Todd Moss
Energy for Growth Hub & CGD
September 2018

Measurements of Energy Access: A better way?

The most common metric to measure energy access is the estimate provided by the international energy agency (iea). For example, the common refrain that "1.3 billion people lack access to modern energy" comes from the IEA. Pros and cons of this approach are:

- ✓ **Clear and simple.** This standard is easy to understand and communicate.
- ✓ **Universality.** IEA estimates are available for nearly all countries.
- × **Limited information.** A binary 0-1 only reports the share of people crossing an arbitrary consumption threshold. It says nothing about energy use above or below the line.
- × **Too low.** The IEA currently defines "modern energy access" as annual consumption above just 100 kWh per person per year in urban areas and 50 kWh in rural areas. This is only enough to power a lightbulb and charge a mobile phone. It is also roughly the energy used by an average American in less than 3 days.
- × **Only covers household consumption.** Access rates do not provide any information about energy in the wider economy, such as industry and commerce where the majority of power is used.

ACCESS TO ELECTRICITY (%)

107 Countries	100%
India	79%
Nigeria	58%
Ethiopia	27%
Tanzania	16%

An improvement on the IEA measurement is the multi-tier framework (MTF) from the World Bank and UN's Sustainable Energy for All (see Figure 1).

- ✓ **Multiple tiers.** The MTF has five tiers, implying an energy ladder rather than a single step.
- ✓ **Energy quality.** Reliability, duration, and affordability are included.
- ✓ **Productive uses coming.** A separate MTF is being developed to cover non-household uses.
- × **Range is still low.** The highest tier is equivalent to just 600 kWh, which is still low by global standards.
- × **Data availability.** Data is only recently being collected as a pilot.

Electricity generation per capita is another useful measure of energy. Reported by the World Bank, this divides an estimate of total national generation by the population.

- ✓ **Includes electricity for all sectors,** including households, industry, and commerce.
- ✓ **Highly correlated with development.** Nearly all high-income countries consume at least 5,000 kWh/capita (see Figure 2).
- × **No information on inequality or in the distribution of consumption.**
- × **Only covers electricity generated for national utilities.**

PER CAPITA ELECTRICITY (kWh)

US	12,987
UK	5,130
China	3,927
Nigeria	144
Ethiopia	70

Better measures? A working group of the Center for Global Development in Washington DC proposed:

1. Re-labeling the IEA's access threshold as an "extreme energy poverty line."
2. Collecting data on household energy consumption at multiple levels, such as 100 kWh (extreme energy poverty), 300 kWh (basic access) and 1,500 kWh (modern access).
3. Create country-level energy groups. As with income, categorize countries by Extreme low energy (< 300 kWh/capita/year), Low (300–1,000), Mid (1,000–5,000 kWh), High (more than 5,000 kWh).

Better data and estimates. Greater investment in energy data could exploit new technologies such as satellite imagery, remote sensors, geocoded household surveys, and low-cost mobile phone polling.

Further Reading

- World Energy Outlook Model, International Energy Agency, 2017
- Beyond Connections Energy Access Redefined, SE4ALL and World Bank, 2015
- "Making Energy Access Meaningful," Morgan Bazilian and Roger Pielke Jr., Issues in Science and Technology, 2013
- "Energy Poverty: What You Measure Matters," Lauren Culver, Stanford Natural Gas Initiative, 2017
- More Than a Lightbulb, Energy Access Working Group, Center for Global Development, 2016

FIGURE 1: The Multi-tier Framework

			Tier 0	Tier 1	Tier 2	Tier 3	Tier 4	Tier 5
Attributes	1. Peak capacity	Power		Very low power, minimum 3 watts	Low power, minimum 50 watts	Medium power, minimum 200 watts	High power, minimum 800 watts	Very high power, minimum 2 kilowatts
		and Daily capacity		Minimum 12 watt-hours	Minimum 200 watt-hours	Minimum 1.0 kilowatt-hours	Minimum 3.4 kilowatt-hours	Minimum 8.2 kilowatt-hours
		or Services		Lighting of 1,000 lumen-hours per day	Electrical lighting, air circulation, television, and phone charging are possible			
	2. Duration	Hours per day		Minimum 4 hours	Minimum 4 hours	Minimum 8 hours	Minimum 16 hours	Minimum 23 hours
		Hours per evening		Minimum 1 hour	Minimum 2 hours	Minimum 3 hours	Minimum 4 hours	Minimum 4 hours
	4. Affordability					Cost of a standard consumption package of 365 kilowatt-hours per annum is less than 5 percent of household income		
	3. Reliability						Maximum 14 disruptions per week	Maximum 3 disruptions per week of total duration less than 2 hours
	5. Legality						Bill is paid to the utility/prepaid card seller/authorized representative	
	6. Health and safety						Absence of past accidents/ no perception of high risk in the future	
	7. Quality						Voltage problems do not affect use of desired appliances	

FIGURE 2: Income versus energy consumption