



**Monitoring report form for CDM programme of activities  
(Version 02.0)**

*Complete this form in accordance with the instructions attached at the end of this form.*

**MONITORING REPORT**

<b>Title of the PoA</b>	Ethiopia Off-Grid Renewable Energy Program	
<b>UNFCCC reference number of the PoA</b>	10285	
<b>Version numbers of the PoA-DD applicable to this monitoring report</b>	7.0	
<b>Version number of this monitoring report</b>	1.0	
<b>Completion date of this monitoring report</b>	09/12/2017	
<b>Monitoring period number</b>	1	
<b>Duration of this monitoring period</b>	01/08/2016 to 31/10/2017	
<b>Monitoring report number for this monitoring period</b>	1	
<b>Coordinating/managing entity</b>	Development Bank of Ethiopia	
<b>Host Parties</b>	<b>Host Party of the PoA</b>	<b>Is this the host Party of a CPA covered in this monitoring report? (yes/no)</b>
	Federal Democratic Republic of Ethiopia	Yes
<b>Sectoral scopes</b>	1: Energy industries (renewable - / non-renewable sources)	
<b>Applied methodologies and standardized baselines</b>	AMS-III.AR. Version 5 - Substituting fossil fuel based lighting with LED/CFL lighting systems  AMS-I.F. Version 3 - Renewable electricity generation for captive use and mini-grid  AMS-I.L. Version 3 - Electrification of rural communities using renewable energy  AMS-I.B. Version 12 - Mechanical energy for the user with or without electrical energy  Applied Standardized Baseline: Not Applicable	
<b>Amount of GHG emission reductions</b>	Amount achieved	Amount achieved

or net anthropogenic GHG removals achieved by all CPAs covered in this monitoring report in this monitoring period	before 1 January 2013	from 1 January 2013
	0	44,733
Amount of GHG emission reductions or net anthropogenic GHG removals estimated ex ante for this monitoring period in the CPA-DDs for the CPAs covered in this monitoring report	31,280	

## PART I Monitoring of programme of activities (PoA)

### SECTION A. Description of PoA

#### A.1. General description of PoA

The Ethiopia Off-Grid Renewable Energy Program (the PoA) is a nation-wide program for Ethiopia that targets the large segment of the population without access to electricity for basic uses. Due to poor grid coverage and the dispersed nature of settlements in rural areas, only 14% of the population are connected to the electricity grid<sup>1</sup>. Meanwhile, more than 12 million rural households rely on sources other than the electricity grid for energy for lighting, with the majority utilizing kerosene lamps.<sup>2</sup> This PoA promotes scaling-up of the uptake of off-grid renewable energy technologies to provide electricity for lighting and other domestic, commercial, or institutional energy needs for households and other users either not connected to the grid, or not served by the grid due to acute shortage of electricity in the grid.

The Government of Ethiopia (GoE) is pursuing dramatic expansion of electricity generation and grid connection;<sup>3</sup> however, even with tremendous investments to rapidly scale up grid connection in Ethiopia, millions of families will still be living without electricity by 2025, leaving a significant market niche that the PoA could contribute to address. Conscious of this reality, the PoA will promote goals related to off-grid energy access of the GoE's Electricity Network Reinforcement and Expansion Project (ENREP), which includes targets of 150,000 solar household solar PV systems, 3,000 institutional solar PV systems and 3,000,000 small solar lighting systems (lamps/lanterns).<sup>1</sup> The GoE wishes to achieve this through the use of market-based instruments such as carbon finance, which will be available through this PoA.

<sup>1</sup> World Bank. *Project Appraisal Document for Electricity Network Reinforcement and Expansion Project (ENREP)*. Page 9. 29 May 2012.

<sup>2</sup> Central Statistical Agency, Federal Democratic Republic of Ethiopia. *Welfare Monitoring Survey 2011, Statistical Report: Indicators on Living Standard, Accessibility and Households Assets, Volume II*. Table 8.4 (b). April 2012.

<sup>3</sup> Ministry of Finance and Economic Development (Ethiopia). *Growth and Transformation Plan 2010/11 – 2014/15*. Page 72. November 2010.

**A.1.1. Corresponding generic component project activities (CPAs)**

Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Sectoral scopes	Applied methodologies and standardized baselines
Title: DBE Off-grid renewable energy solar lamps CPA CPA Type: CPA Type 1	7.0	1	AMS-III.AR Substituting fossil fuel based lighting with LED/CFL lighting systems Version 5 <sup>4</sup>
Title: DBE Off-grid renewable energy captive use mini-hydro power CPA CPA Type: CPA Type 2	7.0	1	AMS-I.F. Version 3 Renewable electricity generation for captive use and mini-grid <sup>5</sup>
Title: DBE Off-grid renewable energy solar PV CPA CPA Type: CPA Type 3	7.0	1	AMS-I.L Version 3 Electrification of Rural Communities Using Renewable Energy <sup>6</sup>
Title: DBE Off-grid renewable energy rural mini-hydro power CPA CPA Type: CPA Type 4	7.0	1	AMS-I.L. Version 3 Electrification of rural communities using renewable energy <sup>7</sup>
Title: DBE Off-grid renewable energy mini-hydro pumps CPA CPA Type: CPA Type 5	7.0	1	AMS-I.B. Version 12 Mechanical energy for the user with or without electrical energy <sup>8</sup>

