recipient of the equipment).<br>Number of CFLs provided and wattage.<br>Number of ICLs exchanged for each type (for Component 1 only). |
|-------------|---|

|                         |   |
|-------------------------|---|
| <b>Data generation</b>  | Customer provides unique identification to REG employee (e.g. REG bill, prepaid purchase or voucher).<br><b>Component 1 only:</b> Customer provides ICL(s) to REG employee.<br>REG provides CFL(s) to customer.                           |
| <b>Responsible</b>      | REG employees   |
| <b>Location</b>         | REG Antennas and Stations   |
| <b>Data recording</b>   | Phase 1: Data entered in a handwritten register and then entered into an Excel database.<br>Phase 2 & 3: Data entered in an Excel database and in an in-house software.<br>The Excel database serves as the reference for data recording. |
| <b>Data aggregation</b> | Phase 1: Data from handwritten registers aggregated in the Excel database<br>Phase 2 & 3: Data aggregated Excel database and in the in-house software.<br>The Excel database serves as the reference for data recording.                  |
| <b>Archiving</b>        | 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 REG central warehouse in Kigali. These lamps will be destroyed. Prior to the destruction of the incandescent lamps, an Environmental study has been conducted to provide guidance on the proper way to dispose of the lamps, to fulfil the requirements of REMA. The study has been concluded and presented to the relevant authority for approval. Once approval is obtained, it will be possible to follow the study recommendations regarding the stored ICLs.

Data collection procedures applicable for Component 1 (AMS-II.J, Version 07)

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 has been implemented.

| Phase   | Time Elapsed from Equipment Installation |                   |                   |                    | 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 | 5/28/2009                                | 10/24/2010        | 3/21/2012         | 9/9/2012           | Apr-08                   | Oct-09 | Jun-11 |
| Phase 2 | 11/26/2010                               | 4/23/2012         | 9/19/2013         | 3/10/2014          | Oct-09                   | Jun-11 | Sep-13 |
| Phase 3 | 5/28/2012                                | 10/24/2013        | 3/22/2015         | 9/10/2015          | Jun-11                   | Sep-13 | NA     |

|             |   |
|-------------|---|
| <b>Data</b> | 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)<br>Record whether CFLs distributed under the project activity are operational<br>Determine whether defective CFLs were replaced by the end-user and, if so, with what type/wattage of lamp.<br><i>General Information:</i><br><i>Interviewer</i> |
|-------------|---|



|                         |   |
|-------------------------|---|
|                         | <i>Date of interview</i><br><i>Name and Address (or description of location of dwelling)</i><br><i>Ownership status (owner/tenant/other).</i> |
| <b>Data generation</b>  | Door-to-door surveys of a sample of CFLs, with a sample size no less than 100 or 0.1% of the population.                                      |
| <b>Responsible</b>      | REG   |
| <b>Location</b>         | Installation locations of distributed CFLs  |
| <b>Data recording</b>   | Data are recorded in a central database, or in a spread sheet and then in the database  |
| <b>Data aggregation</b> | The data analysis results are provided in the survey report   |
| <b>Archiving</b>        | The survey report is stored until two years after the end of the crediting period   |

### Organizational Structure

REG, 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.

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

#### Roles and Responsibilities:

- REG CFL Distribution Staff: Distribute CFLs among REG customers and recording of customer ID, number of CFLs distributed, date and wattage.
- REG Antenna/Station Managers: Ensure the accuracy of the data collected by the distribution staff and enter the information in the in-house software.
- REG CFL Project Coordinator: Revise the information provided by the Antenna/Station Managers through the software, ensure data traceability and reliability, and calculation of the emission reductions achieved by the project.

Initially, the project activity was partially included in REG'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 4<sup>th</sup> Phase, REG was directly in charge of the procurement.

