Project design document form for small-scale CDM project activities

(Version 08.0)

Complete this form in accordance with the Attachment "Instructions for filling out the project design document form for small-scale CDM project activities" at the end of this form.

PROJECT DESIGN DOCUMENT (PDD)	
Title of the project activity	Rwanda Electrogaz Compact Fluorescent Lamp (CFL) distribution project
Version number of the PDD	14
Completion date of the PDD	27/10/2016
Project participant(s)	**Rwanda:** Rwanda Energy Group Ltd (REG Ltd); **Netherlands:** Netherlands' Ministry of Infrastructure and the Environment (IenM); **Germany:** BASF SE; KfW; **Austria:** Kommunalkredit Public Consulting GmbH; **Denmark:** Maersk Olie og Gas A/S; DONG Naturgas A/S; Nordjysk Elhandel A/S; Danish Ministry of Climate, Energy and Building/Danish Energy Agency; Aalborg Portland A/S; **Sweden:** Goteborg Energi AB; **Italy:** Government of Italy - Ministry for the Environment, Land and Sea; **Belgium:** Bruxelles Environnement – IBGE; Walloon Region: Walloon Air and Climate Agency; **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.; **Finland:** Ruukki Metals Oy; **Norway:** Statoil ASA; Statkraft Carbon Invest AS; **Switzerland:** Schweizerische Rückversicherungsgesellschafts AG (Swiss RE); **Japan:** Daiwa Securities 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 **Bilateral and Multilateral Funds:** International Bank for Reconstruction and Development (IBRD) as Trustee of the Community Development Carbon Fund (CDCF)
Host Party	Rwanda

Applied methodology(ies) and, where applicable, applied standardized baseline(s)	• AMS-II.J "Demand-side activities for efficient lighting technologies", Version 07[1]
Sectoral scope(s) linked to the applied methodology(es)	Sectoral scope: 03
Estimated amount of annual average GHG emission reductions	13,483 tCO_2e

[1] As part the permanent deviation request, AMS-II.J, version 07 is applied in this PDD in replacement of AMS-II.J "Demand-side activities for efficient lighting technologies", Version 03 and AMS-II.C "Demand-side energy-efficiency activities for specific technologies", Version 11.

SECTION A. Description of project activity

A.1. Purpose and general description of project activity

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Rwanda is a developing country with about 90% of the population engaged in, mainly subsistence, agriculture. It is the most densely populated country in Africa and is landlocked with few natural resources and minimal industry. Rwanda continues to receive substantial aid and obtained IMF-World Bank Heavily Indebted Poor Country (HIPC) initiative debt relief in 2005-06. Rwanda also received Millennium Challenge Account Threshold status in 2006.

Rwanda faces acute electricity supply shortage even though only 7% of its total population is connected to the grid. Therefore, it is imperative that while developing electricity access in the residential sector, the electricity consumption should simultaneously be reduced or limited. The purpose of the project activity is to expand the use of high-efficiency lighting technology in Rwanda's residential sector through the distribution of high-quality Compact Fluorescent Lamps, starting with the units already connected to the grid (Component 1) and also considering the units that will be connected as part of the national electrification program (Component 2).

This efficient lighting project will benefit the customers providing them high quality, low price CFLs, thereby reducing their electricity consumption and their bills. It also enables the poorest clients to afford access to electricity on a more sustainable basis while proposing a competitive alternative to traditional fuels – such as kerosene lamps and small batteries, which have a negative impact on the local and global environment and health.

The project activity, implemented by the national public electricity utility, Rwanda Energy Group Ltd (REG Ltd)[2], is designed with two components.
Component 1: Existing grid-connected customers will 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 a range up to 20 watts. At the time of exchange, all CFLs are tested to assure that they are functioning and the following data is recorded: (i) the number and wattage of CFLs provided, (ii) the number and wattage of the incandescent lamps, (iii) household information (name of the customer, home location, preferably through the customer reference ID), and (iv) the date of the exchange. The incandescent lamps will be destroyed and disposed of.
Component 2: As part of the national electrification program, which aims to increase the grid-connected rate up to 36% by 2020, new REG Ltd customers will receive a caped number of CFLs with their new electricity meter at the time of the connection, as a "package". Therefore, as the new customers did not have electric lighting spot in their unit before the connection to the grid, the CFLs are installed in new lighting spots, and there is no exchange with ICL in this case.

The CFL distribution project is implemented through several phases starting mid-2007 to 2010. A pilot phase (or phase 1) was completed in August-September 2007 with the distribution of 50,000 CFLs. A maximum of 2 CFLs were provided in exchange of incandescent lamps (ICLs). The second phase, started in September 2008, distributing 150,000 CFLs over the residential sector, up to 5 CFLs per household at a price of RWF200 (US$0.37) per bulb and in exchange of incandescent lamps. The third phase (200,000 CFLs) and the fourth phase (400,000 CFLs) will be implemented respectively by the middle of 2009 and the middle of 2010.
The light bulb distribution will take place through the decentralized distribution outlets run by REG Ltd (named the *antennas* in Kigali or the *stations* in the rural areas of the rest of the country)[3].

[2] At the time of registration, REG Ltd was known as Electrogaz. The utility changed its name in August 2009 for RECO RWASCO, in 2011 for EWSA and in 2013 as EWSA Ltd. In 2014 it was split into two entities namely REG Ltd and WASAC Ltd. The project entity's name is now REG Ltd. The change does not impact project legal terms and implementation. For coherence in the document, only "REG Ltd" is used in the PDD to refer to the project entity.

[3] The REG Ltd antennas and stations are the decentralized offices, in Kigali and the rest of the country, respectively.

Table 1: Indicative project phases

Phase	Number of CFLs	Indicative timeline of distribution
Phase 1	50,000	Aug-Sept 2007
Phase 2	150,000	Sept 2008-March 2009
Phase 3	200,000	Mid 2009
Phase 4	400,000	Mid 2010 to early 2011 (monthly recorded)
TOTAL	**800,000**	

Table 2: Project components

Component	Indicative number of customers
1	Existing customers: 109,000 (by December 08)
2	Electrification program: 95,000 new customers (by 2010)
	Total customers: 204,000 (by 2010 as per the National Access Program)

A market survey was conducted on a 200-household sample[4] to establish the lighting baseline reference, to measure the market penetration, the potential CFL need, the public awareness, and the daily lighting time. It was established that high-quality CFLs are more expensive than incandescent lamps and represent a negligible portion of all the lighting devices available in the market. A post-installation survey following the pilot phase, conducted on a 50-household sample, showed increased interest of the population in this low energy device.

The contributions of the project activity to sustainable development can be summarized as follows:

- Reduction in grid electricity demand, including peak demand (in term of GWh or MW), which allows the utility to increase its consumer base and provide access to unelectrified households
- Lower electricity bill for end-users as CFLs are 75% more energy efficient than incandescent lamps
- Household education on energy efficiency
- Carbon emission reduction linked with electricity generation

A.2. Location of project activity

A.2.1. Host Party

>>
Rwanda

A.2.2. Region/State/Province etc.

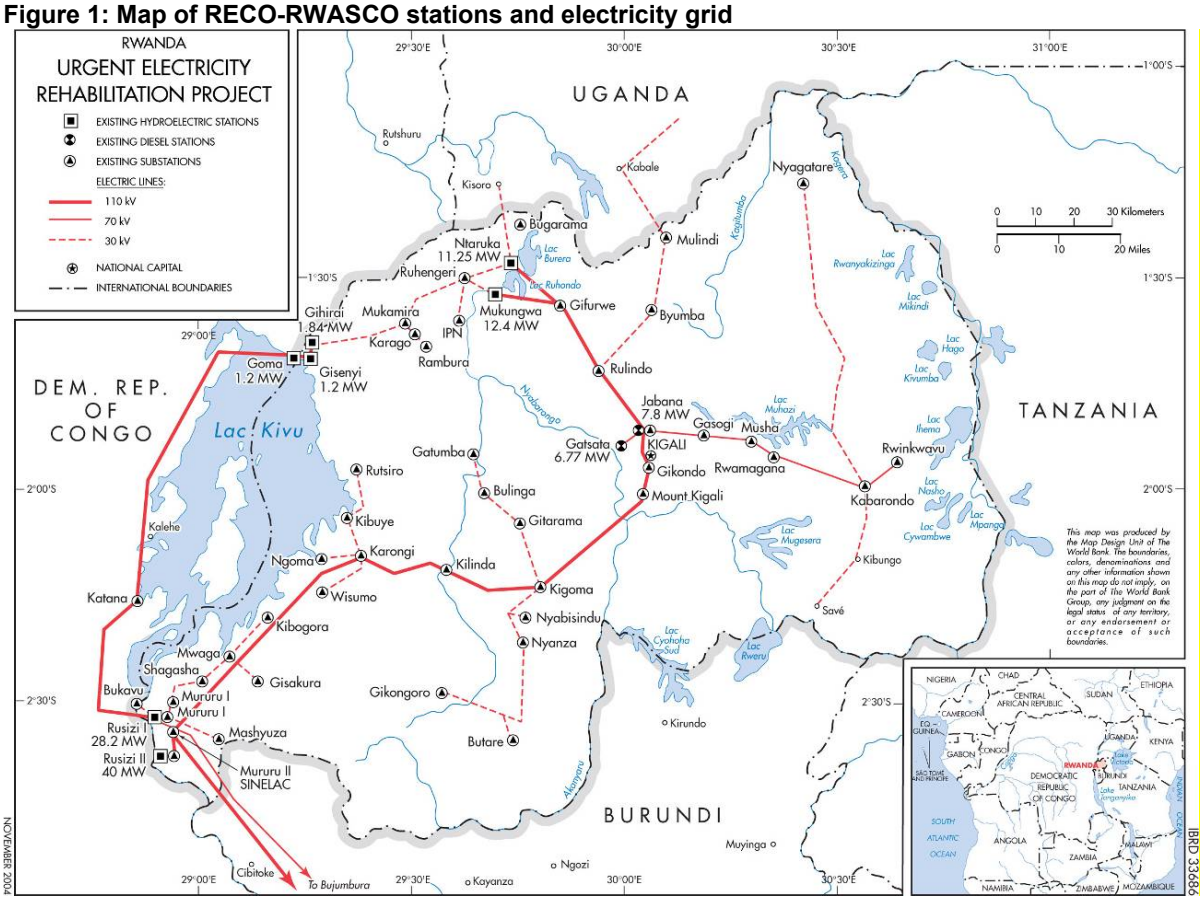
>>
Rwanda

A.2.3. City/Town/Community etc.

