Methodologies to monitor energy access to off-grid electricity & modern cooking

- A comparison between EnDev and other programs -

energising development

What means access for off-grid electricity and cooking?

Traditional binary criteria used in international statistics

- Connection to the electricity grid
- Cooking with non solid fuels

Simple to measure or estimate but misleading, not capturing real access situations

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SE4ALL definition based on multi-dimensional character of energy access and different access service level (tier 0 – 5)

Criteria for access to electricity

1. Capacity of the power supply,
2. Duration,
3. Reliability,
4. Quality,
5. Affordability,
6. Legality
7. Health and Safety,

Criteria for access to cooking

1. Indoor Air Pollution,
2. Stove efficiency,
3. Convenience,
4. Quality of the fuel,
5. Affordability,
6. Availability
7. Safety,

Time-consuming and costly to measure or estimate but providing detailed picture of the access situation

How can we measure energy access?

Information from service user

1. Surveys,
2. Interviews,
3. Expert talks,

Provides a clear picture of the access situation if done properly but time-consuming and costly if the situation shall be analyzed in detail

Information from suppliers

1. Sales figures
2. Installation figures
3. Investment figures

Provides a rough picture of the access situation; can be integrated into monitoring systems of service providers, governments, donors, and implementing organisations

Measuring access to off-grid electricity

SE4ALL Criteria for access to electricity

1. Capacity of the power supply,
2. Duration,
3. Reliability,
4. Quality,
5. Affordability,
6. Legality
7. Health and Safety,

To what extent are the criteria meaningful and applicable for off-grid electricity solutions?

Possible criteria for access to off-grid electricity (excl. mini-grids)

1. Performance/Capacity of the power system,
2. Run time for pico PV systems (Duration),
3. Reliability,
4. Certified Product (Quality),
5. Affordability, (Price or Fee)
6. Legality
7. Health and Safety,

Measuring access to off-grid electricity

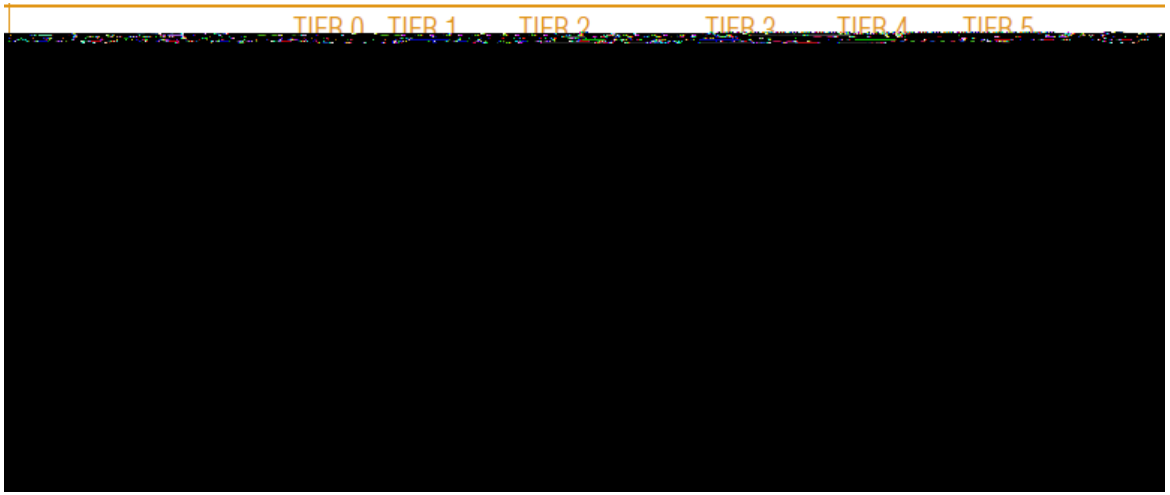
Data about sold and/or installed solar systems in the EnDev monitoring system

- **Location:**
  Community-District-Department-Province; name of company/local partner
- **Technical data:**
  Solar panel size (Wp), Battery Capacity, Autonomous Run time, Certified system,
- **Customer data:**
  price of system (€), No. of systems sold, Average no. of systems purchased per household, No. of people per household
- **Adjustment factors**
  other donor involvement
  % already having access to electricity
  windfall gain factor (%)
  sustainability factor (%)

Which data are necessary to measure access to off-grid electricity?
To which extent should we take into account other donor involvement, lifespan of the product and attributability questions?