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

- The REG CFL distribution staff was trained on the benefits of CFLs at the beginning of the project.
- The REG 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 REG 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 REG 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 REG 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 / Parameter                                     | <b>EF<sub>CO2,ELEC,y</sub> or EF<sub>grid</sub></b>   |
| Unit   | kg CO2e/kWh   |
| Description  | Emission factor for the national electricity grid for 2007  |
| Source of data                                       | See PDD annex for EF grid calculation   |
| Value(s) applied                                     | 0.6540  |
| Choice of data or Measurement methods and procedures | 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 REG Ltd.<br>The calculation is detailed in section B.6.3. All references are included in the annex. |
| Purpose of data                                      | Baseline emissions and project emissions calculation  |
| Additional comment                                   |   |

|  |  |
|--|--|
| Data / Parameter                                     | <b>TD<sub>y</sub></b>                          |
| Unit   | None   |
| Description  | Average annual technical grid losses in year y |
| Source of data                                       | Methodology default value                      |
| Value(s) applied                                     | 10%  |
| Choice of data or Measurement methods and procedures | No recent data is available.                   |
| Purpose of data                                      | Baseline and project emissions calculation     |
| Additional comment                                   | -  |

|  |  |
|--|--|
| Data / Parameter                                     | <b>NTG</b>                                 |
| Unit   | None                                       |
| Description  | Net-to-gross adjustment factor             |
| Source of data                                       | Methodology default value                  |
| Value(s) applied                                     | 0.95                                       |
| Choice of data or Measurement methods and procedures | No recent data is available.               |
| Purpose of data                                      | Baseline and project emissions calculation |
| Additional comment                                   | -  |

|                  |   |
|------------------|---|
| Data / Parameter | <b>O<sub>i</sub></b>  |
| 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  |
| Choice of data or Measurement methods and procedures | As stipulated by methodology: 3.5 hours per 24 hrs period. |
| Purpose of data                                      | Baseline and project emissions calculation                 |
| Additional comment                                   | -  |

|  |  |
|--|--|
| Data / Parameter                                     | $L_i$  |
| Unit   | Hours  |
| Description  | Equipment lifetime   |
| Source of data                                       | Provided by REG Ltd, technical specification set in the tender   |
| Value(s) applied                                     | At least 6000 hours  |
| Choice of data or Measurement methods and procedures | Stipulated by the methodology: 'Rated lifetime' or 'rated average life' or 'rated life to 50% failures' is the expected time at which 50% of the total number of lamps reach the end of their individual life. |
| Purpose of data                                      | Baseline and project emissions calculation   |
| Additional comment                                   | The number is checked through the monitoring of the failure rate   |

|  |   |
|--|---|
| 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  |
| Choice of data or Measurement methods and procedures | Stipulated by methodology, the lower value of 3.5 hours per 24 hrs period is considered for this project activity over 365 days per year. |
| Purpose of data                                      | Baseline and project emissions calculated   |
| Additional comment                                   | -   |

|  |  |
|--|--|
| Data / Parameter                                     | $R_i$  |
| Unit   | %  |
| Description  | Percentage of lamps of type <i>i</i> operating at the rated lifetime   |
| Source of data                                       | Methodology default value  |
| Value(s) applied                                     | 50   |
| Choice of data or Measurement methods and procedures | No project specific data is available.   |
| Purpose of data                                      | Baseline and project emissions calculation   |
| Additional comment                                   | This figure is applied for ex ante calculations or in the case there is not a value from an ex post survey according to paragraph 30 of AMS-II.J version 07. |

|  |  |
|--|--|
| Data / Parameter                                     | $P_{i,BL}$   |
| Unit   | Watt   |
| Description  | Power of the incandescent lamps in the baseline scenario   |
| Source of data                                       | Baseline survey conducted in April 2008  |
| Value(s) applied                                     | 83.3   |
| Choice of data or Measurement methods and procedures | The power of the baseline light bulb has been calculated on a pro rata basis of the ICL breakdown provided by the baseline survey. |

|                    |                                |
|--------------------|--------------------------------|
| Purpose of data    | Baseline emissions calculation |
| Additional comment | -                              |