>>
Country wide, mainly in urban areas, which are or will be covered by REG Ltd

[4] The sample has been chosen outside the pilot phase recipients to avoid interference, as far as possible.

Figure 1: Map of RECO-RWASCO stations and electricity grid



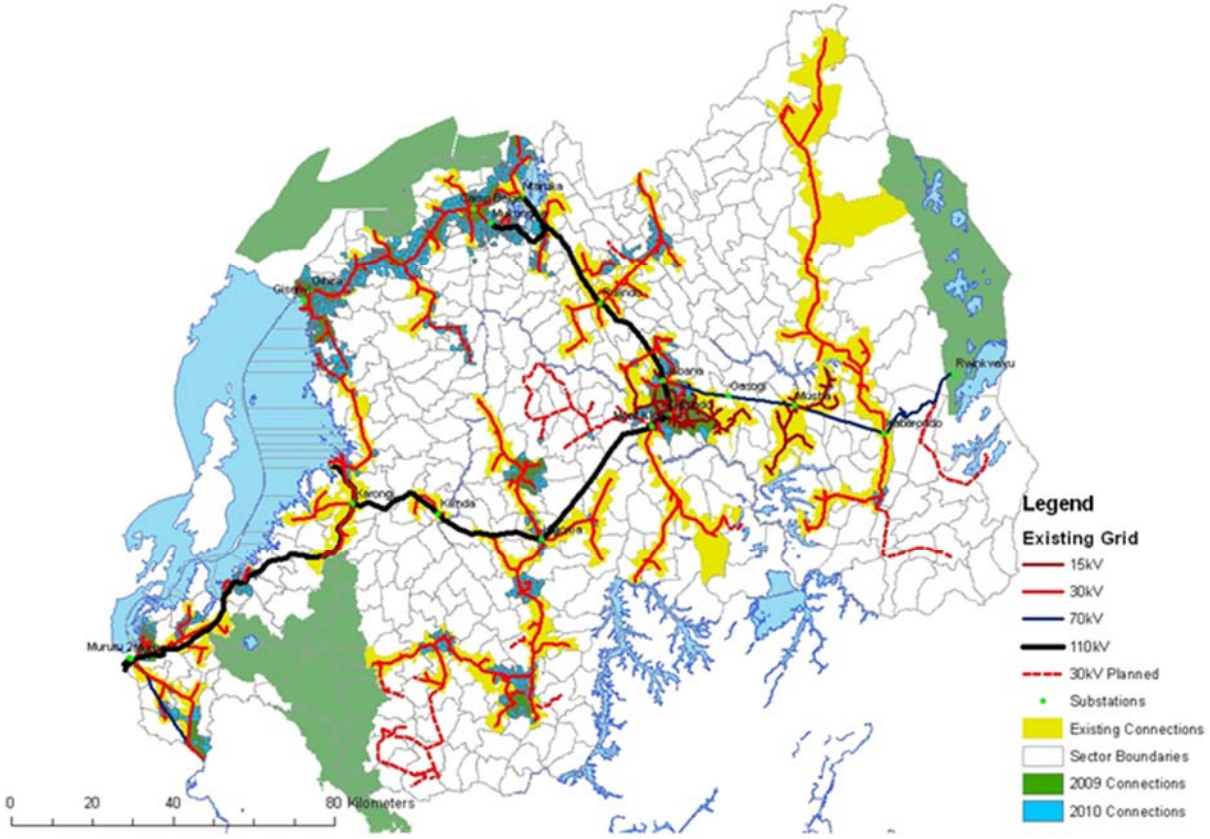
REG Ltd geographic cover is divided in 7 antennas in Kigali and 14 stations in the rest of the country:

- 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.

Note that administrative names were changed in 2007. That may be reflected in the names of the stations and antennas. The list provided above is relevant to 2009.

ACCESS PROGRAMME NEW CONNECTIONS - 2010
(Source: National Access Program, Castalia)

Figure 2: Map of the Rwandan electricity grid extension program



A.2.4. Physical/Geographical location

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

The project targets the existing residential customers of REG Ltd (109,000 electricity customers as of December 2008 data) and the additional 95,000 new customers connected to the grid over 2009 and 2010. The new customer group is part of the national grid extension program.
The distribution of CFLs will be done through the 21 antennas/stations of the utility, where customer information and, where applicable, details of exchanged bulbs will be recorded. This data will assist in unique identification of recipients.

A.3. Technologies and/or measures

>>

This project activity is under Type II – Energy Efficiency Improvement Project, and uses originally two SSC methodologies:

- AMS-II.J "Demand-side activities for efficient lighting technologies", which is presently used for the replacement of Incandescent Lamps (ICLs), and

- AMS-II.C "Demand-side energy-efficiency activities for specific technologies", which is used for the installation of CFLs at new customer sites.

A permanent deviation is requested in this PDD to apply AMS-II.J "Demand-side activities for efficient lighting technologies", Version 07 to the two Components, i.e. for both replacement of existing lamps or installation of the project lamps in new sites.

The methodology (AMS-II, version 07) applies to public or private sector initiatives that encourage the adoption of efficient lighting equipment that is more expensive and less GHG emitting than the baseline technology. The high-efficiency technology must be new equipment not transferred from another activity and may (i) replace existing equipment or (ii) be installed at new sites.

In Rwanda, the inefficient lighting devices are the common ICL available in the market, power rating range from 25 to 100 W. Based on the market survey conducted in April 2008[5], the breakdown of the ICL power shares is assumed to be as per the table below.

Table3: Luminous output equivalence[6]

ICL (W)	ICL breakdown	Output (Lm)
100	57%	1350
75	20%	940
60	14%	715
40	6%	415
25	2%	230
83.3	Pro rata	1087

The methodology requires that the luminosity of the efficient lamps is equivalent to the baseline technology[7], i.e. the output matches the household needs. To reach the better benefits in term of energy saving and ER generation, the project device outputs would be preferably set at the bottom of eligibility.
Note that the baseline outputs calculated in the table above are optimistic as they are based on ELI standards, which are not applied in Rwanda.

For operational reason, REG Ltd distributes only 2 types of CFL – 20W and 15W – which are the more common efficient lighting devices for the residential sector. The technical specifications set in the tenders require a minimum luminosity of 1100Lm or over for a 20W and 780Lm or over for a 15W.

Under Component 1, AMS-II.J requires that the total lumen output of the CFL should be equal to or more than that of the ICL being replaced or that a 100W ICL is replaced by a 20W CLF[8], i.e. 15W CFLs and 20W CFLs are eligible to replace ICLs of respectively up to 60W and up to 100W. It is noteworthy that REG Ltd encourages, for component 1, the exchange of a 60-to-100W ICL by a 20W CFL and a 60W or lower wattage ICL by a 15W CFL.

[5] Phases 1 and 2 occurred before the market survey was conducted and included a simplified replacement targeted at the highest wattage ICLs (75W and 100W).

[6] Local data is not available and most of the packaging at the retailers' does not specify the luminosity of the incandescent Lamps, so correspondence is based on Efficient Lighting Initiative (ELI) voluntary technical specifications.

[7] AMS-II.J requires that "the total lumen output of the CFL should be equal to or more than that of the ICL being replaced". It is also "encouraged to replace incandescent lamps with CFLs that have long rated lifetimes and the lowest eligible wattage that delivers the equivalent or better lumen output than the replaced lamp".

[8] The EB agreed, following a request for deviation, to allow under AMS-II.J the replacement of a 100W ICL by a 20W CFL in this specific project.

For Component 2, the 'package' includes a capped number of efficient lamps of 20W and 15W. Considering that REG Ltd would distribute around 100,000 15W CFLs and 300,000 20W CFLs to the new customers, the weighted average of the luminosity will be at 1020Lm, which is consistent the requirements compared with the market survey (see table above).

Table 4: Component 2 lamp breakdown

Component	Indicative number of lamps		Weighted Average luminosity (Lm)
	15W (+780Lm)	20W (+1100Lm)	
2	100,000	300,000	+1020

To ensure high quality lamps, the international tender require independent test following IEC 60968 and IEC 60969. The tenders also specify a one-year warranty and a rated lifetime[9] of at least 6,000 hours.

A.4. Parties and project participants

Party involved (host) indicates 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)	Rwanda Energy Group Ltd (REG Ltd)	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 Naturgas 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

[9] As per AMS-II.J, the 'Rated lifetime' or 'rated average life' or 'rated life to 50% failures' is the expected time at which 50% of any large number of lamps reach the end of their individual life.

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.5. Public funding of project activity

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Public funding from Parties included in Annex I to the Convention is not being sought to support this CDM project activity.
The project is financed through a loan, equity and an advance payment on carbon revenues.

A.6. Debundling for project activity

>>
There is no other CFL promotion project operating in Rwanda.

