Gold Standard

The Gold Standard Suppressed Demand Methodology
Micro-- scale Electrification and Energization

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1. Technology/measure

The methodology is applicable to renewable energy based electrification[1]/energization[2] activities for communities that do not have access to the national or regional grid or for communities who have less than 50% grid availability[3].

The methodology is eligible for activities under the consolidated standalone micro-scale scheme and for activities under a micro-programme[4] with total emission reductions of less than or equal to 10,000 t CO_2/year per activity. Specific eligibility requirements for the micro-scale scheme[5] or the micro-programme must be met. The renewable energy sources eligible for this methodology are limited to solar, hydro, wind, renewable biomass[6] and biogas[7].

Back-up power generation from fossil fuel based power generation systems is accepted under the methodology. The project can consist of one or more of the following electrification/energization activities:

- Installation of a new mini-grid.[8]
- Substitution of an existing fossil fuel based mini-grid with a renewable energy based mini-grid.
- Substitution and expansion of an existing fossil fuel based mini-grid with a renewable energy based mini-grid. Expansion includes both increasing energy supply to existing consumers and inclusion of new consumers.
- Bringing into operation installed renewable power generation systems, which have not been in operation for 6 months or less during the project lifetime. In such a case, the project developer shall provide reasons for its stoppage and the details of the interventions being made to restart the facility.
- Bringing into operation installed renewable power generation systems, which have not been in operation for more than 6 months prior to the start of the project implementation (e.g. during construction). A detailed description of the intervention should be included as part of the project documentation.
- Facility-scale[9] power supply.

The methodology is applicable to renewable electricity generation systems intended for permanent installation and is not applicable to portable electricity systems, such as batteries or LED lanterns.

[1] Electrification refers to the process of powering by electricity
[2] Energization refers to the process of increasing the quality and/or quantity of a previously insufficient energy supply.
[3] National or regional grid with less than 50% grid availability during the daylight hours based on the annual average
[4] The detailed Micro-Programme Rules can be found at: http://www.cdmgoldstandard.org/project-certification/rules-and-toolkit (Annex U to The Gold Standard Toolkit)
[5] The detailed Micro-Scale Scheme Rules can be found at: http://www.cdmgoldstandard.org/project-certification/rules-and-toolkit (Annex T to The Gold Standard Toolkit)
[6] Defined as per EB 23, Annex 18
[7] Please refer to the latest version of The Gold Standard Annex C – Guidance on project type eligibility for a definition of eligible biogas activities.
[8] Mini-grid refers to small-scale power system with more than one consumer connected and up to a group of consumers. The mini-grid must not be connected to the national/regional grid.
[9] Facility scale refers to the power supply with one single connected consumer; e.g. solar panel on a dispensary.

Community based projects can consist of more than one mini-grid and/or facility scale power supply. The consumer groups, which are already eligible under this methodology, are:

- Households
- Health centers
- Dispensaries
- Schools, both primary and secondary
- Kindergartens
- Public administration buildings
- Trading place

A definition and description of each consumer group is provided in Appendix 1. The project proponent shall provide a justification that all eligible services (e.g. fan, refrigerator etc.) defined in Appendix 1 for each consumer group are relevant for their project activity.

New consumer groups can be added by requesting a revision of the methodology to The Gold Standard Foundation.

The project proponent must provide a justification for the inclusion of new consumer groups, along with the basis for establishing a Minimum Service Level (MSL)[10] for the new consumer group.

2. Boundary

The project boundary covers the entire community, which is supplied with electricity by the project system, i.e. the spatial extent of the project boundary includes:

1. All new and restarted renewable electricity generation systems approved for inclusion in the project activity connected to the mini-grid and/or facility scale power generation units within the community.
2. The entire transmission and distribution system for the mini-grid system and facility scale distribution systems in the community, including existing grids, which are substituted by renewable energy supply.
3. All eligible consumer groups connected to the mini-grid or supplied by the facility scale power generation systems in the community.

[10] Refer to section 3 (Baseline) and Appendix 2 for definition and guidance on establishing MSL. The proposal should include a) Description and definition of consumer group b) default MSL value based on the same model as the already eligible consumer groups as presented in Appendix 1 and 2 in the methodology or a new proposal for a default MSL value.