**A.1.2. CPAs included in the PoA**

Title and UNFCCC reference number of the CPA	Title and reference number of the corresponding generic CPA	Version of the PoA-DD	Crediting period type and duration	Covered in this monitoring report? (yes/no)
Title: DBE Off-grid renewable energy solar lamps CPA 1 Reference Number: 10285-0001	Title: DBE Off-grid renewable energy solar lamps CPA CPA Type: CPA Type 1	7.0	Type: Fixed Duration: 01/08/2016 to 31/07/2023	Yes
Title: DBE Off-grid renewable energy solar home system CPA 1 Reference Number: 10285-0002	Title: DBE Off-grid renewable energy solar PV CPA CPA Type: CPA Type 3	7.0	Type: Renewable Duration: 30/11/2017 to 29/30/2024	No

**A.2. Coordinating/managing entity**

The CME is the Development Bank of Ethiopia (DBE). DBE is a state owned financial institution. The DBE is headquartered in Addis Ababa, with further staff in the branches and regions of Ethiopia. The address of the DBE is the following:

<sup>4</sup> <https://cdm.unfccc.int/methodologies/DB/4K7KI9GY79UEHUKF3140PCID64IXCV>

<sup>5</sup> <https://cdm.unfccc.int/methodologies/DB/9KJWQ1G0WEG6LKHX21MLPS8BQR7242>

<sup>6</sup> <https://cdm.unfccc.int/methodologies/DB/CCZKY3FSL1T28BNEGDRSCKS0CY0WVA>

<sup>7</sup> <https://cdm.unfccc.int/methodologies/DB/CCZKY3FSL1T28BNEGDRSCKS0CY0WVA>

<sup>8</sup> <https://cdm.unfccc.int/methodologies/DB/M204DLP0XMSWSZ9H4SIZ6W86M8RHCM>

Development Bank of Ethiopia  
Kirkos  
Addis Ababa  
Ethiopia

## SECTION B. Implementation of PoA

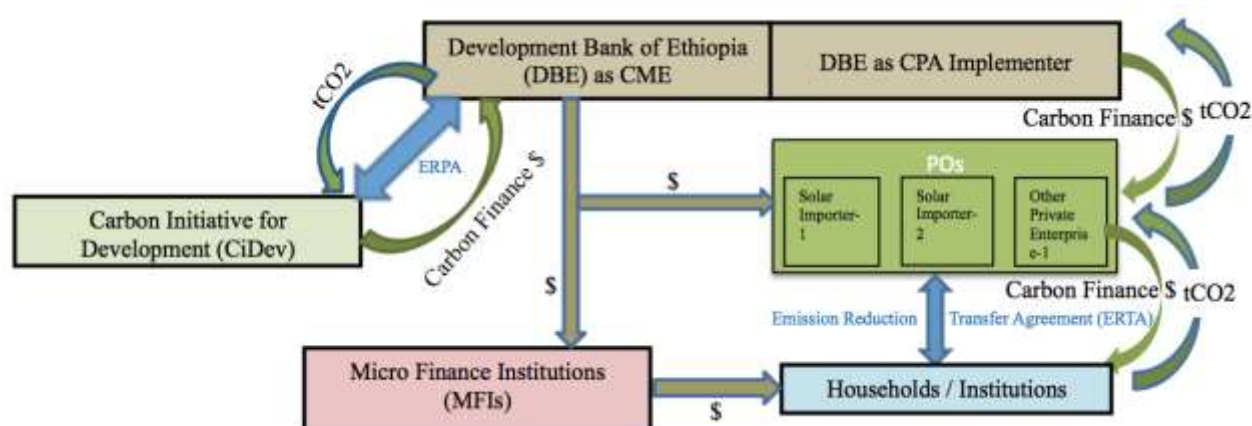
### B.1. Description of implemented PoA

The Development Bank of Ethiopia, the CME, has worked to implement the PoA as per the management system in the PoA-DD. At the time of monitoring, three CPAs have been included under the PoA. Two Type 1 CPAs, covering solar lamps and one type 3 CPA covering solar PV systems. This monitoring report covers only the first solar lamp CPA included at the time of registration. The PoA was registered on 01/07/2016.

The inclusion of CPAs was conducted as per the table in the PoA-DD covering the various responsibilities for CPA inclusion. In the case of the included CPAs, the CME was also the CPA Implementer, so everything from development of the documentation through review of the documents and submission for inclusion was handled by the CME.

The CME also underwent training on the CDM, CPA inclusion, monitoring, verification, and issuance. The training was conducted over 2 days starting on 15/06/2017. The training was conducted by Ci-Dev and Climate Focus.

The figure below shows the entities involved and the relationships between those entities for CPA types 1 and 3, the only CPA types included under the PoA at the time of monitoring.



**Figure 1. Overview of Management System for solar lamp and solar PV system CPAs**

As per the diagram, the CME acted as the CPA Implementer and worked with private operators (POs) and microfinance institutions (MFIs) to disseminate solar technologies to households and institutions in Ethiopia.

The PoA covers efficient lamps that are solar powered and Lighting Africa certified. All lamps adhere to the minimum requirements of the methodology. The exact models and brand of lamps is provided for each specific CPA.

For the CPA included in this monitoring report a sampling approach was not undertaken as it can be assumed as per methodology AMS-III.AR Version 5 that lamps in the first 3 years of operation are 100% functional. Lamps in later vintages will use sampling to determine if they are operational. Under DBE Off-grid renewable energy solar lamps CPA 1, Lighting Africa certified solar lamps were sold or distributed to end-users.

**B.2. Post-registration changes to PoA****B.2.1. Corrections**

There are no corrections to the programme information or fixed parameters at this stage.