## D.2. Data and parameters monitored

### Data and parameters applicable for Component 1 and Component 2 (AMS-II.J, Version 7)

| Data/parameter:                        | Customer information  |
|--|---|
| Unit                                   | -   |
| Description                            | Customer Identification Number (unique – as per REG records)<br>Name of head of household<br>Address or description of location of household                                |
| Measured/calculated/default            | Measured  |
| Source of data                         | Information provided by utility customers at the distribution points upon presentation of a bill or a cash power receipt.   |
| Value(s) of monitored parameter        | Recorded information is available to the DOE; personal information not publicly released  |
| Monitoring equipment                   | N/A   |
| Measuring/reading/recording frequency: | Once at bulb distribution   |
| Calculation method (if applicable):    | N/A   |
| QA/QC procedures:                      | Identity of heads of households and customer ID to be cross-checked with utility records by REG Ltd to avoid several purchase with the same ID                              |
| Purpose of data:                       | This is the basic identification parameter that is used for existing and new customers and forms the foundation of the monitoring of both component 1 and 2 of the project. |
| Additional comments:                   | -   |

| Data/parameter:                        | Distribution date   |
|--|---|
| Unit                                   | Date  |
| Description                            | Date of the CFL distribution uniquely recorded for each customer participant                                  |
| Measured/calculated/default            | Measured  |
| Source of data                         | Recorded by REG at distribution points  |
| Value(s) of monitored parameter        | Available to the DOE in the project distribution database   |
| Monitoring equipment                   | N/A   |
| Measuring/reading/recording frequency: | Once at distribution (check in the database at each verification)   |
| Calculation method (if applicable):    | N/A   |
| QA/QC procedures:                      | Quality check of data sent by REG Ltd branches and antennas at central local in Kigali. Reports from branches |
| Purpose of data:                       | Baseline and project emissions calculation  |
| Additional comments:                   | Components 1 and 2<br>Dates are reported monthly for the purpose of the ER calculations                       |

| 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 REG (Lamps distribution databases)   |
| Value(s) of monitored parameter        | <b>Component 1</b> <ul style="list-style-type: none"> <li>For distributed CFL, <math>i = 15</math> W<br/>Phase 3: 56,726</li> <li>For distributed CFL, <math>i = 20</math> W<br/>Phase 1: 40,328<br/>Phase 2: 132,042<br/>Phase 3: 22,573</li> </ul> <b>Component 2</b> <ul style="list-style-type: none"> <li>For distributed CFL, <math>i = 15</math> W<br/>25,524</li> <li>For distributed CFL, <math>i = 20</math> W<br/>70,990</li> </ul> |
| Monitoring equipment                   | N/A  |
| Measuring/reading/recording frequency: | Once at distribution   |
| Calculation method (if applicable):    | N/A  |
| QA/QC procedures:                      | Quality check of data sent by REG Ltd branches and antennas at central local in Kigali. Comparison of allotted and distributed lamps with procured lamps   |
| Purpose of data:                       | Baseline and project emissions calculation   |
| Additional comments:                   | Component 1. The number of CFL distributed is compared to the number of ICL collected and received at the central storage in Kigali. The lowest number is used as monitored values for ERs calculation.  |

|  |   |
|--|---|
| <b>Data/parameter:</b>                 | <b><math>P_{i,PJ}</math></b>  |
| 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<br>20 W<br>Phase 3<br>15 W and 20 W                       |
| Monitoring equipment                   | N/A   |
| Measuring/reading/recording frequency: | Recorded once at distribution (check in the database at each verification)    |
| Calculation method (if applicable):    | N/A   |
| QA/QC procedures:                      | Specification at procurement and reading during distribution                  |
| Purpose of data:                       | Calculation of project emissions  |
| Additional comments:                   | The number will also be monitored once ex post at distribution                |

|                             |  |
|-----------------------------|--|
| <b>Data/parameter:</b>      | <b><math>Q_{BL,i}</math></b>   |
| Unit                        | -  |
| Description                 | Number (quantity) of pieces of incandescent lamps (ICLs) of type $i$ exchanged under the project |
| Measured/calculated/default | Measured   |
| Source of data              | Recorded by REG (Lamps distribution databases)   |

