Standardized Crediting Framework (SCF): A6 Model for Energy Access Rwanda

DRAFT Methodology for solar home systems

1. Methodology title, version, and date

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| Methodology title | Solar home systems for Rwanda |
| Version | 1.0 |
| Date | 06/04/2023 |

1. Definitions

For this methodology, the following definitions shall apply:

**Facility-scale solar PV system** – solar PV electricity generation system that supplies electricity to a single consumer (e.g., a home or school) and that is not connected with other facilities or generation systems (i.e., stand-alone systems).

**New consumer(s)** – the end-user(s)/facility(ies) (households) that, prior to the activity, had no connection to an operational source of electricity.

1. Summary

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| --- | --- |
| Typical activity(ies)[[1]](#footnote-2) | Rural communities are supplied with electricity from the facility-scale solar PV. The activity supplies electricity to consumers who, prior to activity implementation, were not connected to a national or regional grid. |
| Type of GHG emissions mitigation action | Displacement of fossil fuel use. |

1. Eligibility criteria

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| --- | --- |
| Technology | Facility-scale solar PV systems: solar home systems |
| Consumers | Consumers that were not connected to a national or regional grid or mini-grid |
| Legal | The activity must comply with relevant Rwandan national laws and regulations |
| Technical standards | The activity equipment must comply with the applicable national and/or international standards |
| Double counting | The activity, or parts of the activity, may not be registered with any other emission reduction standard or registry. If the activity had historically been registered with another emission reduction standard or registry, it must not issue any further carbon credits under that standard or registry. |

1. Emission sources and gases

The methodology covers only CO2 resulting from the combustion of fossil fuels. For the baseline, this is the fossil fuel consumption that will be displaced by the activity technologies (e.g., diesel generators). For the activity, there are no emissions directly from facility-scale solar PV (i.e., solar home systems).

1. Baseline emission factor for electrification

This methodology uses a baseline emission factor composed of parameters fixed ex-ante, which are applied to different system sizes. The baseline emission factor is calculated based on the annual amount of renewable electricity consumed per consumer each year.[[2]](#footnote-3)

1. Activity emissions

The emission factor for solar home systems is zero in all cases.

1. Baseline emissions and emission reductions

Baseline emissions for solar home systems are calculated as shown in Equation 1:

|  |  |
| --- | --- |
|  |  |

Where:

|  |  |  |
| --- | --- | --- |
|  | = | Baseline emissions for electrification in year*y* (tCO2) |
|  | = | Number of solar home systems since the start of the activity, in year *y* |
|  | = | Share of operational devices in year *y* (fraction) |
|  | = | Calculated annual electricity consumption in solar home systems by consumer *i* (MWh) |
| *i* | = | Index for solar home system consumers |
|  | = | Baseline emission factor for solar home system by consumer *i* (tCO2/MWh) |
|  |  |  |

To calculate the electricity consumption in solar home system at consumer *i*:

|  |  |
| --- | --- |
|  | Equation (2) |

Where:

|  |  |  |
| --- | --- | --- |
|  | = | Capacity of solar home system used by consumer *i* (MW) |
|  | = | Solar availability in Rwanda (%) |
| 8760 | = | Hours per year |

For the baseline emission factor for solar home system (*EFOG,i*):[[3]](#footnote-4)

* For consumption up to 55 kWh per year, the emissions factor is 2.72 tCO2/MWh.
* For consumption over 55 kWh per year, the emission factor for this additional consumption is 1.0 tCO2/MWh.

The emission factor for each system with annual consumption greater than 55 kWh is therefore:

|  |  |
| --- | --- |
|  | Equation (3) |

Where:

|  |  |  |
| --- | --- | --- |
|  | = | Calculated annual electricity consumption in new solar home system by consumer *i* (MWh) |
| 1.0 | = | Emission factor for consumption greater than 55 kWh (tCO2/MWh) |
| 0.15 | = | Emissions from consumption below 55 kWh (i.e., 0.055 MWh x 2.72 tCO2/MWh) |

Because there are no activity emissions or leakage emissions from solar PV electricity generation, total emission reductions for the entire activity are therefore:

|  |  |
| --- | --- |
|  | Equation (4) |

Where:

|  |  |  |
| --- | --- | --- |
|  | = | Total emission reductions in year*y* (tCO2e) |
|  | = | Baseline emissions for electrification in year*y* (tCO2e) |

If the duration of any monitoring period is more or less than 12 months, the values for consumption should be adjusted accordingly. Where a connection or system is not operational the entire year (i.e., the installation happens mid-year), an appropriate adjustment should be made to account for operation less than the full monitoring period.