**B.2.2. Inclusion of monitoring plan**

There is a post-registration change to include a monitoring plan into the PoA-DD. The post-registration change is being submitted with this monitoring report.

PoA-DD Version Number: 7.0

PoA-DD Completion Date: 22/10/2017

DOE Validation Report Date: DD/MM/YYYY

**B.2.3. Permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools**

There are no permanent changes to the registered monitoring plan, or permanent deviation of monitoring from the applied methodologies, standardized baseline, or other applies standards or tools.

**B.2.4. Changes to programme design**

There are no changes to the programme design included in this monitoring report.

**PART II Monitoring of CPAs**

Title: DBE Off-grid renewable energy solar lamps CPA 1

Reference Number: 10285-0001

**SECTION C. Implementation of CPAs****C.1. Description of implemented CPAs**

The CPA targets poor and vulnerable households mainly in rural areas<sup>9</sup>, who rely primarily on fossil fuels for lighting, and provides improved energy access to such households, with associated benefits for poverty alleviation, while simultaneously reducing greenhouse gas emissions from the exploitation of fossil fuels. This CPA includes the distribution of solar lamps/solar lanterns (referred to collectively as “solar lamps”) that provide lighting powered by solar energy, for households or other end-users in the entirety of Ethiopia. It was expected that this CPA will include approximately

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<sup>9</sup> Urban and peri-urban households may also benefit from the activity

240,000 solar lamps to be installed in Ethiopia between 20/01/2015 – 19/01/2018.<sup>10</sup> The CPA has distributed 417,374 solar lamps over at the time of monitoring. All lamps are solar powered and certified by Lighting Africa. The lamp models distributed under the CPA are the following:

**Table 1. List of Lighting Africa Certified Solar Lamp Technologies under the CPA**

<b>Model</b>	<b>Manufacturer</b>	<b>Number Distributed</b>
S2	d.Light Limited	149,091
S20	d.Light Limited	31,523
S300	d.Light Limited	30,226
D20	d.Light Limited	8,330
Sun King Eco	Greenlight Planet	105,665
Sun King Mobile	Greenlight Planet	5,466
Sun King Pro 2	Greenlight Planet	35,425
Sun King Solo	Greenlight Planet	1,894
MB2-090	Omnivoltaic Power	6,059
MB2-200	Omnivoltaic Power	22,091
MB2-290	Omnivoltaic Power	12,759
MB2-380	Omnivoltaic Power	7,190
ovPilot X	Omnivoltaic Power	1,655
Total		

The volumes of lamp models by retailers are shown in the emission reduction calculations.<sup>11</sup> For technical specifications for each technology covered by the CPA are provided below.

#### **d.Light S300**

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance<sup>12</sup></u>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	100 lumens (high setting) and 29 lumens (low setting)  Wattage is up to 3.3 Watts on high setting <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 100% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-	PV module No separate minimum rated capacity requirement for PV	PV module is a 1.6 watt monocrystalline silicon module

<sup>10</sup> The exact number and dates are subject to change

<sup>11</sup> Emission Reduction Calculation for Monitoring Report.xlsx

<sup>12</sup> Lighting Global. D.Light S300 Technical Specifications. Accessed on October 10<sup>th</sup> 2015 at [https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS\\_dl-s3004.pdf](https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS_dl-s3004.pdf)

<sup>13</sup> Assuming 30-90 lm/W for LED bulbs as per *Rapid Tables: How to convert lumens to watts* accessed at <http://www.rapidtables.com/calc/light/how-lumen-to-watt.htm>

charging (in Watts)	module	
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery is a lithium iron phosphate battery
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 4.1 hours at the high brightness setting and autonomous time is 5 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

#### d.Light D20

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>14</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	170 lumens (high setting), 56 lumens (low setting), and 25 lumens with the lantern at high setting  Wattage is up to 5.7 Watts on high setting <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 98% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 5.4 watt polycrystalline silicon module
Type (e.g. NiMH, Lead-	Li-ion battery preferable	Battery uses lithium based

<sup>14</sup> Lighting Global. D.Light D20 Technical Specifications. Accessed on October 10<sup>th</sup> 2015 at [https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS\\_dl-d20.pdf](https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS_dl-d20.pdf)

Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	No minimum rated capacity of batteries	chemistry
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 4.1 hours at the high brightness setting and autonomous time is 5 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

#### d.Light S20

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance<sup>15</sup></u>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	29 lumens Wattage is up to 1.0 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 103% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 0.4 watt monocrystalline silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium based chemistry
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller

<sup>15</sup> Lighting Global. D.Light S20 Technical Specifications. Accessed on December 4<sup>h</sup> 2017 at [https://www.lightingglobal.org/wp-content/uploads/2013/12/LG\\_SSS-dl-S20\\_AR.pdf](https://www.lightingglobal.org/wp-content/uploads/2013/12/LG_SSS-dl-S20_AR.pdf)



Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 4.5 hours. Autonomous burn time is 6.5 hours.
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

**d.Light S2**

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>16</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	33 lumens Wattage is up to 1.1 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 97% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 0.33 watt monocrystalline silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium based chemistry
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 4 hours. Autonomous burn time is 5.3 hours.
Solar Run Times(s) (SRT)	3.5 hours	The solar run time is 4.1