3. Baseline

The baseline scenario consists of the following two parameters: (i) the baseline service level and (ii) the baseline emissions.

BASELINE SERVICE LEVEL

The approach for measuring emission reductions for suppressed demand[11] activities in this methodology is based on defining the Minimum Service Level (MSL) for each eligible consumer group. The MSL expresses the maximum level of electricity consumption (in kWh/day), which can be included in the baseline.

The actual project service level can be higher than the MSL, however Gold Standard Verified Emission Reductions for a renewable energy system can only be claimed for the baseline emissions based on the MSL adjusted with project and leakage emissions.

For the energy consumed per day, pre-defined MSL values for each eligible consumer group are provided in Table 1. This can be multiplied by 365 days to derive the annual energy consumption for a consumer group. Project proponents can propose new default MSL values for a consumer group based on the guidelines described in Appendix 2. However, new default values must be approved by The Gold Standard Foundation during the validation process of a specific project.

Table 1: Default MSL for electricity consumption (kWh) for each eligible consumer group

Parameter	Description of parameter for each eligible consumer group	Default MSL energy consumption value in kWh for consumer group per day
$MSL_{ec,hh,y}$	Energy consumption in kWh (ec) for a household (hh) in year (y)	3.0 kWh/day
$MSL_{ec,hc,y}$	Energy consumption in kWh (ec) for a health center (hc) in year (y)	8.6 kWh/day
$MSL_{ec,d,y}$	Energy consumption in kWh (ec) for a dispensary (d) in year (y)	4.1 kWh/day
$MSL_{ec,s,y}$	Energy consumption in kWh (ec) for a school (s) in year (y)	10.0 kWh/day
$MSL_{ec,k,y}$	Energy consumption in kWh (ec) for a kindergarten (k) in year (y)	4.4 kWh/day
$MSL_{ec,pa,y}$	Energy consumption in kWh (ec) for a public administration building (pa) in year (y)	4.4 kWh/day
$MSL_{ec,tp,y}$	Energy consumption in kWh (ec) for a trading place (tp) in year (y)	11.0 kWh/day

The following equation should be used to calculate the total MSL for all consumer groups under the project:
$MSL_{ec,y} = (MSL_{ec,hh,y} \times n_{hh}) + (MSL_{ec,hc,y} \times n_{hc}) + (MSL_{ec,d,y} \times n_d) + (MSL_{ec,s,y} \times n_s) + (MSL_{ec,k,y} \times n_k) + (MSL_{ec,pa,y} \times n_{pa}) + (MSL_{ec,tp,y} \times n_{tp}) + (MSL_{ec,xx,y} \times n_{xx})$ $MSL_{ec,y} = \sum_i (MSL_{ec,i,y} \times n_i)$

[11] In many developing countries the level of energy service is not sufficient to meet human development needs due to lack of financial means and/or access to modern energy infrastructure or resources. This concept is known as suppressed demand.

Where:

$MSL_{ec,y}$	Minimum Service Level in energy consumption in kWh (ec) for all consumer groups in a year (y).
$MSL_{ec,i,y} \times n_i$	Minimum Service Level in energy consumption in kWh (ec) for a consumer group (i) in a year (y) times the number of units in the consumer group

BASELINE EMISSIONS

The baseline emissions are defined as the sum of the MSL for all connected consumers multiplied by an appropriate emission factor. Diesel generators are defined as the default baseline measure to deliver the MSL for all eligible consumer groups.

For both mini-grid and facility scale system, a default emission factor for a diesel generator system of 1.3 kg CO_2e/kWh[12] can be used as the basis for calculating baseline emissions.

Alternative emission factors can be proposed by the project proponent and used for calculating baseline emissions. For instance the project proponent can justify higher emission factors for diesel generator systems as proposed in the latest version of CDM Small-Scale Methodology AMS 1.F, table 1.F.1. The project proponent must provide justification for the choice of emission factor and new emission factors must be approved by The Gold Standard Foundation during the validation process of a specific project activity.