SECTION B. Application of selected approved baseline and monitoring methodology and standardized baseline

B.1. Reference of methodology and standardized baseline

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In the original registered PDD, the following methodologies were applied:

- AMS-II.J "Demand-side activities for efficient lighting technologies", Version 3,

Ref: https://cdm.unfccc.int/methodologies/DB/BTR8OICGN3GYJGTMG5P3KGHJVOP550

- AMS-II.C "Demand-side energy-efficiency activities for specific technologies", Version 11

Ref: https://cdm.unfccc.int/methodologies/DB/QLHVO5QIRIDVE6092VXPRAG9VZIOZP

Based on this permanent deviation requested, AMS-II.J, Version 07 is applied to the two components of this project and replaced the original methodologies. The methodology applied is therefore:

- AMS-II.J "Demand-side activities for efficient lighting technologies", Version 07

Ref: https://cdm.unfccc.int/methodologies/DB/GIIF3094709KR4YEEJXX72UY39L6Y4

B.2. Project activity eligibility

>>
The project activity will promote the installation of Compact Fluorescent Lamps (CFLs), which is a lighting energy-efficient device. The project has two components: (1) CFLs replace incandescent lamps for existing REG Ltd customers, and (2) CFLs are installed at new electricity customer houses. The project is eligible to apply a small-scale methodology because the energy savings from the replacement of incandescent lamps by efficient CFLs and the CFLs installed at new sites under the project are estimated to be a maximum of 54 GWh annually, which is below the 60 GWh limit for Type II small-scale project activities.

B.3. Project boundary

>>
Consistent with the SSC methodologies, the project boundary is the physical, geographical location of each CFL installed, within Rwanda's national border. The exact location is determined based on customer ID recorded at the time of the distribution. This enables a unique identification (i.e., name

and address) of the project participants who are limited to REG Ltd customers (existing and new ones).
Certified Emission reductions (CERs) will be earned for the emission reductions associated with the reductions in the demand for electricity supplied by the national utility REG Ltd.

Source		GHGs	Included?	Justification/Explanation
Baseline scenario	Combustion of fossil fuel at grid connected power plants	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification
Project scenario	Combustion of fossil fuel at grid connected power plants	CO_2	Included	Main emission source
		CH_4	Excluded	Excluded for simplification
		N_2O	Excluded	Excluded for simplification

B.4. Establishment and description of baseline scenario

>>
The baseline scenario of the proposed project is assumed to be a continuation of current practice, which involves purchase and use of incandescent lamps (ICLs), by existing and future REG Ltd customers. The baseline is the use of standard incandescent lamps with wattages in a range of 25 to 100 watts.

Component 1
For the existing customers who exchange ICLs, the baseline corresponds to the use of the exchanged ICLs uniquely recorded at the time of distribution.
As specified in the Methodology AMS II.J, the baseline lighting time is set at the default value of 3.5 hours per day per lamp.

Component 2
For the new customers benefiting from the new connection "package", the baseline is established based on the market survey. The baseline incandescent lamp power breakdown is given in the table on the right. Therefore, the baseline power is estimated at 83.3W on a pro rata basis.
As specified in AMS-II.J, version 07 applied to Component 2, the default value of 3.5 hour per day is use for the operating hours.

Table 5: ICL breakdown in Rwanda

ICL power (W)	ICL breakdown
100	57%
75	20%
60	14%
40	6%
25	2%
83.3	Baseline (average)

B.5. Demonstration of additionality

>>
The emissions of GHG are reduced below those that would have occurred in the absence of the registered CDM project activity. The project activity is additional and would have not occurred otherwise due to the financial barriers, as given below:

Investment barrier

In Rwanda, CFLs have to be imported and are approximately 5-15 times more expensive than ICLs. Any type of ICLs is sold at around US$0.4 (or RWF200). The low quality CFLs [10] (7 to 20 watts) are sold at a unit price of US$2 to US$3. The Rwandan market price of good quality CFL is as high as US$7. [11] Considering that the per capita GDP was US$450 in 2008, which is near US$1 per day[12], it is evident that the cost of CFL, specifically good-quality ones, constitutes a very high upfront investment and a barrier for the average households. Hence for this promotional CFL project, the CFLs are provided at a subsidized cost.

Bulk procurement of CFLs results in the utility being able to negotiate significantly reduced price of around US$1.5 per CFL as compared to the market price. In the pilot phase, as the project was promoting a new device and customer response was not known, CFLs were distributed free-of-cost, in exchange of incandescent lamps. The collected incandescent lamps do not have any value for REG Ltd and will be destroyed, as per the methodology, at additional cost to the utility. Based on encouraging response from the customers in the first phase, phase 2 is selling the CFLs at US$0.37 per CFL, as CFLs are not widely available through market channels. For new customers, who already have to disburse the cost of the connection to the grid, the lamps are provided as free in the package to encourage energy efficient behavior.

For the implementation of this project, the utility, REG Ltd, is bearing the purchase[13] and project management costs, including distribution of CFLs, collection and disposal of incandescent lamps, customer data collection and outreach. But the sales do not cover the investment and operation costs.

For the purpose of additionality demonstration, an investment comparison analysis (NPV and IRR calculation) is applied and a sensitive analysis is done, assuming 10 % lower costs and 10 % higher revenues from CFL lamp sales.

The tables 6 and 6 bis show the net present value (NPV) of the project activity with or without carbon revenues. Several discount rates are used for the calculation and the CER price is assumed to be US$15.

[10] None of the CFLs in Rwanda market indicate adherence to international quality standards, provide any label or guarantees. Anecdotal evidence suggests that these widely available low quality CFLs contain high levels of mercury and have a low lifetime (sometimes as low as 3 months), thus affecting the consumer confidence in the product.

[11] Average price obtained from retailers in April 2008.

[12] Source: The World Bank Group database

[13] Through bulk procurement by the utility, the price of a CFL may be brought down to US$1.3 to US$2.0, a price which remains higher than the cost of an ICL, which is around US$0.35.

Table 6: Costs and revenues of the project without CER revenues (in US$)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Initial Investments														
Number of lamps	50,000	150,000	200,000	400,000										
Unit price	$1.97	$1.30	$1.40	$1.36										
CFLs purchase	98,500	195,500	280,000	543,429										
Other costs														
Power and Fuel	4,500	4,500	6,000	6,000										
Labor	30,000	30,000	30,000	20,000										
Destruction of the IBs		10,000	15,000	0										
Administration	20,000	20,000	20,000	20,000										
TOTAL costs	153,000	260,000	351,000	589,429	0	0	0	0	0	0	0	0	0	0
Net Revenues														
Number of lamps		150,000	100,000	100,000										
Net Sales Price	$0.00	$0.37	$0.37	$0.37										
CFL sale		55,500	37,000	37,000										
TOTAL revenues	0	55,500	37,000	37,000	0	0	0	0	0	0	0	0	0	0
Margin without Carbon revenues	-153,000	-204,500	-314,000	-552,429	0	0	0	0	0	0	0	0	0	0

NPV	Discount rate
	0% -$1,223,929
	10% -$921,328
	15% -$809,988
	18% -$752,576
IRR	NA

Table 6 bis: Costs and revenues of the project with CER revenues (in US$)

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Initial Investments														
Number of lamps	50,000	150,000	200,000	400,000										
Unit price	$1.97	$1.30	$1.40	$1.36										
CFLs purchase	98,500	195,500	280,000	543,429										
Other costs														
Power and Fuel	4,500	4,500	6,000	6,000										
Labor	30,000	30,000	30,000	20,000										
Destruction of the IBs		10,000	15,000	0										
Administration	20,000	20,000	20,000	20,000										
CDM Project Development Costs					11,667	11,667	11,667	11,667	11,667	11,667	11,667	11,667	11,667	11,667
TOTAL costs	153,000	260,000	351,000	589,429	11,667	11,667	11,667	11,667	11,667	11,667	11,667	11,667	11,667	11,667
Net Revenues														
Number of lamps		150,000	100,000	100,000										
Net Sales Price	$0.00	$0.37	$0.37	$0.37										
CFL sale		55,500	37,000	37,000										
CER generated (tCO2e)				12,929	31,856	31,204	27,168	22,168	21,572	21,572	21,572	21,572	21,572	5,393
Carbon revenues				193,935	477,840	468,060	407,520	332,520	323,580	323,580	323,580	323,580	323,580	80,895
TOTAL revenues	0	55,500	37,000	230,935	477,840	468,060	407,520	332,520	323,580	323,580	323,580	323,580	323,580	80,895
Margin with Carbon revenues	-153,000	-204,500	-314,000	-358,494	466,173	456,393	395,853	320,853	311,913	311,913	311,913	311,913	311,913	69,228

NPV	Discount rate
	0% $2,238,071
	10% $680,852
	15% $335,266
	18% $196,229
IRR	24.62%

Without carbon revenues, the NPV is negative (US$ -1.224 million). With CER revenues, the NPV increases up to US$ 2.238 million (and the IRR is 24.62%). It demonstrates that the CDM provides the only financial incentive to implement the project activity.

This can be further outlined with the sensitive analysis. When lowering the costs by 10% and increasing the revenues from the sale of CFL by 10%, the NPV of the project without CER revenues is still negative and the IRR of the project with CER revenues is 28.77%.

It is important to note that, REG Ltd has limited amount of funds available under the World Bank supported program, which would be able to purchase only 400,000 CFLs. Advance payment against the potential revenue from the sale of CERs accrued by the first 400,000 CFLs is being used to purchase the next tranche of 400,000 CFLs, which will be distributed to newly electrified households.

B.6. Emission reductions

B.6.1. Explanation of methodological choices

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Ex-ante estimation of emission reductions (ERs) due to the installation of energy efficient CFLs are divided in two components. In this revised PDD, the calculation of ERs for the two components (Component 1: existing REG Ltd customer (CFLs replacing ICLs) and Component 2: new customer (CFLs installed at new sites) is according to AMS-II.J, version 07.