<sup>16</sup> Lighting Global. D.Light S2 Technical Specifications. Accessed on December 4<sup>h</sup> 2017 at [https://www.lightingglobal.org/wp-content/uploads/2013/12/d.Light\\_S2\\_ar-corrected-170627.pdf](https://www.lightingglobal.org/wp-content/uploads/2013/12/d.Light_S2_ar-corrected-170627.pdf)

for products with solar energy charging systems		hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

## Sun King Pro 2

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>17</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	160 lumens Wattage is up to 5.3 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 96% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 3 watt monocrystalline silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium iron phosphate
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 5.5 hours and the autonomous time is 5.9 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a	Not applicable	-

<sup>17</sup> Lighting Global. Sun King Pro 2 Technical Specifications. Accessed on October 10<sup>th</sup> 2015 at [https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS\\_glp-sunkingpro2\\_products\\_v2.pdf](https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS_glp-sunkingpro2_products_v2.pdf)

centralized charging system (e.g. the national grid)		
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

### Sun King Eco

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>18</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	32 lumens Wattage is up to 1 Watt <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 101% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 0.73 watt amorphous silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium iron phosphate
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 5.8 hours and the autonomous time is 5.8 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

<sup>18</sup> Lighting Global. Sun King Eco Technical Specifications. Accessed on October 10<sup>th</sup> 2015 at [https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS\\_glp-sunkingeco\\_v4-1.pdf](https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS_glp-sunkingeco_v4-1.pdf)

**Sun King Mobile**

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>19</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	98 lumens Wattage is up to 3.2 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 96% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 1.6 watt polycrystalline silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium iron phosphate
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 5.4 hours and the autonomous time is 5.4 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

**Sun King Solo**

<sup>19</sup> Lighting Global. Sun King Mobile Technical Specifications. Accessed on October 10<sup>th</sup> 2015 at [https://www.lightingglobal.org/wp-content/uploads/2014/02/LG-SSS\\_glp-sunkingmobile.pdf](https://www.lightingglobal.org/wp-content/uploads/2014/02/LG-SSS_glp-sunkingmobile.pdf)

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>20</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	51 lumens Wattage is up to 1.7 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 94% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 0.78 watt amorphous silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium iron phosphate
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 5.4 hours and the autonomous time is 5.8 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

### Omnivoltaic Beacon MB2-090

<sup>20</sup> Lighting Global. Sun King Solo Technical Specifications. Accessed on October 10<sup>th</sup> 2015 at [https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS\\_glp-sunkingsolo\\_v3.pdf](https://www.lightingglobal.org/wp-content/uploads/2013/12/LG-SSS_glp-sunkingsolo_v3.pdf)

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>21</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	92 lumens Wattage is up to 3.1 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 93% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 1.3 watt polycrystalline silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium iron phosphate
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 5.1 hours and the autonomous time is 5.7 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

### Omnivoltaic Beacon MB2-200

<sup>21</sup> Lighting Global. Omnivoltaic Beacon MB2-090 Technical Specifications. Accessed on December 4<sup>th</sup> 2017 at [https://www.lightingglobal.org/wp-content/uploads/2013/12/LG\\_SSS-Omnivoltaic\\_MB2-090\\_v6.pdf](https://www.lightingglobal.org/wp-content/uploads/2013/12/LG_SSS-Omnivoltaic_MB2-090_v6.pdf)

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>22</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	210 lumens Wattage is up to 7 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 93% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 2.6 watt amorphous silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium iron phosphate
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 4.4 hours and the autonomous time is 5.3 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

### Omnivoltaic Beacon MB2-290

<sup>22</sup> Lighting Global. Omnivoltaic Beacon MB2-200 Technical Specifications. Accessed on October 10<sup>th</sup> 2015 at [https://www.lightingglobal.org/wp-content/uploads/2014/01/LG-SSS\\_mar-mb22001.pdf](https://www.lightingglobal.org/wp-content/uploads/2014/01/LG-SSS_mar-mb22001.pdf)

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>23</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	210 lumens Wattage is up to 7 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 93% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 3.9 watt apolycrystalline silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium iron phosphate
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 4.2 hours and the autonomous time is 5.3 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

### Omnivoltaic Beacon MB2-380

<sup>23</sup> Lighting Global. Omnivoltaic Beacon MB2-290 Technical Specifications. Accessed on December 4<sup>th</sup> 2017 at [https://www.lightingglobal.org/wp-content/uploads/2014/01/LG-SSS\\_mar-mb2290\\_ar-HYBRID-v2-2.pdf](https://www.lightingglobal.org/wp-content/uploads/2014/01/LG-SSS_mar-mb2290_ar-HYBRID-v2-2.pdf)



<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>24</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	210 lumens Wattage is up to 7 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 93% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 3.9 watt polycrystalline silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium iron phosphate
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 4.3 hours and the autonomous time is 5.3 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

## Omnivoltaic ovPilot X

<sup>24</sup> Lighting Global. Omnivoltaic Beacon MB2-380 Technical Specifications. Accessed on December 4<sup>th</sup> 2017 at [https://www.lightingglobal.org/wp-content/uploads/2014/01/LG-SSS\\_mar-mb2380\\_ar-HYBRID-v2-1.pdf](https://www.lightingglobal.org/wp-content/uploads/2014/01/LG-SSS_mar-mb2380_ar-HYBRID-v2-1.pdf)