Baseline emissions for an electricity generation system shall be calculated in the following way:

$$BE_y = MIN\left(E_{d,y} \div MSL_{ec,y}; 1\right) \times \left(\left(MSL_{ec,y} \times EF\right)\right)$$

Where:

BE_y	Baseline emissions in t CO_2 for an electricity generation system in a year (y)
$E_{d,y}$	Renewable electricity in kWh delivered (d) in a year (y). $E_{d,y}$ must be based on actual monitoring (see section 6)
$MSL_{ec,y}$	Minimum Service Level in energy consumption in kWh (ec) for all consumer groups in a year (y)
EF	Default emission factor of 0.0013 t CO_2e/kWh or another approved emission factor
$MIN\left(E_{d,y} \div MSL_{ec,y}; 1\right)$	If the delivered renewable electricity in kWh (E_d) in a year (y) is higher than or equal to the Minimum Service Level for the entire electricity generation system in kWh (MSL_{ec}) in a year (y) then the (MSL_{ec}) is the maximum electricity consumption in kWh which can be credited. If the delivered renewable electricity in kWh (E_d) in a year (y) is less than the Minimum Service Level for the entire electricity generation system in kWh (MSL_{ec}) in a year (y) then the actual renewable electricity delivered in kWh (E_d) constitutes the maximum amount of electricity in kWh which can be credited.

[12] CDM Small-scale Methodology AMS I.F, table I.F.1

4. Leakage

In the case when renewable energy generating equipment is transferred from another activity, leakage is to be considered.

Also, leakage is to be considered if a consumer group, other than those eligible for this methodology are connected to the mini-grid, and they consume electricity from the generation systems, which are part of the project activity. These consumers are defined as non-eligible consumers (NEC) and could include, for instance, a hotel or a petrol station. In a renewable energy system, the estimated or measured electricity in kWh delivered to NECs shall be considered as leakage. The project proponent must therefore provide reasonable assumptions and justifications for the energy consumption for each NEC.

The first step to measure leakage emissions from NECs is to determine the total energy consumption for all NECs within the project boundary.

This is estimated as:

$$NEC_{ec,y} = \sum_{i} NEC_{ec,y,i}$$

Where:

$NEC_{ec,y}$	Total energy consumption in kWh for all NECs in a renewable energy system in a year
i	NEC (e.g. NEC 1, NEC 2, NEC 3, etc.)
y	Year
$NEC_{ec,y,i}$	Electricity consumption in kWh for a NEC, i, in a year

Two scenarios for assessing leakage emissions can occur. The first scenario is where the electricity delivered is greater than or equal to the MSL. In this scenario one of the following two equations must be used to calculate leakage emissions:

For $E_{d,y} \geq MSL_{ec,y}$:

1. If $(NEC_{ec,y} + MSL_{ec,y}) \geq E_{d,y}$ then
$$LE_y = \left((NEC_{ec,y} + MSL_{ec,y}) - E_{d,y}\right) \times EF$$

2. If $(NEC_{ec,y} + MSL_{ec,y}) < E_{d,y}$ then
$$LE_y = 0$$

In the scenario where the electricity delivered is less than the MSL then leakage emissions must be calculated by using the following equation:

$E_{d,y} < MSL_{ec,y}$ then
$$LE_y = NEC_{ec,y} \times EF$$

$E_{d,y}$	Renewable electricity in kWh delivered (E_d) in a year (y)
$MSL_{ec,y}$	Minimum Service Level in energy consumption in kWh (ec) for all consumer groups in a year (y)
$NEC_{ec,y}$	Total energy consumption in kWh for all NECs in a renewable energy system in a year
EF	Default emission factor of 0.0013 t CO_2e/kWh or another approved emission factor
LE_y	Leakage emissions (t CO_2) in a year (y)

5. Project activity emissions

The project SF_6 emissions from transformers are considered insignificant.

Project emissions are considered to be zero tonnes CO_2 each year (PEy =0) for renewable biomass, wind and solar.

However for:

1. Hydropower projects, project emissions must be considered following the procedure described in the most recent version of CDM methodology *ACM0002*[13].
2. Biogas projects, project emissions must be considered following the procedure described in the most recent version of The Gold Standard methodology *Technologies and Practices to Displace Decentralized Thermal Energy Consumption*[14] (Annex 6).