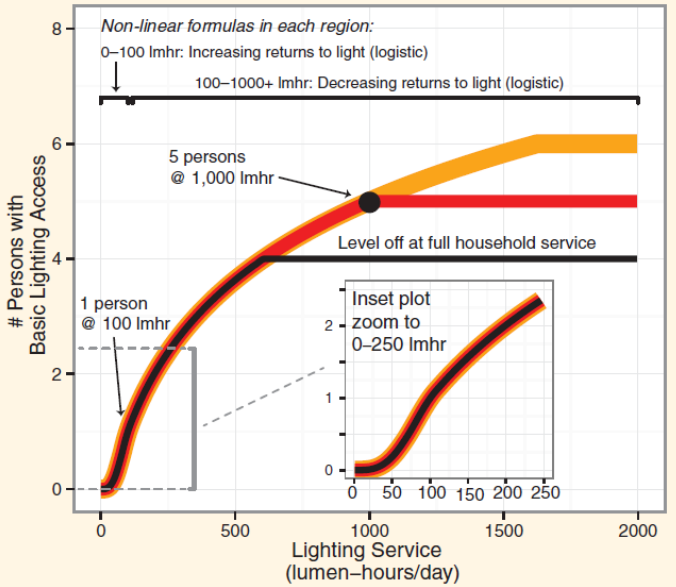
Special issue: pico solar systems

Pico solar system often do not meet tier 1 standards for access to electricity for households



Fractional measurement based
On lumen-hours/day and phone charging

For devices from 0 to 100 lmhr/day	For devices from 100 to 1,000+ lmhr/day	Total number of persons served in the household
A logistic function	*A logarithmic function*	*A summation function*
$P_i = d\left(1 - \frac{1}{1 + \left(\frac{L}{e}\right)^f}\right)$ where: P_i = number of persons served with lighting service by the device L = quantity of available light (lmhr/day) $d = 2$ $e = 100$ $f = 3.3$	$P_i = 0 < h_{base} \times \log 10\left(\frac{L}{a} + b\right) - c < h$ where: P_i = number of persons served with lighting service by the device L = quantity of available light (lmhr/day) $a = 95$ $b = 0.732$ $c = 0.0515$ $h_{base} = 5$ h = household size	Sum for all the light sources in a household: $P_{tot} = \max\left(\sum_i^{All} P_{i,i}, h\right)$ $T_i = \frac{P_{tot}}{h}$ where: P_{tot} = number of persons served with lighting service in total h = household size T_i = effective tier for lighting



Is there a way to include pico solar systems in the tracking framework but simply the measuring methodology?

Measuring access to modern cooking solutions

Criteria for access to cooking

1. Indoor Air Pollution – PM and CO concentration
   daily exposure levels or kitchen concentrations
   threshold concentrations
2. Stove efficiency – efficiency threshold values still under discussion
   reliability and relevance of laboratory data
   energy efficiency of the generation and conversion chain versus efficiency of the stove (comparability of cooking systems?)
3. Convenience – stove preparation time, fuel acquisition and preparation time
4. Quality of the fuel – variations in heat rate due to fuel quality
5. Affordability – cost of cooking solutions in relation to household income
6. Availability – availability during the year
7. Safety – based on laboratory tests or past accidents

To what extent are the criteria meaningful and applicable to define access to modern cooking solutions?
Which proxys can be used to assess the key attributes of modern cooking systems as none of the attributes can be easily measured?

Measuring access to modern cooking solutions

Data about sold and/or installed stoves (predominant) in the EnDev monitoring

- **Location:**
  Community-District-Department-Province; name of company/local partner
- **Technical data/convenience:**
  Type of stove, lifespan, type of fuel, time for fuel and stove preparation, time between lighting and start of cooking; ease of cleaning and maintaining; ease of controlling the temperature
- **Socioeconomic and customer data:**
  price of stove, No. of stoves sold, Share of low income households (according to national definition) among beneficiaries [%], average no. of stoves purchased per household, No. of people per household; fuel consumption, price of fuel or collection time, availability of fuel
- **Cooking conditions**
  outdoor-indoor with or without ventilation (windows, chimney, hood)
- **Adjustment factors**
  other donor involvement
  % already having access to electricity
  windfall gain factor (%)
  sustainability factor (%)

1. To which extent should we take into account convenience attributes, ventilation, the cooking environment, and other field conditions
2. Should lab test data be obligatory or would it make sense to define stove proxys for the different tiers?
3. How do we handle other donor involvement, lifespan of the product and attributability questions?

Thank you for your attention.

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