Component 1: <u>CFLs replacing ICLs</u>

As per AMS-II.J, version 07, the electricity saved by the project activity in year *y* is calculated as follows:

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

Where:

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

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 CFL[14]
$P_{i, PJ}$ = 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 ($LFR_{i,y}$) is the % of lamps that have failed during a year. A deviation is requested along with the present Post Registration Changes to use provisions in AMS-II.J, version 07 following Option 2 to use of data monitored every three years. According to para. 30 of AMS-II.J, version 07, changes to Lamp Failure Rate ($LFR_{i,y}$) and treatment of differences between Rated Average Life and Average Life for adjustment of Net Electricity Savings (NESy): the Net Electricity Savings shall be modified for changes to the Lamp Failure Rate as may be indicated by ex post monitoring survey results. The modifications shall be made using the following methods:

(a) Calculated LFRi,y values in equation (3) shall be used for the periods when ex post monitoring surveys are not conducted;
(b) However, when ex post monitoring surveys are conducted (i.e. year 1, 4, 7,.), actual failure rates determined through the survey shall be used instead of the calculated LFRi,y values in equation (3);
(c) For subsequent years beginning from the first calculation year after completion of the ex-post monitoring survey, a new value for Li shall be determined using equation (3) and newly

[14] 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)".

calculated values of $LFR_{i,y}$ shall be used. The adjustment of Li and $LFR_{i,y}$ should be repeated every time when ex post monitoring surveys are conducted.

The rated lifetime is used to calculate the ex-ante Lamp Failure Rate as follows[15]:

$LFR_{i,y} = y * X_i * (100 – R_i) / (100 * L_i)$

Where:

$LFR_{i,y}$ = Lamp Failure Rate for equipment type i in year y (fraction)
L_i = Rated average life for equipment type i (hours)
R_i = Percentage of lamps of type *i* operating at the rated lifetime (use a value of 50)
X_i = Number of operating hours per year for equipment type *i* (hours)
y = Counter for year

$ER_y = NES_y * EF_{CO2,ELEC,y}$

$EF_{CO2,ELEC,y}$ = Emission factor in year *y* calculated in accordance with the provisions in AMS I.D (tCO_2/MWh)
ER_y = Emission reductions in year *y* (tCO_2e)

Component 2: <u>CFLs installed at new sites</u>

As part of the request to adopt the default operating hours of AMS-II.J, the emission reductions for Component 2 will be calculated using the same equation as Component 1. During its 50th meeting, *the SSC WG was of the view that above proposed revisions to the monitoring plant of Component 2, including the adoption of the default 3.5 hours/day for the operating project lamps could be allowed only if the PP adopts all the requirements of the methodology AMS-II.J related to the calculation of emission reductions and monitoring requirements as component 1. (e.g. application of the lamp failure rate, frequency of the subsequent ex-post monitoring survey, sampling requirements).* Accordingly, the emission reductions will be calculated consistently with Component 1 using requirements in AMS-II.J, version 07. This request is also consistent with the AMS-II.C, version 15 approved during EB89.

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

Where:

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

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*

[15] A permanent deviation is requested to allow the calculation of the lamp failure rate using Equation (3) in AMS-II.J, version 07 and allow claiming emission reductions for lamps that are still operational beyond the rated average lifetime. The result of the third ex-post surveys indicated that for Phase 1 and Phase 2, the lamp failure rates were 47.3% and 40% respectively at the rated lifetime of the lamps. Therefore, the ex-post monitored lamp failure rate will be applied according to paragraph 30 b) of AMS-II.J version 07.

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

The Lamp Failure Rate (LFRy) is the percentage of lamps that have failed during a year. For clarity, a deviation is requested along with the present Post Registration Changes to use provisions in AMS-II.J, version 07 following Option 2 to use of data monitored every three years. According to para. 30 of AMS-II.J, version 07, changes to Lamp Failure Rate ($LFR_{i,y}$) and treatment of differences between Rated Average Life and Average Life for adjustment of Net Electricity Savings (NESy): the Net Electricity Savings shall be modified for changes to the Lamp Failure Rate as may be indicated by ex post monitoring survey results. The modifications shall be made using the following methods:

(a) Calculated LFRi,y values in equation (3) shall be used for the periods when ex post monitoring surveys are not conducted;

(b) However, when ex post monitoring surveys are conducted (i.e. year 1, 4, 7,.), actual failure rates determined through the survey shall be used instead of the calculated LFRi,y values in equation (3);

(c) For subsequent years beginning from the first calculation year after completion of the ex-post monitoring survey, a new value for Li shall be determined using equation (3) and newly calculated values of $LFR_{i,y}$ shall be used. The adjustment of Li and $LFR_{i,y}$ should be repeated every time when ex post monitoring surveys are conducted.

The rated lifetime is used to calculate the ex-ante Lamp Failure Rate as follows[16]:

$$LFR_{i,y} = y * X_i * (100 – R_i) / (100 * L_i)$$

Where:

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

L_i = Rated average life for equipment type i (hours)

R_i = Percentage of lamps of type *i* operating at the rated lifetime (use a value of 50)

X_i = Number of operating hours per year for equipment type *i* (hours)

y = Counter for year

$$ER_y = NES_y * EF_{CO2,ELEC,y}$$

$EF_{CO2,ELEC,y}$ = Emission factor in year *y* calculated in accordance with the provisions in AMS I.D (tCO_2/MWh)

ER_y = Emission reductions in year *y* (tCO_2e)

B.6.2. Data and parameters fixed ex ante

Data applicable to both Component 1 and Component 2

[16] A permanent deviation is requested to allow the calculation of the lamp failure rate using Equation (3) in AMS-II.J, version 07 and allow claiming emission reductions for lamps that are still operational beyond the rated average lifetime. This request is also consistent with the AMS-II.C, version 15 approved during EB89. The result of the third ex-post surveys indicated that for Phase 1 and Phase 2, the lamp failure rates were 47.3% and 40% respectively at the rated lifetime of the lamps. Therefore, the ex-post monitored lamp failure rate will be applied according to paragraph 30 b) of AMS-II.J version 07.

Data / Parameter	**$EF_{CO2,ELEC,y}$ or EF_{grid}**
Unit	kg CO2e/kWh
Description	Emission factor for the national electricity grid for 2007
Source of data	See PDD 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. 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	**TD_y**
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	**NTG**
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	**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
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	Years

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	R_i
Unit	None
Description	Percentage of lamps of type 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	X_i
Unit	hours
Description	Number of operating hours per year for equipment type *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 and parameters applicable for Component 2 (AMS-II.C) alone

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	

B.6.3. Ex ante calculation of emission reductions

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A. Emission Factor calculation

The baseline emission factor is calculated ex-ante in a transparent and conservative manner as a combined margin (CM) consisting of the average of the operating margin (OM) and the build margin (BM), according to the procedures prescribed in the "Tool to calculate the emission factor for an electricity system" (version 2).

STEP 1: Identify the relevant electric power system
The project electricity system is the Rwandan national grid, which is supplied by 8 power plants: 4 hydro power plants and 4 diesel/light fuel oil power plants.[17]

STEP 2: Choose whether to include off-grid power plants in the project electricity system (optional)
NA

STEP 3: Select a method to determine the operating margin (OM) method
The Simple Operating Margin method is used since low cost, must-run resources constitute less than 50% of total grid generation in Rwanda in average of the five most recent years (2004 to 2008).

Table 7: Electricity generation per source

Net generation 2004-2008 (GWh)		
Hydro	319.09	41.9%
Diesel/light fuel oil	442.54	58.1%
TOTAL	761.63	100%

The emission factor is calculated using ex ante data as 2006 to 2008 data is readily available for the Project.

STEP 4: Calculate the operating margin emission factor according to the selected method
The emission factor is calculated as per the formula provided in the "Tool to calculate the emission factor for an electricity system" (version 2). Option A (preferred) based on data on fuel consumption and net electricity generation of each power plant / unit is used.

Where:

$EF_{grid,OM\text{-}ave,y}$	=	Simple operating margin CO2 emission factor in year y (tCO2/MWh)
$FC_{i,m,y}$	=	Amount of fossil fuel type i consumed by power plant / unit m in year y
$NCV_{i,y}$	=	Net calorific value (energy content) of fossil fuel type i in year y (0.041 TJ/ton of diesel as per the 2006 IPCC Guidelines for National Greenhouse Gas Inventories)
$EF_{CO2,i,y}$	=	CO2 emission factor of fossil fuel type i in year y (72.6 tCO2e/TJ as per the 2006 IPCC Guidelines for National Greenhouse Gas Inventories)
$EG_{m,y}$	=	Net electricity generated and delivered to the grid by power plant / unit m in year y (MWh)
m	=	All power plants / units serving the grid in year y except low-cost / must-run power plants / units
i	=	All fossil fuel types combusted in power plant / unit m in year y
y	=	The three most recent years for which data is available at the time of submission of the CDM-PDD to the DOE for validation (2006 to 2008)

[17] An old power plant of 2MW is not considered here as it has not functioned for at least 5 years.

For this calculation, 2006 to 2008 data are used. They are entered in an Excel table and the result is given below:

Power plant	Type of power	2006		2007		2008	
		Net gen (GWh)	fuel cons (ton)	Net gen (GWh)	fuel cons (ton)	Net gen (GWh)	fuel cons (ton)
Gihira	Hydro	6.032		7.196		6.431	
Gisenyi	Hydro	3.815		5.591		6.425	
Mukungwa	Hydro	22.881		18.102		43.273	
Ntaruka	Hydro	1.197		1.157		15.106	
Jabana	Diesel/light fuel oil	18.943	4,113.32	11.030	2,574.77	5.806	1,005.98
Gatsata (new)	Diesel/light fuel oil	1.184	285.50	1.979	455.62	0.000	0.00
Gikondo	Diesel/light fuel oil	82.256	18,320.16	79.214	18,144.81	78.203	17,231.35
Mukungwa	Diesel/light fuel oil	27.478	6,108.01	41.014	8,975.10	39.040	8,525.64
Total electricity supplied by the national system, not including low cost plants		129.861	28,826.98	133.237	30,150.29	123.049	26,762.97

$EF_{grid,OM\text{-}ave,y}$ = [(28,826.98 * 0.041 * 72.6) / 129,861 + (30,150.29 * 0.041 * 72.6) / 133,237 + (26,762.97 * 0.041 * 72.6) / 123,049] / 3
= **0.6606 tCO2e/MWh**

STEP 5: Identify the group of power units to be included in the build margin (BM)

The sample group of power units 'm' used to calculate the build margin consists of either:
(a) The set of five power units that have been built most recently, or
(b) The set of power capacity additions in the electricity system that comprise 20% of the system generation (in MWh) and that have been built most recently.
The set of power units that comprises the larger annual generation corresponds to option (a).