Emission reductions are calculated as:

$$ER_y = BE_y - PE_y - LE_y$$

Where:

ER_y	Emission reductions (t CO_2) during one year (y)
BE_y	Baseline emissions (t CO_2) in a year (y)
PE_y	Project emissions (t CO_2) in a year (y)
LE_y	Leakage emissions (t CO_2) in a year (y)

The total amount of emission reductions per micro-scale project activity cannot exceed 10,000 t CO_2 /year.

6. Monitoring

The monitoring is based on measuring the net renewable energy generation and the number of connected consumers for each consumer group. The monitoring of net energy generation shall be carried out on a continuous basis.

[13] ACM0002 "Consolidated baseline methodology for grid-connected electricity generation from renewable sources"
[14] http://www.cdmgoldstandard.org/project-certification/gs-methodologies

The actual consumption for each consumer, including the split between different types of services for one consumer, will not be monitored.

The renewable electricity delivered to connected consumer(s) in a year is:

$$E_{d,y} = E_{m,y} \times (1 - TDL)$$

Where:

$E_{d,y}$	Renewable electricity in kWh delivered (E_d) in a year (y)
$E_{m,y}$	Measured net amount of renewable electricity in kWh produced (E_m) in a year (y) at the renewable energy generation system.
TDL	Transmission and distribution loss[15] of 10 % may be anticipated, which means that TDL = 0.1 in this case. If another or more precise TDL value can be justified it can be used in the calculation instead.

The number of connected consumers for each consumer group will be monitored.

For distributed energy generation systems such as solar photovoltaic electricity systems, estimates for the electricity delivered to the consumers are based on the installed capacity times an availability factor. Assume a twelve per cent (12%) availability for solar photovoltaic electricity systems. The number of operating renewable electricity generation systems within the project shall be determined annually and can be determined on a sample basis. To determine the sample size choose 90/10 confidence/precision following the requirements under "Standard on sampling and surveys for CDM project activities and PoAs" [16].

Whenever actual emission reductions exceed the threshold of 10,000 t CO_2/year the claimable emission reductions are capped at 10,000 t CO_2/year.

Data and Parameters monitored over the crediting period

Data / Parameter	$E_{m,y}$
Data Unit	kWh/y
Description	Measured net amount of renewable electricity produced in kWh (E_m) in a year (y) by the renewable energy generation system.
Source of data	Electricity meter(s)
Monitoring frequency	Continuous monitoring and recording at least once per month during a monitoring period
QA/QC procedures	-
Additional comment	Information for a monitoring period shall be kept until the end of the crediting period

Data / Parameter	N_i
Data Unit	Number

[15] Transmission and distribution loss refers to the electricity lost whilst traveling from the production source to the end consumers.

[16] EB 69, Annex 4 or the most recent version

Description	Number of units in a type of consumer group connected to a specific renewable energy system
Source of data	Information gathered by appointed person(s)
Monitoring frequency	Information gathered once within a monitoring period
QA/QC procedures	-
Additional comment	Information for a monitoring period shall be kept until the end of the crediting period

Data / Parameter	$NEC_{ec,y}$
Data Unit	kWh/y
Description	Measured and/or justified electricity consumption in kWh for a non-eligible consumer connected to a specific renewable energy system
Source of data	Information gathered by appointed person(s)
Monitoring frequency	Information gathered once within a monitoring period
QA/QC procedures	-
Additional comment	Information for a monitoring period shall be kept until the end of the crediting period.

7. Bundle and PoA's

Project activities can be submitted within a bundle, however the upper threshold outlined in The Gold Standard's micro-scale scheme rules applies to the bundle as a whole. Project Participants shall refer to The Gold Standard micro-programme rules for the submission of micro-scale activities under a programme.

8. Appendix 1: Assumptions for default MSL values for eligible consumer groups

Household			
Definition, description and assumptions:	Type of Service	Number	Operation hours/day
A domestic unit consisting of the members of a family who live together. The assumption is that a household consists of 6 family members and often 5 rooms.	Indoor light	3	5
	Radio	1	2
	Cell Phone	2	24
	Refrigerator	1	24
	Fan	3	5

Health Center			
Definition, description and assumptions:	Type of Service	Number	Operation hours/day
A center with a possibility for minor surgery and operations. The center also dispenses medications and medical supplies. The size of a health center can vary, but at least 5 rooms are expected and at least 5 employees.	Indoor light	5	12
	Outdoor light	2	12
	Radio	1	2
	Cell Phone	4	24
	Fan	5	12
	Refrigerator	1	24