<u>Design Aspect</u>	<u>Requirement</u>	<u>Technology Performance</u> <sup>25</sup>
Lamp wattage (in Watts) and luminous flux output (in lumens)	Luminous flux output: 25 lumens No separate minimum wattage requirement	74 lumens Wattage is up to 2.5 Watts <sup>13</sup>
Rated lamp life (in hours)	5,000 hours (Option 1, paragraph 17) or 10,000 hours Option 2, paragraph 18). For Option 2, in place of long-term measurement, the relative luminous flux shall not decrease by more than 15% during 2,000 hours of continuous operation.	Option 2 is chosen. 98% of the original output remains after 2,000 hours of run time
Type and rated capacity of the renewable energy equipment used for battery-charging (in Watts)	PV module No separate minimum rated capacity requirement for PV module	PV module is a 2 watt polycrystalline silicon module
Type (e.g. NiMH, Lead-Acid, Li-ion), and rated capacity of the batteries (in Ampere hours)	Li-ion battery preferable No minimum rated capacity of batteries	Battery uses lithium ion
Type of charge controller (e.g. active or passive)	Passive charge controller	Passive charge controller
Autonomous time and DBT	DBT at least 4 hours	Run time per day of solar charging (DBT) is 8.9 hours and the autonomous time is 12 hours
Solar Run Times(s) (SRT) for products with solar energy charging systems	3.5 hours	The solar run time is 4.1 hours
Amount of time to fully charge the product using mechanical means or a centralized charging system (e.g. the national grid)	Not applicable	-
Physical protection against environmental factors (e.g. rain, heat, insect ingress)	Lamps shall comply with Lighting Africa / Lighting Global Quality Test Method	Product passed Lighting Global Minimum Quality Standards, including physical ingress protection test

All technologies to be distributed were be stand-alone, off-grid lighting products where the energy comes from a rechargeable battery, which are charged by a solar panel. These units provided lighting for individual households.

The CPA reduced GHGs by substituting lighting powered by renewable, solar energy for the use of lamps that rely on burning fossil fuels, namely kerosene. This substitution reduced mainly CO<sub>2</sub>

<sup>25</sup> Lighting Global. Omnivoltaic ovPilot X Technical Specifications. Accessed on December 4<sup>th</sup> 2017 at [https://www.lightingglobal.org/wp-content/uploads/2016/10/LG\\_SSS\\_omni-ovpilotX\\_AR-v2.pdf](https://www.lightingglobal.org/wp-content/uploads/2016/10/LG_SSS_omni-ovpilotX_AR-v2.pdf)

emissions. In the existing scenario, end-users targeted by the CPA used primarily kerosene for lighting.

A long term line of credit was made available by the World Bank Group's (WBG) International Development Association (IDA) in 2013 for market development of renewable energy and energy efficient products. The credit line has addressed financial constraints across the off-grid technologies' value chains regarding access to finance through DBE by providing working capital loans to private companies importing, distributing and selling renewable technologies. This access to foreign credit has allowed private companies to obtain required upfront capital to import, distribute, install and service solar technologies.

Solar lamps under the CPA are sold to end-user through different private solar importers who borrow loan under IDA credit line. The solar importers operating under the CPA are Vera International Business, Rensys, Universal Electronics, Dama Trade, and Lydetco. Depending on individual business models, sometimes these importers also act as distributors and even as retailers making sales directly to consumers.

Under the IDA credit line, the private solar importers receive financing from the CME to import solar products eligible under the CME's PoA. The agreement between the CME and the private solar importers specifies that the carbon credit rights for products imported through the IDA credit line are conceded to the CME and the private solar importers are required to provide the necessary information for monitoring and tracking of the solar products imported. The CME receives regular reports (monthly or quarterly) from the retailers/importers on the volumes of solar lamps sold by model. The summary of the monthly sales since the start of the CPA are shown in the emission reduction calculation excel sheet.<sup>26</sup>

The following diagram shows the different monitoring points of the CPA.



\*end-user information may not be collected for lamps of vintage 1, 2, or 3 as full operationality can be assumed

**Figure 2. Monitoring Points of the CPA**

The emission reduction calculations are based on the sales information from Monitoring Point 2. The volumes sold can be validated from importation records collected at Monitoring Point 1. For solar lamps of vintage 4 or older end-user information is collected through an electronic warranty registration system, however, for this monitoring period no lamps are older than vintage 3.

For the first three years of operation 100% of the lamps distributed are assumed operational. The sales and sales dates of the technologies are tracked to determine the number of lamps in operation.

<sup>26</sup> Emission Reduction Calculation for Monitoring Report.xlsx

## C.2. Location of CPAs

The geographical boundary is the borders of the Federal Democratic Republic of Ethiopia. The CPA was implemented across Ethiopia, as shown in Figure 1 below.