| 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 <sub>ABL</sub>  | 25       | 953                           | 0              | 0             | 0             |
|  | P <sub>BBL</sub>  | 40       | 12,330                        | 1,068          | 22,059        | 0             |
|  | P <sub>CBL</sub>  | 60       | 11,961                        | 51,266         | 34,667        | 0             |
|  | P <sub>DBL</sub>  | 75       | 15,084                        | 79,708         | 0             | 22,573        |
|  | <b>Total</b>  | <b>-</b> | <b>40,328</b>                 | <b>132,042</b> | <b>56,726</b> | <b>22,573</b> |
| Monitoring equipment                   | N/A   |          |                               |                |               |               |
| Measuring/reading/recording frequency: | Once at CFL distribution  |          |                               |                |               |               |
| Calculation method (if applicable):    | N/A   |          |                               |                |               |               |
| QA/QC procedures:                      | <p>A third party was engaged to certify the number of ICLs collected. The report is available for Phases 1, 2 and 3. The sampling methodology is based on the Standard ISO 2859-1: 1999. The report was prepared by an independent consultant using a sampling approach based on the Guidelines for sampling and surveys for CDM project activities and programme of activities, version 04.0.</p> <p>Overall, the numbers of ICLs derived from the reports are compared to the number of ICLs in the database and the lowest values are always used for ERs calculations. For Phase 1, the report found a total of 41,169 ICLs, of which the lower value of 40,328 ICLs is used in ER calculation. For Phase 2 and Phase 3, the report found 136,325 ICLs and 87,626 ICLs compared to 132,042 ICLs and 79,299 ICLs respectively.</p> |          |                               |                |               |               |
| Purpose of data:                       | Baseline and project emissions calculation  |          |                               |                |               |               |
| Additional comments:                   | <p>For Component 1 only. Collected ICLs are matched to distributed project CFLs on a 1 to 1 basis.</p> <p>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.</p> <p>The monitored values are derived from the comparison between the number of ICL collected and received at the central storage in Kigali. The lowest number is used for ERs calculation.</p> <p>The emission reduction calculations apply the minimum number of bulbs between ICLs collected and CFLs distributed.</p>  |          |                               |                |               |               |

|  |   |            |               |               |                |
|--|---|------------|---------------|---------------|----------------|
| <b>Data/parameter:</b>                 | P <sub>i,BL</sub> (for component 1 only)  |            |               |               |                |
| Unit                                   | Watts   |            |               |               |                |
| Description                            | Power of the incandescent lamps exchanged (for the component 1 only)                  |            |               |               |                |
| Measured/calculated/default            | Measured as taken from ICL nameplate  |            |               |               |                |
| Source of data                         | Lamp marking data   |            |               |               |                |
| Value(s) of monitored parameter        | 25 W, 40 W, 60 W and 75 W   |            |               |               |                |
|  | The following table summarized the number of ICLs for each baseline wattage category. |            |               |               |                |
|  |   | <b>25W</b> | <b>40 W</b>   | <b>60 W</b>   | <b>75 W</b>    |
|  | Phase 1   | 953        | 12,330        | 11,961        | 15,084         |
|  | Phase 2   | 0          | 1,068         | 51,266        | 79,708         |
|  | Phase 3   | 0          | 22,059        | 34,667        | 22,573         |
|  | <b>Total</b>  | <b>953</b> | <b>35,457</b> | <b>97,894</b> | <b>117,365</b> |
| Monitoring equipment                   | N/A   |            |               |               |                |
| Measuring/reading/recording frequency: | Recorded once at distribution (check in the database at each verification)            |            |               |               |                |
| Calculation method (if applicable):    | N/A   |            |               |               |                |

|                      |   |
|----------------------|---|
| QA/QC procedures:    | A third party was engaged to certify the number of ICLs collected. The report is currently available for Phase 1, 2 and 3. The sampling methodology is based on the ISO 2859-1: 1999.   |
| Purpose of data:     | Baseline and project emissions calculation  |
| Additional comments: | Component 1<br>The numbers of ICL per wattage of baseline devices are consolidated as shown in the previous table. Only final numbers used in ER calculation are used. Note that for Phase 1, ICLs with unreadable wattage were assigned a wattage proportional to the distribution of wattages in the bulbs with a wattage measurement. Refer to "Component 1 Monitored PBL" in ERs calculation spreadsheet. |

