

# Beyond Connections: Energy Access Redefined

## Introducing Multi-Tier Approach to Measuring Energy Access

### 1. Why is measuring energy access important?

There is increasing evidence and widespread agreement that access to modern energy services is fundamental to sustainable development. This understanding underpins the formulation of Sustainable Development (SDG) goal, which calls for achieving universal access to reliable, affordable and modern energy services by 2030 (Target 7.1).<sup>i</sup> Universal access to modern energy services is also one of the three goals of the Sustainable Energy for All Initiative, launched by the Secretary General of the United Nations in 2011.

Access to energy, however, is not the end in itself, but a means to many ends. Reliable and affordable energy is needed to improve living standards, increase rural incomes, support delivery of health and educational services, and improve gender and social inequality. Access to clean cooking technologies and fuels is essential to reducing indoor air pollution – one of the world’s major health risk hazards – which according to the World Health Organization leads to over 4 million premature deaths every year.<sup>ii</sup>

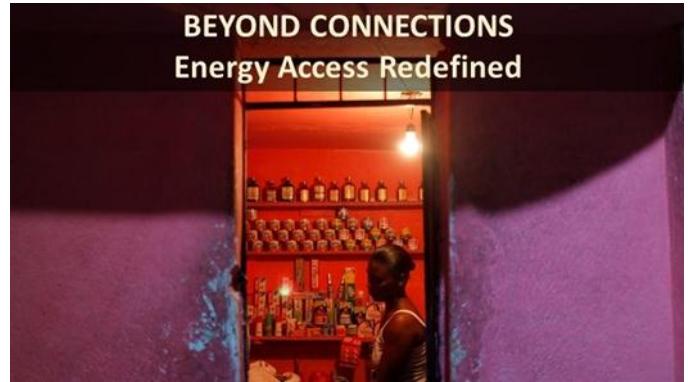
But how do we define and measure energy access?

### 2. How is energy access usually defined and measured (and why this may be a problem)?

Currently, both electricity access and access to modern cooking solutions are measured in a binary way. This typically means “having / not having an electricity connection” and “having /not having access to non-solid fuels”. The advantage of this mode of tracking is that it is simple and relies on available data, but the data can be misleading. Its focus on only one attribute – access to infrastructure / fuel – provides a simplistic and often distorted picture because it fails to determine how this access translates into reliable, affordable and modern service. Consequently, as the world is rushing to reach the universal access target, the purpose behind the target – having energy services provided in sufficient quantity and quality to trigger desired development outcomes – may be lost.

In addition, the traditional counting method is static and fails to account for evolving technology solutions: e.g. a solar lighting kit is typically not considered an

“electricity connection”, yet it satisfies the key energy needs of lower income households. An advanced biomass stove uses a “dirty” biomass fuel but it burns it in such a way that the indoor air pollution is reduced compared to traditional cooking, triggering positive health outcomes. Yet these solutions are not counted in the current access tracking method.



### 3. What is the Multi-Tier Framework (MTF): Energy Access Redefined?

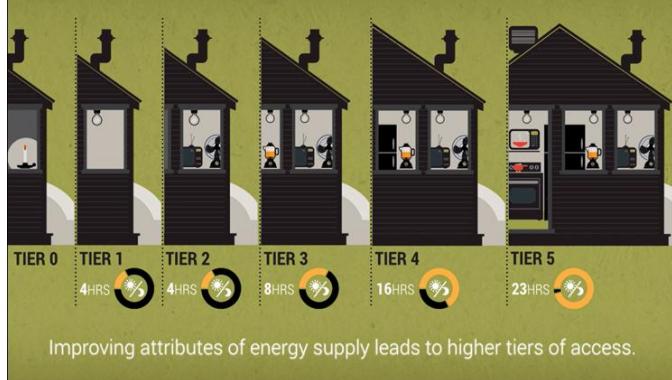
The MTF redefines energy access to fill the gaps in the Global Tracking Framework binary access measurement. It acknowledges that access is a spectrum of service levels experienced by households. The Framework was developed by the World Bank acting in the role of the SE4ALL Knowledge Hub, with the support of the Energy Sector Management Assistance Program (ESMAP), in partnership and thorough consultations with multiple SE4ALL stakeholders. The need for a multi-tier approach to improve on the binary measurement was first introduced in the SE4ALL Global Tracking Framework (GTF), published by the World Bank and SE4ALL in 2013. The MTF was published in 2015: World Bank, SE4ALL: Beyond Connections; Energy Access Redefined, 2015.

The key features of MTF are:

1. Focus on service from the user's perspective. MTF does not only record whether a household is receiving an energy service, but whether this service is “usable” from the household’s perspective. The Framework has therefore identified the key attributes that together determine the “usability” of service. For electricity, this include: (i) how much capacity the electricity solution can deliver, (ii) how many hours does the household receive electricity

service every day, and in particular in the evening, (iii-iv) is the service reliable and of adequate quality (e.g. outages and voltage fluctuations), (v) is the service affordable, (vi) is it provided legally, and (vii) is it safe. For cooking, MTF records the combination of all cookstoves and fuels used by a household in order to determine impact on indoor air pollution, stove efficiency, convenience, safety, affordability, and quality and availability of fuels. The Multi-Tier Framework therefore includes all aspects of SDG7 definition of energy access, including reliability and affordability.