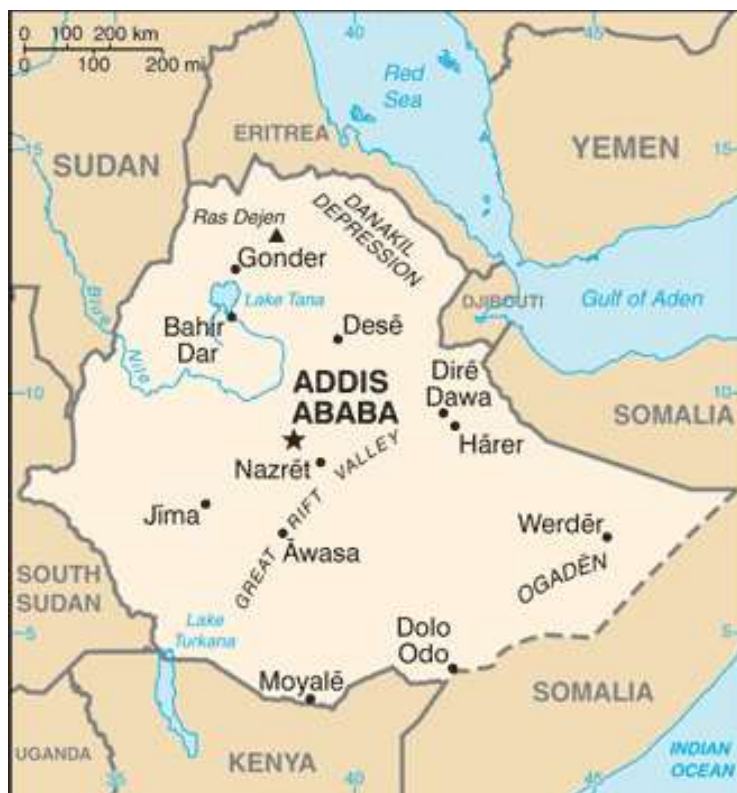


Figure 3. Map of Ethiopia

The capital city, Addis Ababa, is located at 9.0300° N and E 38.7400° E.

## C.3. Post-registration changes to CPAs

### C.3.1. Temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies or standardized baselines

There are no temporary deviations from the monitoring plans in the included CPA-DDs, applied methodologies or standardized baselines during this monitoring period, for any CPAs covered in this monitoring report.

### C.3.2. Corrections

There are no corrections to project information or parameters fixed at inclusion or renewal of the crediting period of any of the CPAs covered in this monitoring report.

### C.3.3. Changes to the start date of the crediting period

There are no changes to the start date of the crediting period fixed at the inclusion of any of the CPAs covered in this monitoring report.

**C.3.4. Inclusion of monitoring plan**

There have been post-registration changes to include a monitoring plan into the CPA-DD, for which the delayed submission of the monitoring plan was chosen by the CME at the time of inclusion of the CPA.

Changes that have been notified to the secretariat from the period prior to this monitoring period:

None.

Changes that have been notified to the secretariat as applicable from this monitoring period:

[List of Changes]

[Notification Date]

[Reference Number]

**C.3.5. Permanent changes to the included monitoring plans, or permanent deviation of monitoring from the applied methodologies, standardized baselines, or other applied standards or tools**

There are no permanent changes to the monitoring plans included in the CPA-DD, or permanent deviation of monitoring from the applied methodologies, or standardized baseline, or other applied standards or tools for the CPA covered in this monitoring report.

**C.3.6. Changes to project design**

There are no changes to the project design of the CPA included in this monitoring report.

**SECTION D. Description of monitoring system of CPAs**Operational and Management Structure

The CME is also the CPA Implementer for the CPA and is responsible for implementing the monitoring plan for this CPA. Within the office, the CME's PoA Manager was the individual with overall responsibility and sign-off for the implementation of monitoring. The CME directly coordinated with the Partner Organizations (POs), to collect the information on the volume of lamps sold and the sales dates for the program database.

The POs are retailer and importers distributing products under the CPA. The full list of POs as well as the model and volume of lamps under the CPA is shown below.

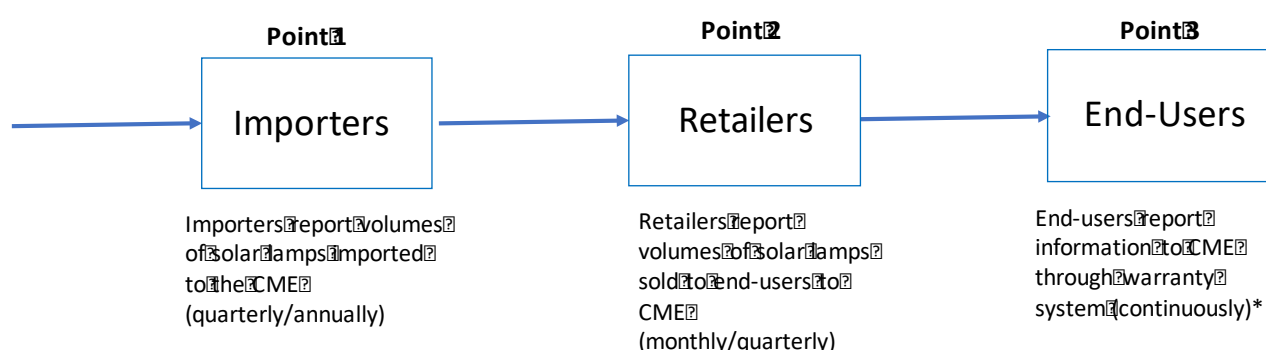
Importer	Model	Total Lamps
Dama	OVPilot X	1,655
	MB2-90	6,059
	MB2-200	22,091
	MB2-290	12,759
	MB2-380	7,190
	Sunking Pro 2	446
	Sunking Mobile	57
Vera	D-Light S2	115,024

	D-Light S20	7,564
	D-Light S300	30,226
	D-Light D20	8,330
Rensys	D-Light S2	34,067
	D-Light S20	23,959
Lydetco	Sun King Pro 2	14,438
	Sun King Solo	1,894
	Sun King Eco	8,643
	Sun King Mobile	5,409
Universal	Sunking Eco	97,022
	Sunking Pro 2	20,541

#### Responsibilities and Institutional Arrangements for Data Collection and Archiving

POs reported directly to the CPA implementer on the distribution of solar lamps, including relevant information for the program database related to solar lamp identification, date of sale, identity and any contact information of the end-user, if available. For quality control, it was ensured that only Lighting Africa certified solar lamps were included under the CPA.