|  |   |
|--|---|
| <b>Data/parameter:</b>                 | <b>N<sub>sample,s</sub></b>   |
| Unit                                   | -   |
| Description                            | Number of sampled CFLs during the post installation survey s  |
| Measured/calculated/default            | Measured  |
| Source of data                         | Survey reports  |
| Value(s) of monitored parameter        | 1 <sup>st</sup> ex-post monitoring survey: Phase 1: 100<br>2 <sup>nd</sup> ex-post monitoring survey: Phase 1: 100, Phase 2: 200<br>3 <sup>rd</sup> ex-post monitoring survey: Phase 1: 110, Phase 2: 125, Phase 3: 120<br>4 <sup>th</sup> ex-post monitoring survey: Phase 2: 125; Phase 3: 120  |
| Monitoring equipment                   | N/A   |
| Measuring/reading/recording frequency: | Four ex-post monitoring surveys have been conducted as shown below based on the requirement of the frequency in AMS-II.J (version 3)<br>1 <sup>st</sup> ex-post monitoring survey: April, 2008<br>2 <sup>nd</sup> ex-post monitoring survey: October, 2009<br>3 <sup>rd</sup> ex-post monitoring survey: June, 2011<br>4 <sup>th</sup> ex-post monitoring survey: September 2013<br><br>Given the above ex-post surveys were all conducted before the approval of the post-registration dated December 2, 2016. Based on the approved revised PDD. the revised sampling approach applies only to surveys conducted after the approval of the post registration changes. A deviation is therefore requested to use the monitoring requirements in the initially registered PDD for previous monitoring periods including this one. |
| Calculation method (if applicable):    | N/A   |

|                      |   |
|----------------------|---|
| QA/QC procedures:    | <p>As per AMS-II.J, version 07, 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).</p> <p>At the PDD registration, and in the absence of detailed guidelines from the UNFCCC on formula to calculate sample sizes, the project participant confirmed the minimum sample size for the Lamp Failure Rate parameter using the procedures outlined in Cochran (1977)<sup>5</sup> and described by Bartlett et al (2001)<sup>6</sup>:</p> $n_o = \frac{(t)^2 \times (p \times q)}{(d)^2}$ <p>Where:<br/> t = value for the standard normal distribution value, with an infinite number of readings, and for the desired confidence level. For confidence level of 90%, t = 1.645<br/> (p x q) = estimate of variance value = 0.25, meaning standard deviation (variability) of 50% is assumed as no historical data were available.<br/> d = acceptable margin of error (precision) for proportion being estimated 10%</p> $n_o = \frac{(1.645)^2 \times (0.25)}{(0.1)^2} = 68$ |
| Purpose of data:     | Calculation of baseline emissions   |
| Additional comments: | The ex-post survey were conducted well before the approval of the post-registration change. The procedures defined in AMS-II. J version 03 were followed at the time of the survey instead of AMS-II. J version 7 which results in a temporary deviation from the methodology.  |

|  |  |
|--|--|
| <b>Data/parameter:</b>                 | <b>N<sub>OK,s</sub></b>  |
| Unit                                   | -  |
| Description                            | Number of sampled CFLs which are functional during the post installation surveys   |
| Measured/calculated/default            | Measured   |
| Source of data                         | Survey reports   |
| Value(s) of monitored parameter        | 1 <sup>st</sup> ex-post monitoring survey: Phase 1: 84<br>2 <sup>nd</sup> ex-post monitoring survey: Phase 1: 88; Phase 2: 160<br>3 <sup>rd</sup> ex-post monitoring survey: Phase 1: 58; Phase 2: 74; Phase 3: 77<br>4 <sup>th</sup> ex-post monitoring survey: Phase 2: 75; Phase 3: 75  |
| Monitoring equipment                   | N/A  |
| Measuring/reading/recording frequency: | Four ex-post monitoring surveys have been conducted as shown below based on the requirement of the frequency in AMS-II.J (version 3) 1 <sup>st</sup> ex-post monitoring survey: April, 2008<br>2 <sup>nd</sup> ex-post monitoring survey: October, 2009<br>3 <sup>rd</sup> ex-post monitoring survey: June, 2011<br>4 <sup>th</sup> ex-post monitoring survey: September 2013<br><br>Given the above ex-post surveys were all conducted before the approval of the post-registration dated December 2, 2016. Based on the approved revised PDD. the revised sampling approach applies only to surveys conducted after the approval of the post registration changes. |