**Figure 1: Access as a continuum of energy services**



**2. Acknowledgment that energy access is a spectrum of service levels.** MTF classifies energy services in tiers – starting from Tier 0 (no service) to Tier 5 (full service), as charted in Figure 1. For electricity, Tier 1 provides a basic service level, such as lighting and cell phone charging. This type of service, for example, can be provided by a small solar lighting kit. Higher tiers imply higher capacity and service duration, allowing households to acquire more domestic appliances and using power for productive purposes. While the highest Tier 5 may be the ultimate objective, MTF acknowledges the incremental benefits of each tier. In fact, numerous studies show that even the first step – from kerosene-based lighting (Tier 0) to a basic electricity service (Tier 1) – can significantly impact household's welfare. The equivalent in cooking is moving from open fire and traditional stoves to cleaner and more efficient cookstoves and fuels.

**3. Technology-neutral approach.** Multi-tier approach is technology neutral. It does not matter how the service is provided; what matters is whether the benchmarks for each tier are met. It therefore allows aggregation of different technologies with different service levels. For example, a grid connection providing a reliable service 24 hours a day / 7 days a week, will be rated higher than a solar home system providing only a few hours of service a day. At the

same time, however, if that grid connection does not deliver on its potential, and the household only receives a few hours of service a day, this grid connection may be classified in an even lower tier than a solar home system. Both the electricity and the cooking frameworks are included in Figures 3 and 4 at the end of this note.

#### 4. How are the data for MTF collected?

The best practice for MTF data collection is household surveys. World Bank/ESMAP is partnering with the Scaling up Renewable Energy Program (SREP) to carry out a global baseline survey. The survey, covering household access to electricity and clean cooking, is carried out through a household questionnaire applied to a nationally representative sample of households. The survey will be initially implemented in 10-15 access deficit countries, and then extended to cover the majority of population without access. All survey tools developed by the World Bank/ESMAP are available to other stakeholders interested in carrying out baselines in their country or project areas.

In addition to the baseline surveys, a short energy access module has been developed, which is now being introduced in the regular national household surveys (such as LSMS) carried out by the national statistical offices. The inclusion of the module in regular household surveys ensures that updated data are collected regularly and at low costs, allowing regular reporting on the progress of multi-tier energy access against the baseline. World Bank/ESMAP is also testing technology innovations to reduce collection costs, such as use of remote monitoring devices and cell phones.

Data from service user can be complemented with data from service providers and Government or donor projects. E.g. WBG Lighting Global Program and the Global Off-grid Lighting Association (GOGLA)

#### Box 1: How to count access provided by solar lanterns

Solar lanterns typically provide service level that does not qualify for Tier 1 (less than 1,000 lumen-hour and not all of them have an associated cell phone charging capacity). Yet these solutions provide very valuable services to poor unelectrified households that otherwise would need to rely on inferior, expensive and polluting fossil-fuel lighting like kerosene. MTF has developed a methodology that allows the counting of solar lanterns towards energy access proportionally to the lighting/cell phone charging levels they delivers (e.g. a lantern may electrify a half or a quarter of a household).

are reporting on number of people benefiting from solar lanterns, using the MTF methodology (See Box 1). In addition, MTF allows tracking access contributions from upstream investments, such as generation and transmission. For example, investments in generation capacity can improve duration and therefore move households from lower to higher tiers. Specific methodologies for estimating multi-tier access impacts from such upstream investments are being developed.

## 5. How can MTF benefit Governments and their development partners?

Comprehensive and consistent household demand and supply data. Governments and their development partners will benefit from having detailed household-level energy data from demand and supply side for both electricity and clean cooking. The electricity baseline module will gather information on all supply alternatives that households are using (main source and back-ups) and will provide additional demand data on energy-related expenditure, as well as on user preferences and satisfaction with service. Similarly, for cooking the surveys will provide a comprehensive overview of all combinations of cookstoves and fuels used by households. They will also provide demand data related to cooking expenditure and fuel consumption, as well as gender-related data, such as time spent collecting wood fuel. Data will be gender disaggregated.

Better information and tools to set country-appropriate access targets. The MTF approach can be used to set realistic targets for universal access, which take into account the country's starting conditions and the time-frame in which universal access should be achieved. Considering the limited financial resources and the desired time-frame for reaching universal access, the governments may have to choose between focusing resources to provide higher tier access (e.g. Tier 4-5) to a smaller percentage of the population or a lower tier access (e.g. Tier 1-2) for everyone. Planning tools, using the

multi-tier structure, are now becoming available to assist governments in this task.