1. Data and parameters fixed ex-ante

| *Parameter* | *Description* | *Value* |
| --- | --- | --- |
|  | Baseline emission factor for solar home system by consumer *i*:   * For annual consumption up to 55 kWh * For consumption beyond 55 kWh | 2.72 tCO2/MWh  1.0 tCO2/MWh |
|  | Solar PV availability in Rwanda (%) | 13.83% |
|  | Annual electricity consumption in solar home system by consumer *i* | Calculated for each system at installation based on 13.83% availability (see equation 2).  Capacity of the device (*Ci*) based on technical specifications. |

1. Monitoring requirements

|  |  |  |
| --- | --- | --- |
| *Parameter* | *Description* | *Monitoring approach* |
|  | Cumulative number of solar home systems since the start of the activity in year *y* | Continuously recorded in the activity database. |
|  | Share of operational devices in the year *y* | Option A: Survey of 60 randomly selected consumers out of the complete number (of new consumers under the activity (i.e., total SHS population) to determine whether system is operational (could include phone-based surveys).[[4]](#footnote-5)  Option B: Representative data reported from other credible monitoring standards (e.g., CDM program monitoring)  Option C: Representative data from utility or other official sources  Frequency: annual (or each monitoring period if period is long than 12 months) |

Version history

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| *Version* | *Date* | *Contents revised* |
| 1.0 | 06/04/2023 | Initial adoption by SCF Governing Board |

Appendix 1. Justification of selected default parameters

**Solar PV availability in Rwanda**

Solar availability was calculated based on the widely used RETScreen tool.[[5]](#footnote-6) A representative location in Rwanda is Kigali (-1.9 N, 30.1 W). The average daily horizontal irradiation at Kigali is 4.88 kWh/m2-d, according to the RETScreen climate database. Based on these inputs, the minimum availability factor for solar home systems in Rwanda, across the range of possible slopes, would be 13.83%,

The technical assumptions to estimate the solar availability are based on the typical characteristics of a residential solar panel:

|  |  |  |
| --- | --- | --- |
| Residential panel | 18 unit = | 10 kW |
| Efficiency | 21% |  |
| Irradiation | 4.88 | kWh/m2/day |
| Frame area | 1.8 | m2 |

1. The activity (i.e., projects or programs) described in the activity documentation under the CDM, SCF, Article 6.4 Mechanism, or another crediting mechanism, capable of generating emission reductions under a crediting mechanism [↑](#footnote-ref-2)
2. Based on AMS.I-L. “Electrification of rural communities using renewable energy”. Version 3.0. [↑](#footnote-ref-3)
3. Based on CDM “Tool 33 Default values for common parameters” Version 2.0. This tool considers conservative emission factors where, in the baseline, kerosene usage for lighting purposes is envisaged. The rural population in Rwanda largely uses kerosene lamps for lighting, as shown in the ‘2018 Rwanda energy diagnostic report’ from the World Bank. Since there is a lack of specific information on the share of technologies used for lighting in rural population without connexion to a national or regional grid, the conservative approach provided by this tool is applied. [↑](#footnote-ref-4)
4. Since the devices comply with international quality standards according to the ‘Ministerial Guidelines on Minimum Standards for Solar Home Systems in Rwanda’, the devices do not vary drastically in their reliability. In addition, devices that reach 5 years of rated lifetime are removed from the database, which ensures that their operating time will not be considered beyond that. This allows the total population of SHS to be sampled, as the quality standards and their rated lifetime provide certainty about their reliability and operations. [↑](#footnote-ref-5)
5. RETScreen Expert software. Visualization 9.0.0.0. Minister of Natural Resources Canada 1997-2022. Available at <https://www.nrcan.gc.ca/maps-tools-and-publications/tools/modelling-tools/retscreen/7465>. [↑](#footnote-ref-6)