|                                     |   |
|-------------------------------------|---|
| Calculation method (if applicable): | N/A   |
| QA/QC procedures:                   | N/A   |
| Purpose of data:                    | Calculation of baseline emissions   |
| Additional comments:                | The ex-post survey were conducted well before the approval of the post-registration change. The procedures defined in AMS-II. J version 03 were followed at the time of the survey instead of AMS-II. J version 7 which results in a temporary deviation from the methodology |

|  |  |
|--|--|
| <b>Data/parameter:</b>                 | <b>LFR<sub>i,y</sub></b>   |
| Unit                                   | Fraction   |
| Description                            | Lamp Failure Rate for equipment type i in year y (fraction)  |
| Measured/calculated/default            | Measured   |
| Source of data                         | Provided by the consultant conducting the survey   |
| Value(s) of monitored parameter        | Refer to the ER calculation  |
| Monitoring equipment                   | N/A  |
| Measuring/reading/recording frequency: | At least every three years after installation of equipment (as per procedures in paragraph 29 and 30 of AMS-II.J, version 07)  |
| Calculation method (if applicable):    | <p>The Lamp Failure Rate is determined through ex post monitoring surveys applying the “Standard: Sampling and surveys for CDM project activities and programme of activities” and the “Guideline: Sampling and surveys for CDM project activities and programmes of activities”.</p> <p>As per AMS-II.J, version 03, the sample size is determined by minimum 90% confidence interval and the 10% maximum error margin. The sample size will be applied to each Phase separately. According to the sampling plan described in B.7.2, the sample size for each Phase will be at least 271 CFLs to be surveyed and the number of lamps that still in operation will be counted. The data of each checked CFL will be recorded on the survey questionnaire while the ex-post installation survey is conducted. One questionnaire is filled in per each sampled customer. The information from the questionnaire is afterwards entered into a survey database; this database is related to one monitoring interval. The number of sampled CFLs will be divided by the number of CFLs received by each customer to determine the number of customers to visit.</p> <p>The Lamp failure rate is calculated by dividing the number of lamps that are found not working during household visits by the total number of lamps actually surveyed.</p> |
| QA/QC procedures:                      | Application of standardized data forms and compliance protocols.   |
| Purpose of data:                       | Calculation of project emissions   |
| Additional comments:                   | Please note that the revised sampling approach applies only to surveys conducted after the approval of the post registration changes. A deviation is therefore requested to use the monitoring requirements in the initially registered PDD for previous monitoring periods)   |

### D.3. Implementation of sampling plan

>>

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

N<sub>sample,s</sub> Number of sampled CFLs during the post installation survey s & N<sub>OK,s</sub> Number of sampled CFLs which are functional during the post installation surveys

#### 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. Multi-stage sampling was applied where clusters (first stage) corresponded to REG branches, which are located in various administrative entities called sectors and districts, and clusters were randomly selected. In the second stage, households were selected randomly, in each selected cluster (REG branch).

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 (21 total in Phases 1 and 2; 23 total in Phase 3)
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. Proceed until enough branches are selected to fulfil the sample size requirement (see table below)
7. Within the cluster, 5 (five) households to be surveyed are randomly selected (except for the first survey of Phase 1, where households were randomly selected proportionally to the quantity of bulbs distributed).

The number of samples for the survey relevant for this monitoring report is presented in the below table. The survey date is September 2013, which corresponds to the fourth survey for Phase 2 and second survey for Phase 3.

| Survey #          | Sampling Frame | Final Sample Size (#CFLs) | Number of CFLs per household | Number of households surveyed | Number of clusters (branches surveyed) |
|-------------------|----------------|---------------------------|------------------------------|-------------------------------|--|
| 1) April 2008     | Phase 1 CFLs   | 100                       | 2                            | 50                            | 7                                      |
| 2) October 2009   | Phase 1 CFLs   | 100                       | 2                            | 50                            | 10                                     |
|                   | Phase 2 CFLs   | 200                       | 5                            | 40                            | 8                                      |
|                   | Total          | 300                       | -                            | 90                            | -                                      |
| 3) June 2011      | Phase 1 CFLs   | 110                       | 2                            | 55                            | 11                                     |
|                   | Phase 2 CFLs   | 125                       | 5                            | 25                            | 5                                      |
|                   | Phase 3 CFLs   | 120                       | 4                            | 30                            | 6                                      |
|                   | Total          | 355                       | -                            | 110                           | -                                      |
| 4) September 2013 | Phase 2 CFLs   | 125                       | 5                            | 25                            | 8                                      |
|                   | Phase 3 CFLs   | 120                       | 4                            | 30                            | 9                                      |
|                   | Total          | 245                       |                              | 55                            |  |

### Collected Data

The collected data is summarized in the survey report.