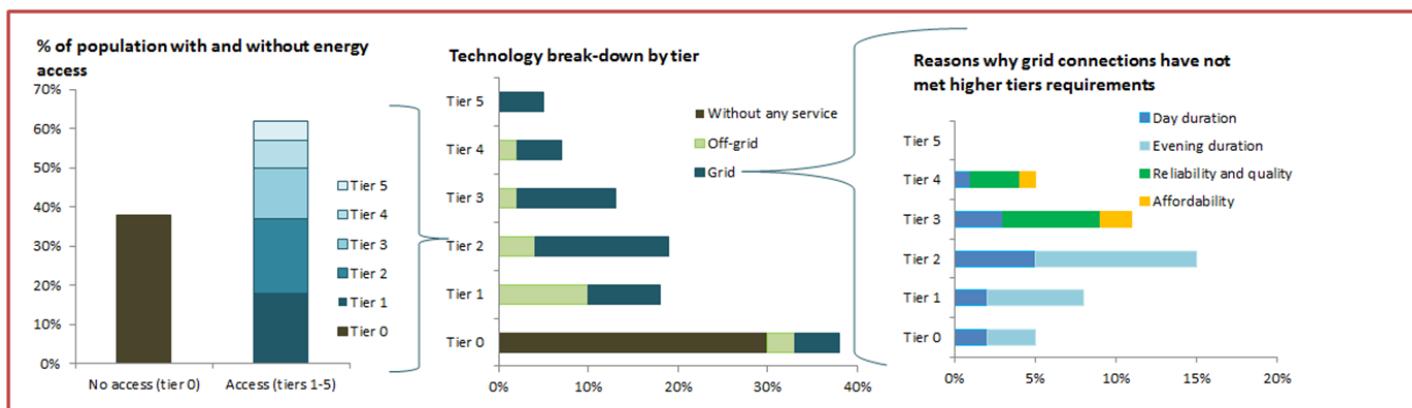
Informed decision-making on access interventions: MTF data can be disaggregated for each attribute and each technology included. As a result, it is possible to determine the key reasons holding back the country from achieving higher tier levels. For example, as demonstrated in Figure 2, a large number of grid-connected households could be moved from Tier 0-2 to Tiers 3-5 if the duration of service, in particularly the evening duration can be increased. This type of information can help target specific energy sector interventions.

## 6. How do the “binary” and the “multi-tier” access rates differ?

The major differences between the two approaches are that (i) MTF provides more accurate data on the actual services households receive, and that (ii) MTF can provide more granular and disaggregated data, and it is therefore a more accurate and powerful tool for policy and investment decisions. MTF can provide details on tiers, technologies and individual service attributes according to the needs of the data user. Figure 2 illustrates these disaggregation levels. MTF access rates, however, may differ from traditional binary access rates, whose approach captures only the existence of a connection and/or a non-solid fuel. MTF, on the other hand, requires several service benchmarks to be met.

This means that MTF access figures may be higher than those previously reported under the binary approach – such as when the traditional binary approach did not account for off-grid solutions. It may also be lower than the binary approach – for example in cases where grid-connected households are not receiving a minimum number of hours of supply to qualify for Tier 1 (at least 4 hours a day and at least an hour in the evening).

**Figure 2: TF provides several levels of disaggregation of access data to guide policy-makers, development partners and investors in the energy access space**



**Figure 3: Multi-Tier Framework for Electricity**

The tier level is determined by the lowest tier for which all applicable attributes are met. For example, electricity Tier 2 requires a combination of capacity and hours of supply. However, higher tiers, such as Tier 4 and 5 require meeting additional attributes such as reliability, quality, affordability, safety and legality.

	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Capacity			Capacity (from 3W to above 2kW) and ability to power appliances (applicable for off-grid solutions)			
Duration - day			From at least 4 hours a day to over 23 hours a day			
Duration - evening			From at least 1 hour in the evening to over 4 hours			
Reliability					Number and duration of outages (applicable for Tier 4 & 5 only)	
Quality					Voltage problems do not affect the use of desired appliances (Tier 4&5)	
Affordability				Basic service less than 5% of a household income (Tiers 3-5)		
Legality					Service provided legally (Tier 4&5)	
Health and Safety					Absence of accidents (Tier 4&5)	

**Figure 4: Multi-Tier Framework for Cooking**

	Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Indoor air quality			Concentration of PM2.5 and CO; tiers aligned with WHO guidelines			
Efficiency			Tier benchmarks under development, awaiting results of ISO process			
Convenience			Stove preparation time and fuel collection and preparation (applicable from Tier 2 on)			
Safety			Absence of accidents and alignment with the ISO process (from Tier 2 on)			
Affordability				Levelized cost of cooking solution < 5% of household income		
Quality and availability of fuel					Cooking not affected by seasonal variations in fuel quality and	

For more information see the Beyond Connections report at

[www.worldbank.org/en/topic/energy/publication/energy-access-redefined](http://www.worldbank.org/en/topic/energy/publication/energy-access-redefined)

<sup>i</sup> United Nations: Sustainable Development Goals: [www.un.org/sustainabledevelopment/energy](http://www.un.org/sustainabledevelopment/energy)

<sup>ii</sup> WHO: Household air pollution and health, Fact sheet N°292, Updated February 2016: [www.who.int/mediacentre/factsheets/fs292/en/](http://www.who.int/mediacentre/factsheets/fs292/en/)