Power plant	Type of power	Year of operation	2008	
			Net gen (GWh)	Net gen (%)
Gihira	Hydro	1984	6.43	3.3%
Gisenyi	Hydro	1957	6.43	3.3%
Mukungwa	Hydro	1984	43.27	22.3%
Ntaruka	Hydro	1957	15.11	7.8%
Jabana	Diesel/light fuel oil	2004	5.81	3.0%
Gatsata (new)	Diesel/light fuel oil	2001	0.00	0.0%
Gikondo	Diesel/light fuel oil	2005	78.20	40.3%
Mukungwa	Diesel/light fuel oil	2006	39.04	20.1%

However, the group of power units identified for estimating the BM includes power units that are built more than 10 years ago (Gihira and Mukungwa, built in 1984). So those units are excluded from the group. As none grid connected power project was registered under the CDM, the set of power units is composed of Mukungwa, Gikondo, Gatsata, and Jabana.
As per REG Ltd information, those four power plants are diesel power plants which generated 123 GWh in 2008 out of 194 GWh generated by the 8 system power plants or 63%.

Using option 1 of step 4 of the "Tool to calculate the emission factor for an electricity system" (version 2), the build margin emission factor is ex-ante based, using the 2008 data which is the most recent information available.

STEP 6: Calculate the build margin emission factor

The BM emission factor is calculated using the formula given below and provided in the "Tool to calculate the emission factor for an electricity system" (version 2).

Where:

$EF_{grid,BM,y}$ = Build margin CO2 emission factor in year y (tCO2/MWh)

$EG_{m,y}$ = Net quantity of electricity generated and delivered to the grid by power unit m in year y (MWh)

$EF_{EL,m,y}$ = CO2 emission factor of power unit m in year y (tCO2/MWh)

m = Power units included in the build margin

y = Most recent historical year for which power generation data is available

Power plant	Type of power	Year of operation	2008		EF (tCO2e/MWh)
			Net gen (GWh)	fuel cons (ton)	
Jabana	Diesel/light fuel oil	2004	5.806	1,005.98	0.5157
Gatsata (new)	Diesel/light fuel oil	2001	0.000	0.00	
Gikondo	Diesel/light fuel oil	2005	78.203	17,231.35	0.6559
Mukungwa	Diesel/light fuel oil	2006	39.040	8,525.64	0.6500
Total Jabana + Gatsata +Gikondo + Mukungwa			123.049		

$EF_{grid,BM,y}$ = $\sum$ EG * EF (plant) / $\sum$ EG (plant)
= **0.6474 tCO2e/MWh**

STEP 7: Calculate the combined margin (CM) emission factor

The Baseline Emission Factor is calculated as the simple average CM. All margins are expressed in tCO2/MWh.

EF_{CM} = 0.5 * $EF_{grid,OM-ave,y}$ + 0.5 * $EF_{grid,BM,y}$
= 0.5 * 0. 6606 + 0.5 * 0.6474
= **0.6540 tCO2e/MWh**

B. Emission Reductions calculation

The Electricity Savings are assumed to be the difference between the electricity consumption of the ICLs exchanged or market referenced at new sites (Baseline) and the electricity consumption of CFLs with similar luminous output (Project).
Applying the formulae given in this PDD section B 6.1, for both component 1 and component 2, the ex-ante calculations of the energy savings and emission reductions are explained below. The exact number and rating of CFLs distributed during the project will be recorded at the time of distribution.

Component 1

This component, which refers to 400,000 CFLs distributed to the existing customers in exchange of the incandescent lamps, is (simplistically) to be implemented in the 3 first phases.

For ex-ante calculations, it is considered that:

- For each phase, all the CFLs are installed/distributed in one month.

- A 20W CFL or a 15W CFL replace respectively a 75 W ICL or a 40 W ICL, which is consistent with the luminous output equivalence given in section A.4.2.[18]
- Considering the equipment lifetime and the crediting period starting date, the component 1 will generate ERs from April 2010 to February 2014 (the crediting period running until March 2020).

Table 8: Component 1 ex ante phasing

	CFL #	Power (W)	Rated lifetime (hours)	Daily operating time (hours)	Distribution date	Rated lifetime period[19]	ICL replaced power (W)
Phase 1	50,000	20	6000	3.5	Sept 07	Oct 07-May 12	75
Phase 2	150,000	20	6000	3.5	Sept 08	Oct 08-May 13	75
Phase 3	100,000	15	6000	3.5	June 09	July 09-Feb 14	40
	100,000	20	6000	3.5	June 09	July 09-Feb 14	75

The calculation is done according to the equations (1), (2) and (3) of AMS-II.J (mentioned in section B.6.1 above) and based on a monthly basis.
For one CFL (P_{PJ}, L) and for each year y of the crediting period, the following data are calculated (see section B.6.1 for definitions of the factors):

- d (# of years): the total duration of operation of a CFL at the end of the year y (or total number of months of operation m / 12) or the rated lifetime when reached
- LFR (%): it is calculated as per the end of the year y
  = d*X*(100-R) / (100*L) = d*1278*(100-50) / (100*L)
- NES_y (W)
  = $(P_{BL}-P_{PJ})$ *O*365*(d_y-d_{y-1})*(1-LFR_y)/(1-TD) *NTG
  = $(P_{BL}-P_{PJ})$ *3.5*365*(d_y-d_{y-1})*(1-LFR_y)*1.11*0.95

The annual Net Electricity Savings is the sum of the NES generated by each CFL in the year y.
And: ER = NES * EF = NES * 0.6540
The ex-ante calculations are reported in the tables below.

[18] 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)". But for ex ante calculations in the PDD, we use a median value which is conservative as the power gap (75-20=55) is smaller compared to the 100W ICL situation (100-22=78).

[19] For simplification purposes, it is considered that the rated lifetime period starts the month following the installation/distribution of the CFL.

Component 1

Calculations using AMS-II.J

O_i	3.5	
1/(1-Tdy)	1.1111111	
NTG	0.95	
X	1277.5	
R	50	
EF (tCO2e/MWh)	0.6540	
L	6,000 hours	
lifetime	4.7 years	or 56 months

Included in the Crediting Period (April 2010-March 2020)

	2010	2011	2012	2013	2014
Energy savings	15,645	18,473	14,729	8,556	911
Emission reductions	10,232	12,081	9,632	5,596	596

Component 2

For simplification of the ex-ante calculations, the component 2 is assumed to be implemented in one phase, at a regular pace of 40,000 CFLs per month during 10 months starting on July 2010, 25% are 15W CFLs and 75% are 20W CFLs.

Table 9: Component 2 ex ante phasing

Component 2 - Pace of CFL distribution	
Jul-10	40,000
Aug-10	40,000
Sep-10	40,000
Oct-10	40,000
Nov-10	40,000
Dec-10	40,000
Jan-11	40,000
Feb-11	40,000
Mar-11	40,000
Apr-11	40,000
Total number of lamps	400,000

Adopting the equations of AMS-II.J (mentioned in section B.6.1 above), the baseline emissions and the project emissions are calculated on a monthly basis (consistently with the timeline of distribution).

For one CFL (P_{PJ}, L) and for each year y of the crediting period, the following data are calculated (see section B.6.1 for definitions of the factors):

- d (# of years): the total duration of operation of a CFL at the end of the year y (or total number of months of operation m / 12) or the rated lifetime when reached
- LFR (%): it is calculated as per the end of the year y
  = d*X*(100-R) / (100*L) = d*1278*(100-50) / (100*L)
- NES_y (W)
  = $(P_{BL}-P_{PJ})$ *O*365*(d_y-d_{y-1})*(1-LFR_y)/(1-TD) *NTG
  = $(P_{BL}-P_{PJ})$ *3.5*365*(d_y-d_{y-1})*(1-LFR_y)*1.11*0.95

The annual Net Electricity Savings is the sum of the NES generated by each CFL in the year y.
And: ER = NES * EF = NES * 0.6540
The ex-ante calculations are reported in the tables below.

Component 2

Calculations using AMS-II.J

O_i	3.5	
EF (tCO2e/MWh)	0.6540	
1/(1-Tdy)	1.1111	
NTG	0.95	
X	1277.5	
R	50	
L	6,000	hours

$P_{i,BL}$	$P_{i,PJ}$
83.3	18.75

Included in the Crediting Period (April 2010 to March 2020)

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	TOTAL
Energy savings (MWh)	3,889	28,518	27,404	23,698	19,991	16,284	12,578	8,871	5,165	1,458	0	147,856
Emission reductions (tCO2e)	2,543	18,651	17,922	15,498	13,074	10,650	8,226	5,802	3,378	954	0	96,698

Summary of ex-ante calculations of emission reductions and energy savings over the crediting period

	Estimation of Energy or Net Energy savings (MWh)	Estimation of Emission Reductions (tCO2e)
Apr-Dec 2010	19,534	12,775
2011	46,991	30,732
2012	42,133	27,554
2013	32,254	21,094
2014	20,902	13,670
2015	16,284	10,650
2016	12,578	8,226
2017	8,871	5,802
2018	5,165	3,378
2019	1,458	954
Jan-Mar 2020	0	0
TOTAL	**206,170**	**134,835**

Year	Ex ante estimate of emission reductions		
	Component 1 (t CO_2e)	Component 2 (t CO_2e)	Total Emission reductions (t CO_2e)
Apr-Dec 2010	10,232	2,543	12,775
2011	12,081	18,651	30,732
2012	9,632	17,922	27,554
2013	5,596	15,498	21,094
2014	596	13,074	13,670
2015	0	10,650	10,650
2016	0	8,226	8,226

2017	0	5,802	5,802
2018	0	3,378	3,378
2019	0	954	954
Jan-Mar 2020	0	0	0
Total	**38,137**	**96,698**	**134,835**

B.6.4. Summary of ex ante estimates of emission reductions

As ex-ante estimated calculations, the project activity generates 134,835 tonnes of CO2e over 10 years of the crediting period. The estimated annual energy savings varies up to 47 GWh.