POs involved in importation report the volumes imported to the CME at Monitoring Point 1. POs involved in importation and retail sale, or only retail sale report the volumes sold to the CME at Monitoring Point 2. Monitoring Point 3 covers the registration of the solar lamp technologies with the CME by end-users to activate the product warranty. This can be done for lamps of all vintages but is only required for lamps older than 3 years.



\*end-user information may not be collected for lamps of vintage 1, 2, or 3 as full operability can be assumed

**Figure 4. Monitoring Points of the CPA**

For the monitoring of the CPA, the sales data reported to the CME at Monitoring Point 2 was aggregated and used to determine the parameters required for calculating the emission reductions under the CPA. Retail sales under Monitoring Point 2 are typically reported quarterly. Lamps under the CPA were assumed to be operational from the start of the month following their sale. POs under the CPA are registered private companies, non-profits, or importers and abide by all legal, licensing, and environmental requirements of the Ethiopian government.

While the CPA-DD covers a sampling plan, no survey or sampling was conducted at this stage as it is assumed, following the methodology, that 100% of lamps are operational in the first three years of operation. No lamps under the CPA during the monitoring period are older than three years.

**SECTION E. Data and parameters****E.1. Data and parameters fixed ex ante**

<b>Data/Parameter</b>	DV
Unit	tCO <sub>2</sub> per project lamp
Description	Lamp Emission Factor
Source of data	AMS-III.AR Version 5
Value(s) applied	0.092
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

<b>Data/Parameter</b>	FUR
Unit	L/hour
Description	Fuel Use Rate
Source of data	AMS-III.AR Version 5
Value(s) applied	0.03
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

<b>Data/Parameter</b>	O
Unit	Hours/day
Description	Utilization Rate
Source of data	AMS-III.AR Version 5
Value(s) applied	3.5
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	
<b>Data/Parameter</b>	U
Unit	Days/Year
Description	Annual Utilization
Source of data	AMS-III.AR Version 5
Value(s) applied	365
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

<b>Data/Parameter</b>	EF
Unit	kgCO <sub>2</sub> /liter
Description	Fuel Emissions Factor
Source of data	AMS-III.AR Version 5
Value(s) applied	2.4
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

<b>Data/Parameter</b>	n
Unit	-
Description	Number of fuel-based lamps replaced per project lamp
Source of data	AMS-III.AR Version 5
Value(s) applied	1
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

<b>Data/Parameter</b>	GF,y
Unit	-
Description	Grid Factor in year y
Source of data	AMS-III.AR Version 5
Value(s) applied	1.0
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Applicable to lamps that are charged with renewable energy

<b>Data/Parameter</b>	LF
Unit	-
Description	Leakage Factor
Source of data	AMS-III.AR Version 5
Value(s) applied	1.0
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of leakage
Additional comments	



<b>Data/Parameter</b>	NTG
Unit	-
Description	Net-to-gross adjustment factor
Source of data	AMS-III.AR Version 5
Value(s) applied	1.0
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

<b>Data/Parameter</b>	DBy
Unit	-
Description	Dynamic Baseline Factor in Year y
Source of data	AMS-III.AR Version 5
Value(s) applied	1.0
Choice of data or measurement methods and procedures	Methodology default value
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Default value in absence of relevant information

## E.2. Data and parameters monitored

<b>Data/Parameter</b>	$N_{i,j}$
Unit	Lamps-years
Description	Number of full-time project lamps distributed to end users of lamp type $i$ with charging method $j$ = solar
Measured/calculated/default	Calculated
Source of data	Sales and Import Records
Value(s) of monitored parameter	<p>The number of full-time project lamps is measured in lamp-years. The parameter is determined through summation of the fraction of the year the lamp was in use. For lamps with evidence of a retail sale date to the end-user, the lamp is deemed in use from the start of the following month. For lamps with evidence of a wholesale date, the lamp is deemed in use from the start of the third month after sale.</p> <p>For example:</p> <p>A lamp sold through retail sale on 14/05/2016 is deemed operational from 01/06/2016. A lamp sold through whole sale on 14/05/2016 is deemed operational from 01/08/2016.</p>
Monitoring equipment	N/A
Measuring/reading/recording frequency	Once per lamp vintage
Calculation method (if applicable)	Summation of the full-time equivalent of all lamps in the monitoring period
QA/QC procedures	The lamp serial number may be cross-checked with the PO's records to ensure the PO imported or manufactured the lamp in question

Purpose of data/parameter	Calculation of baseline emissions
Additional comments	

Data/Parameter	$OF_{y,i,j}$
Unit	Fraction
Description	Fraction of project lamps distributed to end users that are operating and in service in year $y$ , for each lamp type $i$ and charging method $j$
Measured/calculated/default	Measured/default
Source of data	Methodology default values or surveys
Value(s) of monitored parameter	CPA Implementer or PO is responsible for the year 3 monitoring survey, as determined by written agreement between the two.  Monitoring surveys to determine percentage of project lamps distributed to end users that are operating and in service will be conducted during the third year of the crediting period. The survey to be utilized to determine this percentage is described in more detail in Section B.7.2 of this CPA-DD.
Monitoring equipment	Surveys, in-person inspection
Measuring/reading/recording frequency	Once in per vintage started in year for each vintages 4, 5, 6, and 7
Calculation method (if applicable)	Calculated as the fraction of lamps in operation through sampling
QA/QC procedures	The survey will conform to 90/10 confidence / precision requirements  Only project lamps with a unique project marking (matching serial number) can be counted as operating and in service, taking into account the additional comments
Purpose of data/parameter	Calculation of baseline emissions
Additional comments	Project lamps that had been replaced as part of a regular maintenance or warranty program can be counted as operating at the time of the survey

### E.3. Implementation of sampling plan

There was no sampling for this monitoring period.