### Analysis of the collected data

| Survey #      | Sampling Frame | N <sub>OK,s</sub> | N <sub>sample,s</sub> | LFR <sub>i,y</sub> |
|---------------|----------------|-------------------|-----------------------|--------------------|
| 1) April 2008 | Phase 1 CFLs   | 84                | 100                   | 0.160              |

|                   |              |     |     |       |
|-------------------|--------------|-----|-----|-------|
| 2) October 2009   | Phase 1 CFLs | 88  | 100 | 0.120 |
|                   | Phase 2 CFLs | 160 | 200 | 0.200 |
| 3) June 2011      | Phase 1 CFLs | 58  | 110 | 0.473 |
|                   | Phase 2 CFLs | 74  | 125 | 0.408 |
|                   | Phase 3 CFLs | 77  | 120 | 0.358 |
| 4) September 2013 | Phase 2 CFLs | 75  | 125 | 0.400 |
|                   | Phase 3 CFLs | 75  | 120 | 0.375 |

### **Demonstration confidence/precision requirements**

The reliability of the sampling approach is checked to confirm that the 90/10 confidence/precision level requirement is met. As per the Standard for “*Sampling and surveys for CDM project activities and program of activities*” version 04.1, paragraph 11 (a) (i), the absolute precision level was calculated for all surveys under each phase. As it can be seen in the table below, the absolute precision level of 10% was achieved for all of them (for further information on the calculation of the absolute precision level, please see excel sheet named “Absolute Precision Calculation”).

|         | Survey 1 –<br>April 2008 | Survey 2 –<br>October 2009 | Survey 3 – June<br>2011 | Survey 4 –<br>September 2013 |
|---------|--------------------------|----------------------------|-------------------------|------------------------------|
| Phase 1 | 6.02%                    | 5.34%                      | 7.82%                   | -                            |
| Phase 2 | -                        | 4.65%                      | 7.23%                   | 7.20%                        |
| Phase 3 | -                        | -                          | 7.20%                   | 7.28%                        |

It should be noted that only CFLs from existing customers have been considered in the ER calculations for Component 1 (i.e. 79,299 CFLs), and only CFLs from new customers have used for the ERs calculation under Component 2 (i.e. 96,514). For further reference, please check the ER calculation spreadsheet.

## **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 (version 7), 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 (tCO<sub>2</sub>/MWh)

$ER_y$  = Emission reductions in year  $y$  (tCO<sub>2</sub>e)

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

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

Where:

$NES_y$  = Net electricity saved in year  $y$  (kWh)

- $QP_{J,i}$  = 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  
 $P_{i, BL}$  = 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 CFL<sup>7</sup>  
 $P_{i, PJ}$  = 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<sub>y</sub>), the % of lamps that have failed, is calculated based on the results of the ex-post surveys as follows:

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

| Survey #          | Sampling Frame | N <sub>OK,s</sub> | N <sub>sample,s</sub> | LFR <sub>i,y</sub> |
|-------------------|----------------|-------------------|-----------------------|--------------------|
| 1) April 2008     | Phase 1 CFLs   | 84                | 100                   | 0.160              |
| 2) October 2009   | Phase 1 CFLs   | 88                | 100                   | 0.120              |
|                   | Phase 2 CFLs   | 160               | 200                   | 0.200              |
| 3) June 2011      | Phase 1 CFLs   | 58                | 110                   | 0.473              |
|                   | Phase 2 CFLs   | 74                | 125                   | 0.408              |
|                   | Phase 3 CFLs   | 77                | 120                   | 0.358              |
| 4) September 2013 | Phase 2 CFLs   | 75                | 125                   | 0.400              |
|                   | Phase 3 CFLs   | 75                | 120                   | 0.375              |

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 ER calculation spreadsheet.