Year	Baseline emissions (t CO_2e)	Project emissions (t CO_2e)	Leakage (t CO_2e)	Emission reductions (t CO_2e)
Apr-Dec 2010	12,775	0	0	12,775
2011	30,732	0	0	30,732
2012	27,554	0	0	27,554
2013	21,094	0	0	21,094
2014	13,670	0	0	13,670
2015	10,650	0	0	10,650
2016	8,226	0	0	8,226
2017	5,802	0	0	5,802
2018	3,378	0	0	3,378
2019	954	0	0	954
Jan-Mar 2020	0	0	0	0
Total	**134,835**	**0**	**0**	**134,835**
Total number of crediting years	10			
Annual average over the crediting period	13,483	0	0	13,483

B.7. Monitoring plan

B.7.1. Data and parameters to be monitored

Data and parameters applicable for Component 1 and Component 2

Data / Parameter	**Customer information**
Unit	None
Description	Customer identification Number (unique – as per REG Ltd records) Name of head of household Location of household
Source of data	Information provided by utility customers at the distribution points upon presentation of a bill or a cash power receipt.
Value(s) applied	
Measurement methods and procedures	Information to be collected once during CFL distribution and recorded in a register or in a in-house software
Monitoring frequency	
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 comment	

Data / Parameter	**Distribution date**
Unit	Date
Description	Date of the CFL distribution uniquely recorded for each customer participant
Source of data	Recorded by REG Ltd staff at distribution points
Value(s) applied	Format dd.mm.yyyy
Measurement methods and procedures	Information to be collected by REG Ltd staff during the CFL distribution and recorded in a register or in a in-house software
Monitoring frequency	Recorded once at distribution (check in the database at each verification)
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 comment	

Data / Parameter	**$Q_{BL,i}$ (for component 1 only)**
Unit	None
Description	Number (quantity) of pieces of incandescent lamps (ICLs) of type *i* exchanged (Component 1) or newly distributed (Component 2) under the project
Source of data	Recorded by REG Ltd staff at distribution points
Value(s) applied	Monitored
Measurement methods and procedures	No measurements required Information to be collected by REG Ltd staff during the CFL distribution and recorded in a register or in a in-house software/database
Monitoring frequency	Recorded once at distribution (check in the database at each verification)
QA/QC procedures	Control of the stock is done by an external party at the end of each phase to ensure consistency between the stock register and the database.
Purpose of data	Baseline and project emissions calculation
Additional comment	Cross-check with CFL inventory

Data / Parameter	**$Q_{PJ,i}$**
Unit	None
Description	Number (quantity) of pieces of CFLs of type *i* distributed under the project
Source of data	Recorded by REG Ltd staff at distribution points in a database
Value(s) applied	Component 1 if i = 15W CFL, $Q_{PJ,i}$ = 100,000 if i = 20W CFL, $Q_{,P,J,i}$ = 300,000 Component 2 if i = 15W CFL, $Q_{PJ,i}$ = 100,000 if i = 20W CFL, $Q_{,P,J,i}$ = 300,000
Measurement methods and procedures	Information to be collected by REG Ltd staff during the CFL distribution and recorded in a register or in a in-house software
Monitoring frequency	Recorded once at distribution (check in the database at each verification)
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 comment	

Data / Parameter	**$P_{i,BL}$ (for component 1 only)**
Unit	Watt

Description	Power of the incandescent lamps exchanged (for the component 1 only)
Source of data	Lamp marking data
Value(s) applied	25W, 40W, 60W or 75W
Measurement methods and procedures	Read by the distributor staff from the lamp while distribution is taking place. Information to be collected by REG Ltd staff during the CFL distribution and recorded in a register or in an in-house software
Monitoring frequency	Recorded once at distribution (check in the database at each verification)
QA/QC procedures	Control of the stock is done by an external party at the end of each phase to ensure consistency between the stock register and the database
Purpose of data	Baseline and project emissions calculation
Additional comment	

Data / Parameter	$\mathbf{P_{i,PJ}}$
Unit	Watts
Description	Rated power of the project CFLs of the group of "*i*" lighting devices
Source of data	Provided by REG Ltd, technical specification set in the tender
Value(s) applied	15W or 20W[20]
Measurement methods and procedures	Read by the distributor staff from the lamp while distribution is taking place Information to be collected by REG Ltd staff during the CFL distribution and recorded in a register or in a in-house software
Monitoring frequency	Recorded once at distribution (check in the database at each verification)
QA/QC procedures	Specification at procurement and reading during distribution
Purpose of data	Project emissions calculation
Additional comment	The number will also be monitored once ex post at distribution

Data / Parameter	$\mathbf{LFR_{i,y}}$
Unit	Fraction
Description	Lamp Failure Rate for equipment type i in year y (fraction)
Source of data	Provided by the consultant conducting the survey
Value(s) applied	Survey results as per ex-post monitoring as per the procedures in paragraph 29 and 30 of AMS-II.J, version 07.

[20] 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)".

Measurement methods and procedures	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"[21]. 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. 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.
Monitoring frequency	At least every three years after installation of equipment (as per procedures in paragraph 29 and 30 of AMS-II.J, version 07)
QA/QC procedures	Application of standardized data forms and compliance protocols.
Purpose of data	Project emissions calculation
Additional comment	A permanent deviation is requested to allow the calculation of the lamp failure rate according to paragraph 30 of methodology AMS II-J version 07. The deviation is to allow ER to be generated until the end of the crediting period applying ex-post monitored lamp failure rate. This request is consistent with the AMS-II.J, version 07 and AMS-II.C, 15 approved during EB89 to allow project lamps that can still operate beyond the rated lifetime to continue earning emission reductions.

B.7.2. Sampling plan

>>

The sampling plan is developed in accordance with the "Standard: Sampling and surveys for CDM project activities and programme of activities" version 05 and the "Guideline: Sampling and surveys for CDM project activities and programmes of activities", Version 04. This sampling plan applies to both Component 1 and Component 2.

Objectives and reliability requirements

The objective of the sampling plan is to determine the lamp failure rate on which basis the percentage of lamps that are still operating will be derived to discount the emission reductions. As such ex-post monitoring surveys will be implemented to collect the needed data on a sample of lamps to calculate the lamp failure rate following the monitoring requirements described in AMS-II.J, version 07.

As a small scale project activity, 90/10 confidence/precision will be used as the criteria for reliability of sampling efforts as per the "Standard for Sampling and Surveys for CDM Project activities and Programme of Activities".

Target population and sampling frame

[21] 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.

The sampling is implemented for each Phase (batch of distributed lamps) separately. The target population is the number of lamps in each Phase. The sampling frame consists in the list of lamps distributed in each Phase.

Sampling method and sample size

A simple random sampling method will be used and applied to each Phase separately so that the failure rate is derived for each phase. Each element of the sample will be drawn randomly from the total population. The sample size is calculated using the confidence level of 90% with 10% relative precision.

Using the "Guidelines for sampling and surveys for CDM project activities and programme of activities", Version 04, the equation to give the approximate required sample size is:

$$n = \frac{1.645^2 (1 - p)}{0.1^2 \times p}$$

Where

n	Sample size
p	Expected proportion of CFLs that are still operating (minimum 0.50 in all groups at the beginning). The lamp failure rate is 1 – p.
1.645	Represents the 90% confidence required
0.1	Represents the 10% relative precision

The sample size of CFL to be surveyed is:

(1.6452 x 0.5) / (0.12 x 0.5) =271

Phase 3 comprises lamps of both components. For conservativeness purpose the sample will be calculated from the total number of estimated/procured CFLs as follows:

Phase	Number of CFLs Procured	Number of CFLs per households	Computed Sampled CFLs	Selected Sampled CFLs	Number of households	Number of households to survey	Methodology applied
Phase 1	50,000	2	271	278	25,000	139	AMS-II.J
Phase 2	150,000	5	271	278	30,000	66	AMS-II.J
Phase 3	200,000	4	271	278	25,000	70	AMS-II.J
Phase 4	400,000	4	271	278	100,000	70	AMS-II.C

The number of households to visit is determined by dividing the sample size by the number of CFLs distributed per household in each phase.

For ex-post survey, the sample size will be recalculated/reconfirmed in the survey report.

Data Measurement, quality assurance/quality control and analysis

The nature of the information to be captured is a proportion value for the categorical data requiring two possible answers (functioning or non-functioning). A survey questionnaire is used to collect the needed data.

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.

Once the survey is completed the achieved precision level will be checked using the relevant formula in the "Guidelines for sampling and surveys for CDM project activities and programme of activities", Version 04.

Implementation

The sampling plan will be implemented by REG. An independent consultant will be hired to conduct the survey.

B.7.3. Other elements of monitoring plan

>>

This Monitoring Plan (MP) describes the management systems and procedures to be implemented by the project entity upon project implementation in order to ensure consistency with the two Components, especially regarding monitoring, processing and reporting of data required for the calculation of emission reductions (ERs). All data collected is entered into the database.

The methodologies require the following monitoring activities:

Applicable for both Component 1 and Component 2,

(i) Recording of lamp distribution data

(ii) Ex post monitoring surveys carried out within the first year after installation and subsequently once every three years of the elapsed rated lifetime. The sample will be determined as per the sampling plan described in Section B.7.2, with size is no less than 100, as per the specification of the methodology, is chosen within the project and includes a representative population of each phase (meaning the different types of devices and different failure rates, as per the phases)..

Applicable for Component 1,

(iii) An ex ante baseline survey,

Applicable for Component 2,

(iv) The operating hours will not be recorded. Instead, a conservative default value of 3.5 hours per day will used for the calculation of the emission reductions, to be consistent with Component 1 using the AMS-II.J methodology default value.