Dispensary			
Definition, description and assumptions:	Type of Service	Number	Operation hours/day
An office that dispenses medications and medical supplies. Often 2 rooms and at least 1 employee.	Indoor light	2	12
	Outdoor light	1	12
	Radio	1	2
	Cell Phone	1	24
	Fan	2	12
	Refrigerator	1	24

School			
Definition, description and assumptions:	Type of Service	Number	Operation hours/day
A school is an institution designed for the teaching of pupils under the direction of teachers. Often the children are between the ages of 5 – 16 years. Often several hundred pupils and often around 3 parallel classes. At least 10 employees and around 6 rooms anticipated.	Indoor light	12	5
	Outdoor light	2	12
	Radio	1	2
	Cell Phone	4	12
	Fan	6	12
	Refrigerator	1	24

Kindergarten

Definition, description and assumptions:	Type of Service	Number	Operation hours/day
A preschool educational institution for children. Children are often between the ages of 2-6 years. At least 2 employees and at least 2 rooms.	Indoor light	2	5
	Outdoor light	1	12
	Radio	1	2
	Cell Phone	2	12
	Fan	2	12
	Refrigerator	1	24

Public Administration			
Definition, description and assumptions:	Type of Service	Number	Operation hours/day
Public administration comprises police stations, HIV centers and other administrative buildings. At least 2 employees and at least 2 rooms.	Indoor light	2	5
	Outdoor light	1	12
	Radio	1	2
	Cell Phone	2	24
	Fan	2	12
	Refrigerator	1	24

Trading Place			
Definition, description and assumptions:	Type of Service	Number	Operation hours/day
A trading place is often in the central part of a village. A trading place would generally comprise of approx. 15 shops. Many types of shops may be expected, for instance meat vendors, clothing shops, barbershops, beverage retailers, kerosene and diesel sellers and maybe charging facilities. Often the trading place is nearby a bus stop and the main street.	Indoor light	30	5
	Outdoor light	7	12

9. Appendix 2: Type and quality of service

As an alternative to the default MSL values provided in the methodology, project proponents could propose new MSL values.

This includes proposals for:

- An alternative number of installations for lights or fans or any other service for a pre-defined consumer group, when a predefined consumer group increases in size compared to the standard case described in Appendix 1.
- Alternative service types to be added to the default list of services as given in Appendix 1.

In order to propose a new MSL, project proponents must use the normalised values presented below to measure the MSL (kWh).

Description	Unit	Value	Source
Indoor light	Lumen	1700	http://www.economicallysound.com/lighting_basics_for_your_basic_bulb_purchase.html
Indoor light	Watt	30	http://fleap.com/CFL.html
Outdoor light	Lumen	6000	http://hypertextbook.com/facts/2004/MarinaAvetisyan.shtml (average assumption)
Outdoor light	Watt	80	http://hypertextbook.com/facts/2004/MarinaAvetisyan.shtml (specific reference)
Radio	Watt	10	http://www.energysavers.gov/your_home/appliances/index.cfm/mytopic=10040
Refrigerator 300 l (food and drinks)	Wh/day	1534	http://www.google.dk/url?sa=t&rct=j&q=industry%20as%20a%20partner%20for%20sustainable%20development%20refrigerator&source=web&cd=1&ved=0CC4QFjAA&url=http%3A%2F%2Fwww.unep.fr%2Fscp%2Fcsd%2Fwssd%2Fdocs%2Fsectors%2Ffinal%2Frefrigeration.pdf&ei=qYnRUNGcN8XFtAaUn4CIBQ&usg=AFQjCNG7G_8-obwdEOBKj6tH9ukU5pFYgA&bvm=bv.1355534169,d.Yms
Refrigerator (Vaccine)	Wh/day	895	http://cdm.unfccc.int/methodologies/SSCmethodologies/approved (NM0073 and WHO (EO3/PV01.1)
Cell Phone	Wh/day	30	http://www.cs.wichita.edu/~vnambood/mypubs/JGEPavel2011.pdf
Fan, mainly cooling	Watt	65	http://www.energysavers.gov/your_home/appliances/index.cfm/mytopic=10040