## SECTION F. Calculation of emission reductions or net anthropogenic removals

### F.1. Calculation of baseline emissions or baseline net removals

Baseline emissions for the monitoring period were calculated as follows:

$$ER_y = \sum_{i,j} N_{i,j} * BE_{y,i} * OF_{y,i,j}$$

Where:

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

$N_{i,j}$  Number of project lamps distributed to end users of lamp type  $i$  with charging method  $j$  = solar

$OF_{y,i,j}$  Percentage of project lamps distributed to end users that are operating and in service in year  $y$ , for each lamp type  $i$  and charging method  $j$ . Assumed to be equal to 100% for years 1, 2 and 3, and equal to the value determined in paragraph 28, for years 4, 5, 6 and 7

According to paragraph 30 of AMS-III.AR Version 5, for project lamps that will claim emission reductions for up to seven years, *ex-post* monitoring surveys to determine percentage of project

lamps distributed to end users that are operating and in service will be conducted during the third year of the crediting period.

With:

$$BE_y = DV * GF_y * DB_y$$

Where

$BE_y$  Baseline emissions per project lamp in year  $y$  (t CO<sub>2</sub>e)

$GF$  Grid Factor in year  $y$ , Equal to 1.0 since charging option defined in paragraph 3(a) is used

$DB_y$  Dynamic Baseline Factor (change in baseline fuel, fuel use rate, and/or utilization during crediting period) in year  $y$ , Option 1: default of 1.0 in the absence of relevant information

Project emissions are zero, following paragraph 23 of AMS-III.AR Version 5: "There are no project emissions ( $PE_y = 0$ ) if the project lamp charging mechanism utilized is as defined in: (a) Paragraph 3(a)."

And:

$$\begin{aligned} DV &= FUR * O * U * EF / 1000 * LF * n * NTG \\ &= 0.03 \text{ L/hr} * 3.5 \text{ hr/day} * 365 \text{ day/yr} * 2.4 \text{ kgCO}_2/\text{L} / 1000 * 1 * 1 * 1 \\ &= 0.092 \text{ tCO}_2 \end{aligned}$$

$$\begin{aligned} BE_y &= DV * GF_y * DB_y \\ &= 0.092 \text{ tCO}_2 * 1.0 * 1.0 \\ &= 0.092 \text{ tCO}_2 \end{aligned}$$

The operational fraction  $OF_{y,i,j}$  is assumed to be 100% for all lamps for the first three years of operation. All lamps under the activity are either vintage 1 or 2. The number of full-time operational lamps as per the monitoring exercise is 486,225.<sup>27</sup>

$$\begin{aligned} ER_y &= \sum_{i,j} N_{i,j} * BE_{y,i} * OF_{y,i,j} \\ &= 486,225 * 0.092 \text{ tCO}_2 * 100\% \\ &= 44,733 \text{ tCO}_2 \end{aligned}$$

## F.2. Calculation of project emissions or actual net removals

As per AMS-III.AR Version 5, the project emissions assumed to be 0 as all technologies under the project activity fall under paragraph 3(a) of the methodology. As per paragraph 23 of the methodology, project emissions are 0.

## F.3. Calculation of leakage emissions

As per AMS-III.AR Version 5, the leakage factor is assumed to be 1.0 therefore leakage is not calculated.

<sup>27</sup> Emission Reduction Calculation for Monitoring Report.xlsx

**F.4. Calculation of emission reductions or net anthropogenic removals**

CPA UNFCCC reference number	Baseline GHG emissions or baseline net GHG removals (t CO <sub>2</sub> e)	Project GHG emissions or actual net GHG removals (t CO <sub>2</sub> e)	Leakage GHG emissions (t CO <sub>2</sub> e)	GHG emission reductions or net anthropogenic GHG removals (t CO <sub>2</sub> e)		
				Before 01/01/2013	From 01/01/2013	Total amount
10285-0001	44,733	0	0	0	44,733	44,733
<b>Total</b>	44,733	0	0	0	44,733	44,733

**F.5. Comparison of emission reductions or net anthropogenic removals achieved with estimates in the included CPA-DDs**

CPA UNFCCC reference number	Amount achieved during this monitoring period (t CO <sub>2</sub> e)	Amount estimated ex ante (t CO <sub>2</sub> e)
10285-0001	44,733	31,280
<b>Total</b>	44,733	31,280

**F.6. Remarks on increase in achieved emission reductions**

The emission reductions achieved during the monitoring period are higher than the estimated ex ante emissions. The reason for the higher than expected emission reductions is the higher than expected volume of solar lamps sold/distributed in the CPA since the start of the CPA, allowing for more lamps to be operational during the monitoring period.

The initial estimate targeted 240,000 solar lamps. Under the CPA 417,374 lamps were sold/distributed. This is a 74 per cent increase of the projected number of solar lamps. The achieved emission reductions are 43 per cent larger than the estimate. The resulting increase in ERs is not equal to the increase in lamps, sold as these lamps were sold throughout the monitoring period.

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**Document information**

<i>Version</i>	<i>Date</i>	<i>Description</i>
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