The implementation organisation

REG Ltd is the implementer of this project activity. It conducts the project activity campaign, the CFL distribution through its antennas and stations or through private retailers, the ICLs collection and destruction, and the monitoring. The monitoring surveys are undertaken by external consultants.

The project activity is partially included in the Urgent Electricity Rehabilitation Project (UERP). For the three first phases, the UERP implementation unit is responsible for the CFL purchase, including the procurement process. For the following phases, REG Ltd will be in charge of the procurement.

The Ministry of Infrastructure (MININFRA) was the originator of this project. It was pre-designed there and some early tasks have been undertaken by the MININFRA staff.

The monitoring plan consists of the elements listed in the following table:

Key Elements of Monitoring Plans Applicable to Deemed Savings

Monitoring Plan Element	Rwanda CFL Monitoring Plan
Ex ante baseline survey	The purpose of the ex-ante baseline survey is to obtain information about existing light bulb market and baseline operating time. This information helps in CFL procurement and other aspects of the CDM project design. The survey has been conducted door-to-door in April 2008, on a 200-household sample, chosen randomly within REG Ltd customers – minus those having benefited from the first phase in August-September 2007 in order to assure relevant data.

	The questionnaire was consistent with the template provided in the Annexe I of AMS-II.J. It identified and documented the following information: • Type(s) of installed lamps • Number of lamps per room • Wattage or other measure of equipment capacity • Usage patterns, including hours of operation • Awareness on energy efficient lamps Data is recorded in a database.
Recording of lamp distribution data	1- The CFLs are purchased through a procurement process, including tender documents which describe the required technical specifications (number of CFLs procured, wattage, lumen, lifetime, etc.). 2- All REG Ltd customers are eligible to participate in the project. The CFLs are distributed by REG Ltd to the customers upon presentation of a document enabling unique identification (i.e. his/her REG Ltd bill, prepaid purchase or voucher) and assuring (with cross-check or so) unique-time purchase. For the existing customers, CFLs are distributed in exchange of the incandescent lamps brought by the customers. For the new customers, the CFLs are distributed with the new electricity meter as a "package". Each customer is provided up to a maximum number of CFLs (2 in Phase 1, 5 in Phase 2, etc.). Each CFL is tested before distribution. The ICLs are also tested, and only the functional ones are collected and stored at the distribution outlets. The distribution staffs were trained on the benefit of the CFL at the beginning of the project. During each phase distribution, the following data are recorded: • Date of distribution • REG Ltd customer ID, which allows for unambiguous identification of the recipient of the equipment. This facilitates ex post surveys. • Number of CFLs provided for each type i device technology and, when appropriate, amount paid • Number of ICLs (for component 1 only) exchanged for each type I baseline technology A data management and quality assurance system is established, which include data entry forms. During phase 1, data have been recorded in a writing register and then filled in an Excel spread sheet. For the following phases, information is directly entered in an in-house software. All data collected will be archived for 2 years from the end of the crediting period. Identified staffs using the software were trained by the IT staff at the time of installation. 3- The distributor body maintains inventory of collected ICLs. The ICLs are shipped to REG Ltd central store in Kigali where they are stored before being destroyed. To assure that the ICLs are not reused, the lamps inventory and destruction process are cross-checked or supervised by an independent body who delivers a "certification". The destruction is done as specified by the appropriate local authority. It is assured that the destruction and the waste disposal are done in an appropriate and environmental friendly way with due care and safety and without causing any hazard.
Ex post installation surveys (Component 1 and Component2), typically to confirm that	Ex post installation surveys are conducted to confirm that the energy-efficient equipments were installed and that they are operating appropriately. The surveys will be conducted on a

equipment was installed and is still operating	sampling basis with sample size determined separately for each Phase. The sampling plan is conducted in accordance with the "Standard: Sampling and surveys for CDM project activities and programme of activities". The sampling plan as outlined in B.7.2 will be applied to the ex post surveys conducted from 13 September 2015 onwards. Previous ex post surveys keep applying the requirements stated in methodology AMS II.J version 3. On the basis of ex post monitoring surveys, the net electricity savings are adjusted considering the actual lamp failure data, consistently with AMS-II.J.
Annual record of the device power and the operating hours (Component 2)	The operating hours will not be recorded. Instead, a conservative default value of 3.5 hours per day will used for the calculation of the emission reductions, to be consistent with Component 1 using the AMS-II.J methodology default value.
Quality Control and Assurance	• Specific number of CFLs are received by the station/antenna manager. • The storekeeper releases fixed number of CFLs to the cashier. • Cashier operates the computer, where data on customer name/number, ICLs received, CFLs given and amount received is entered. • The cashier and the customer test the ICLs and CFLs before the exchange. • Storekeeper receives fixed number of ICLs from the cashier. • ICLs are shipped at the REG Ltd workshop in Kigali where they are stored before destruction. • A the end of each phase, an independent party certifies the collection of incandescent lamps through a random sampling of the lamps stored in the workshop – the number, rating and operational condition of the ICLs, as per REG Ltd records. • The independent certifier prepares a report, including witnessing the destruction/crushing of the ICLs in the safe disposal area.

Monitoring period
The monitoring intervals (or monitoring timeline), which refer to the time of the surveys or data record, will be conducted according to AMS-II.J, version 07.

Ex post monitoring surveys will be conducted at a pace allowing to match more phases, considering that the surveys will be implemented at least every 3 years.

B.8. Date of completion of application of methodology and standardized baseline and contact information of responsible persons/ entities

>>
Completed: 13/05/2016
Prepared by: World Bank, 1818 H Street, NW, Washington DC,
Affouda Leon Biaou, abiaou1@worldbank.org

SECTION C. Duration and crediting period

C.1. Duration of project activity

C.1.1. Start date of project activity

>>
10 January, 2007, which is the date of signature of the purchase contract of the first batch (50,000 CFLs)

C.1.2. Expected operational lifetime of project activity

>>
Around 13 years as per combined timeline for all phases, each phase has a separate timeline related to the time of installation of the lamps and the lamp lifetime.

C.2. Crediting period of project activity

C.2.1. Type of crediting period

>>
Fixed crediting period

C.2.2. Start date of crediting period

>>
01/04/2010
or date of registration of project, whichever is later

C.2.3. Length of crediting period

>>
10 years 0 month

SECTION D. Environmental impacts

D.1. Analysis of environmental impacts

>>
In Rwanda, the Organic Law No.04/2005 of 08/04/2005 (Article 67) requires that projects, programs and policies that may affect the environment shall be subjected to environmental impact assessment before obtaining authorization for implementation.
The Government of Rwanda established Rwanda Environmental Management Authority (REMA), under Organic Law Article 64, to coordinate and oversee all aspects of environmental management for sustainable development. One of REMA's main functions is to oversee the conduct of EIA and take a decision on proposed development projects to be undertaken by both public and private sectors.

Under the World Bank policy, the CFL project was included in the Environmental and Social Management Framework update that was done in 2009 under the Rwanda Electricity Urgent Rehabilitation Project. All documents were cleared and disclosed by the World Bank. As per REMA, relating government institutions and REG Ltd continue to discuss how to conduct the Environmental Impact Assessment of the project and how to establish a proper management system of CFLs that will be discarded in the future. The new team, which will be put in place mid 2010 at REG Ltd to conduct the new Electrification project, will be reinforced with safeguards specialists who will handle this question.

There is no regulation in Rwanda on the fluorescent lamp waste. Therefore, all fluorescent lamps in the private market in Rwanda – especially the tubular shaped lamps being used in commercial as well as in residential applications – are not currently recycled but disposed with the regular waste in landfills. Tubular lamps and CFLs contain mercury and therefore may eventually add to contamination of soils and groundwater resources. REG Ltd is aware of this fact and wants to

address this issue proactively and therefore will implement mitigation measures that will contribute to the prevention of mercury pollution from the project activity. The measures have been decided considering the following elements:

- REG Ltd will purchase the devices through tenders that require high quality CFLs, which contain nowadays less than 5 mg of mercury according to American NEMA (compared with low quality CFLs available in the private market, which have a higher amount of mercury).

The table below shows the improvement made on four-foot fluorescent lamps, (smaller) CFLs needing less mercury to operate than the four-foot lamps.

Figure 3: Mercury Contained in Four-Foot Fluorescent Lamp – Industry Average – ***Source: NEMA, Fluorescent and other Mercury-Containing Lamps and the Environment, March 2005***

- It has been estimated that the energy savings generated by the use of a CFL instead of an incandescent lamp will reduce, more than GHG emissions, mercury emissions from fossil fuel fired power plant.[22]
- A safety information campaign conducted by REG Ltd by the beginning of 2009 will inform the REG Ltd customers who are part of the project activity about the mercury danger and how to use and handle the CFLs properly.
- The CFLs used in the project activity have a long lifetime, at least 6,000 utilization hours. This long lifetime also reduces the amount of other waste (glass, aluminium, plastic, PCB-board, etc.) to be disposed of and energy required to produce and distribute lamps, compared to incandescent lamps, whose lifetime is no more than 1,000 hours. The high quality of the lamps is therefore eminent to make this a sustainable project.
- A study will be conducted to propose waste management solutions (including collection) and identify the environmental risks. The outputs of the study will be provided to the Rwandan government to be considered in the national waste management policy or to be included in any waste management project.
- REG Ltd will organize the destruction of the collected incandescent lamps and will manage the waste of the destroyed incandescent lamps. The waste will be handled in an appropriate and environmental friendly way with due care and safety without causing any hazard in accordance with national environmental regulations.

SECTION E. Local stakeholder consultation

E.1. Solicitation of comments from local stakeholders

>>

[22] For example, according to a survey conducted by NEMA in September 2007, in the US where a large part of the electricity is generated by coal fired power plant, “four to five times as much as mercury is emitted into the air to generate the electricity needed to run a standard light bulb than a CFL”.