## Component 2

As per AMS-II.J (version 7), the emissions reductions 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 (tCO<sub>2</sub>/MWh)

$ER_y$  = Emission reductions in year  $y$  (tCO<sub>2</sub>e)

<sup>7</sup> 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)".

Where:

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

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

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 83.3 W as per the baseline survey in 2008

$P_{i, PJ}$  = 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

For the calculation of lamp failure rate, please refer to description of the calculation for Component 1 above.

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

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

>>

N/A

## E.3. Calculation of leakage

>>

N/A

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

| Item         | Baseline emissions or baseline net GHG removals by sinks (t CO <sub>2</sub> e) | Project emissions or actual net GHG removals by sinks (t CO <sub>2</sub> e) | Leakage (t CO <sub>2</sub> e) | GHG emission reductions or net GHG removals by sinks (t CO <sub>2</sub> e) achieved in the monitoring period |                 |              |
|--------------|--|---|-------------------------------|--|-----------------|--------------|
|              |  |   |                               | Up to 31/12/2012   | From 01/01/2013 | Total amount |
| <b>Total</b> | 14,592   | 0   | 0                             | 3,682  | 10,910          | 14,592       |

## E.5. Comparison of actual emission reductions or net 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 |
|------|---|--|
|------|---|--|

| Item   | Values estimated in ex ante calculation of registered PDD | Actual values achieved during this monitoring period |
|--|---|--|
| Emission reductions or GHG removals by sinks (t CO <sub>2</sub> e) | 45,714*   | 14,592   |

*\*The PDD value been calculated by prorating the PDD values by the number of days to match this monitored period (01/08/2012 to 31/03/2014).*

#### **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.

## Appendix 1. Contact information of project participants and responsible persons/entities

|  |  |
|--|--|
| <b>Project participant and/or responsible person/ entity</b> | <input checked="" type="checkbox"/> Project participant<br><input checked="" type="checkbox"/> Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity |
| <b>Organization name</b>                                     | Rwanda Energy Group Limited (REG Ltd)  |
| <b>Street/P.O. Box</b>                                       | KN 82 ST 3, Nyarugenge District, PO Box 537 Kigali - Rwanda  |
| <b>Building</b>  |  |
| <b>City</b>  | Kigali   |
| <b>State/Region</b>  | Kigali City  |
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**Document information**

| <i>Version</i>  | <i>Date</i>     | <i>Description</i>   |
|---|-----------------|--|
| 05.1  | 4 May 2015      | Editorial revision to correct version numbering.   |
| 05.0  | 1 April 2015    | Revisions to: <ul style="list-style-type: none"> <li>• Include provisions related to delayed submission of a monitoring plan;</li> <li>• Provisions related to the Host Party;</li> <li>• Remove reference to programme of activities;</li> <li>• Overall editorial improvement.</li> </ul>  |
| 04.0  | 25 June 2014    | Revisions to: <ul style="list-style-type: none"> <li>• Include the Attachment: Instructions for filling out the monitoring report form (these instructions supersede the "Guideline: Completing the monitoring report form" (Version 04.0));</li> <li>• Include provisions related to standardized baselines;</li> <li>• Add contact information on a responsible person(s)/ entity(ies) for completing the CDM-MR-FORM in A.6 and Appendix 1;</li> <li>• Change the reference number from <i>F-CDM-MR</i> to <i>CDM-MR-FORM</i>;</li> <li>• Editorial improvement.</li> </ul> |
| 03.2  | 5 November 2013 | Editorial revision to correct table in page 1.   |
| 03.1  | 2 January 2013  | Editorial revision to correct table in section E.5.  |
| 03.0  | 3 December 2012 | Revision required to introduce a provision on reporting actual emission reductions or net GHG removals by sinks for the period up to 31 December 2012 and the period from 1 January 2013 onwards (EB70, Annex 11).   |
| 02.0  | 13 March 2012   | Revision required to ensure consistency with the "Guidelines for completing the monitoring report form" (EB 66, Annex 20).   |
| 01  | 28 May 2010     | EB 54, Annex 34. Initial adoption.   |
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