Large communication campaigns have been organized just before and during the distributions of the pilot phase and the first phase. REG Ltd used various kinds of supports in Kinyarwanda, French and English:

a. **Billboards rentals and printing** at strategic locations
b. **Lollipops rentals and printing** spread over Kigali
c. **TV spots** on TVR 3
d. **Radio spots on the most famous radio stations** (City radio, Contact FM and Radio Rwanda). Radio is the better way of communication in Rwanda, moreover in rural areas.
e. **Posters A2,** fixed in REG Ltd stations and antennas and in other places, and s**tickers**
f. **Inserts A4** in Imvaho, New Times and Creaxion.
g. **Stand at the Rwanda Expo 2007 and 2008** (Rwanda International Trade Fair) held in August/September 2007 and 2008. There, REG Ltd staff showed, on a demonstration board, the electrical benefits of using CFLs. CFLs were also distributed as a promotion.

This broad campaign was the more efficient way to inform the Rwandan population, but also government officials and representatives of various institutions and international bodies (who were by the way present at the Expo).
REG Ltd has also a hotline where everyone can ask questions.

E.2. Summary of comments received

>>
The questions frequently asked via the hotline are available. No major issues have been raised, either via the hotline or at the Expo, where customers could discuss directly with REG Ltd staff. Generally, they were asking clarifications or implementation questions. They mainly (not to say all) agreed that the project would have significant benefits to the local community and the country as a whole.

E.3. Report on consideration of comments received

>> No adverse comment on the project activity was received from any of the stakeholder parties.

SECTION F. Approval and authorization

>> Letters of approval have been received from Rwanda and State of the Netherlands.

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

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Rwanda Energy Group Limited (REG Ltd)
Street/P.O. Box	KN 82 ST 3, Nyarugenge District, PO Box 537 Kigali - Rwanda
Building	
City	Kigali
State/Region	Kigali City
Postcode	
Country	Rwanda
Telephone	+250 252 573 666
Fax	+250 252 573 802
E-mail	reg@rwanda1.com
Website	www.reg.rw
Contact person	
Title	Chief Executive Officer (CEO)
Salutation	Mr.
Last name	Mugiraneza
Middle name	Bosco
First name	Jean
Department	Head Office
Mobile	
Direct fax	+250 252 573 802
Direct tel.	+ 250 788300172
Personal e-mail	jbmugiraneza@reg.rw

Project participant and/or responsible person/ entity	☒ Project participant ☐ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	Netherlands' Ministry of Infrastructure and the Environment (IenM)
Street/P.O. Box	Rijnstraat 8 30945
Building	
City	The Hague
State/Region	
Postcode	2500 GX
Country	The Netherlands
Telephone	+310703393456
Fax	+310703391306
E-mail	Ferry.vanhagen@minvrom.nl
Website	

Contact person	
Title	Director for International Environmental Affairs
Salutation	Mr.
Last name	Von Meijenfeldt
Middle name	
First name	Hugo
Department	International Environmental Affairs
Mobile	
Direct fax	
Direct tel.	
Personal e-mail	Ferry.vanhagen@minvrom.nl

Project participant and/or responsible person/ entity	☒ Project participant ☒ Responsible person/ entity for application of the selected methodology (ies) and, where applicable, the selected standardized baselines to the project activity
Organization name	International Bank for Reconstruction and Development (IBRD) as Trustee of the Community Development Carbon Fund (CDCF)
Street/P.O. Box	The World Bank, 1818 H St., NW
Building	
City	Washington
State/Region	DC
Postcode	20433
Country	USA
Telephone	
Fax	
E-mail	
Website	www.carbonfinance.org
Contact person	
Title	Operations Team Leader
Salutation	Mr.
Last name	Andreu
Middle name	
First name	Jose
Department	
Mobile	
Direct fax	
Direct tel.	+1 – 202 – 473-6966
Personal e-mail	ibrd-carbonfinance@worldbank.org

Appendix 2. Affirmation regarding public funding

Not applicable

Appendix 3. Applicability of methodology and standardized baseline

The applicability of the selected methodology is discussed in Section B.

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

A baseline survey was conducted in April 2008. A sample of 200 customers was chosen among REG Ltd electricity customers who had not benefited from the pilot phase of the project, which was the distribution of 50,000 compact fluorescent lamps during the period of June-August 2007.

The sample was chosen in different geographical areas and among the four economic and social categories to reach an actual proportional representation of REG Ltd customers.

- **Table 1. Sample description** •

Customer category	no. of HH in sample
Workers	35
Civil servant	65
Private sector	59
Unemployed /retired	41
TOTAL	200

The data were collected by the pollsters on site during the interviews with the customers making the sample in compliance with the preset questionnaire. Answers/responses were grouped and analyzed using SPSS programs. Some quotes of the survey illustrating the baseline are provided below.

- **Number of lamps and location**

As showed in the table below, most of the lamps are used in the bedrooms (22%), followed by outside (20%) and the dining rooms representing 18%.

Table 2. Number of lamps per room

	Bedroom	Kitchen	Family room	Dining Room	Outside	Bathroom	Total Lights
Total of lamps	252	133	189	208	225	143	1150

Percentage	22%	12%	16%	18%	20%	12%	100%
Average/HH	1.26	0.66	0.94	1.04	1.12	0.71	5.75

- **Types of lamps**

The breakdown by type of lamp shows an important number of incandescent lamps about 56%. The fittings are mainly the sockets (fittings of incandescent lamps and compact fluorescent lamps) by 78.3 %, when “reglettes” (fittings for fluorescent tubes) come on a second position by around 20%.

Type of lamp	Wattage	Total	Percent
Compact fluorescent	10W	8	1%
Compact fluorescent	20W	246	21%
SUBTOTAL		254	22%
Fluorescent short	20W	118	10%
Fluorescent long	40W	115	10%
SUBTOTAL		233	20%
Incandescent	40W	42	4%
Incandescent	60W	96	8%
Incandescent	75W	132	11%
Incandescent	100W	373	32%
SUBTOTAL		643	56%
Other	25W	16	1%
Circular	100W	4	0%
SUBTOTAL		20	2%
Total General		1150	

- **Daily lighting time**

Concerning the hours of use per day, the survey showed that the daily lighting time lamps is quite high.
30% of the lamps are turned on less than 2 hours a day, 28% between 2 an 4 hours and 42% more than 4 hours. According to the survey which is not accurate on this data, the balanced time of daily lighting per lamp is 3.84 hours.

	Daily operation time (hours)			
Type of lamp	< 2	2 to 4	> 4	ALL
Incandescent	225	206	212	643
Compact fluorescent	92	54	108	254
Fluorescent Long	19	22	74	115
Fluorescent short	15	27	76	118
Other types of lamp	0	7	13	20
TOTAL all lamps	351	316	483	1150
	30.5%	27.5%	42.0%	100.0%

Appendix 5. Further background information on monitoring plan

No further information on monitoring plan.

Appendix 6. Summary of post registration changes

The table below captures major changes and assesses their impact on baseline, additionality, eligibility criteria, monitoring, whichever is relevant:

CORRECTIONS			
No.	**Description**	**Impact**	**Sections of PDD revised**
1	To change of the name of the project participant in accordance with the notification made to the UNFCCC. REG Ltd is used in the PDD to replace Electrogaz.	Baseline: N/A Additionality: N/A Eligibility criteria: N/A Monitoring: N/A	Whole PDD
2	To list project participants as per the UNFCCC webpage since the registered PDD was not consistent.	Baseline: N/A Additionality: N/A Eligibility criteria: N/A Monitoring: N/A	B.6.2 B.7.1
3	To include the parameter fixed ex ante "Percentage of lamps of type i operating at the rated lifetime (Ri)" that not listed in the registered PDD. It is a default value provided by applied methodology AMS.II.J version 07.	Baseline: N/A Additionality: N/A Eligibility criteria: N/A Monitoring: N/A	B.6.2
4	To update the list of parameters fixed ex ante and parameters to be monitored.	Baseline: N/A Additionality: N/A Eligibility criteria: N/A Monitoring: N/A	B.6.2 B.7.1
PERMANENT CHANGES TO THE MONITORING PLAN			
1	To adopt all the requirements of methodology AMS-II.J version 07 to Component 1 and Component 2 as it was recommended by the SSCWG during the 50th meeting.	Baseline: N/A Additionality: N/A Eligibility criteria: N/A Monitoring: N/A	All PDD
2	To include a description of the sampling plan according to the Standard: Sampling and surveys for CDM project activities and programme of activities" version 05.0	Baseline: N/A Additionality: N/A Eligibility criteria: N/A Monitoring: conservative streamlining of the monitoring process.	B.7.2

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Document information

Version	*Date*	*Description*
08.0	22 July 2016	EB 90, Annex 2 Revision to include provisions related to automatically additional project activities.
07.0	15 April 2016	Revision to ensure consistency with the “Standard: Applicability of sectoral scopes” (CDM-EB88-A04-STAN) (version 01.0).
06.0	9 March 2015	Revisions to: • Include provisions related to statement on erroneous inclusion of a CPA; • Include provisions related to delayed submission of a monitoring plan; • Provisions related to local stakeholder consultation; • Provisions related to the Host Party; • Editorial improvement.
05.0	25 June 2014	Revisions to: • Include the Attachment: Instructions for filling out the project design document form for small-scale CDM project activities (these instructions supersede the "Guidelines for completing the project design document form for small-scale CDM project activities" (Version 01.1)); • Include provisions related to standardized baselines; • Add contact information on a responsible person(s)/ entity(ies) for the application of the methodology (ies) to the project activity in B.7.4 and Appendix 1; • Change the reference number from *F-CDM-SSC-PDD* to *CDM-SSC-PDD-FORM*; • Editorial improvement.
04.1	11 April 2012	Editorial revision to change history box by adding EB meeting and annex numbers in the Date column.
04.0	13 March 2012	EB 66, Annex 9 Revision required to ensure consistency with the “Guidelines for completing the project design document form for small-scale CDM project activities”
03.0	15 December 2006	EB 28, Annex 34 • The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.
02.0	08 July 2005	EB 20, Annex 14 • The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.

Version	*Date*	*Description*
01.0	21 January 2003	EB 07, Annex 05 Initial adoption.

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