



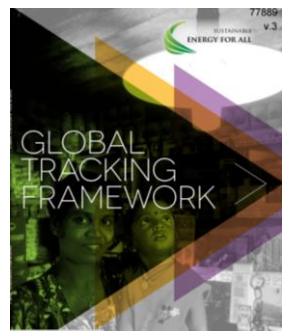
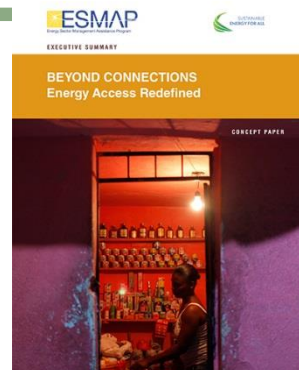
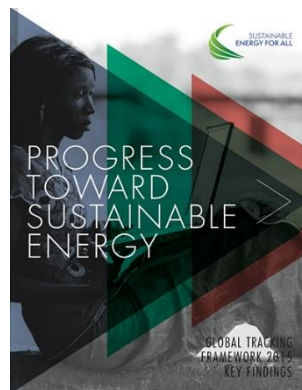
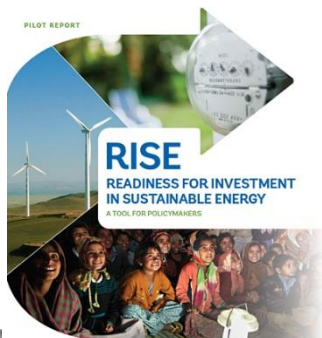
WORLD BANK GROUP
Energy & Extractives

Global Energy Survey:

Applying Multi-Tier Framework for Measuring Energy Access



SE4ALL Knowledge Hub publications



GTF
2013

RISE
2014

GTF
2015

MTF
2015

- **Website for additional information**

- 1) MTF: <https://www.esmap.org/node/55526>
- 2) GTF: <https://www.esmap.org/node/55527>
- 3) RISE: <https://www.esmap.org/node/55529>
- 4) Sustainable Energy for All Knowledge Hub: <https://www.esmap.org/node/55540>

What is the energy access challenge ?

SDG 7

Target 1. By 2030, ensure universal access to affordable, reliable and modern energy services.

SE4All

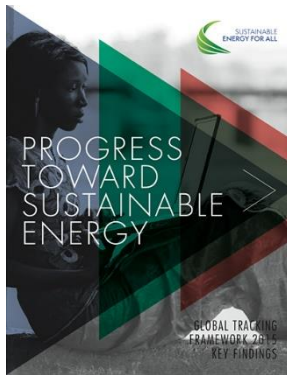
Objective 1. Ensure universal access to modern energy services.

Challenge

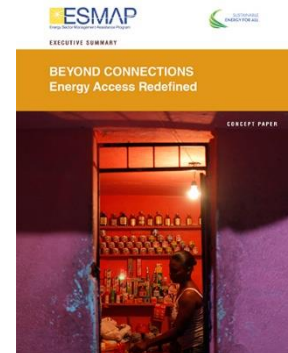
1. Defining: How to define affordable, reliable, and modern energy service.
2. Tracking: how to measure the progress toward universal access



SE4All
Knowledge
Hub



The GTF presents initial system for regular reporting on progress in reaching SE4All targets and SDG 7 progress.



The MTF redefines energy access based on capacity, duration, availability, quality, reliability, affordability, legality, health and safety.

“The knowledge hub ... offers an invaluable tool for follow-up and review as we implement SDG7.” – UN Secretary-General (Sep 16, 2015)

Applying MTF – where are we?

Support from more than 20 agencies in conceptualization

PILOTS:

- Aug.-Sep. 2013: Kinshasa, DRC.
- Oct.-Dec. 2013: Uganda
- May 2015: Bihar, India.
- Dec 2015: Malawi

Jun.-Dec. 2015: MTF survey in Guinea (3,000 HH)

Apr. 2016: Launch of MTF Global energy access survey in 15 countries.

Conceptualization and piloting

Application

2011

2012

2013

2014

2015

2016

2017



The UN General Assembly declares “International Year of Sustainable Energy for All.”



SDG 7: “Ensure access to affordable, reliable, sustainable and modern energy for all”

Why think beyond connections?

BEYOND CONNECTIONS MEANS:



Off-grid solutions



Quality and quantity of grid electricity



Upstream electricity projects



Clean cooking solutions

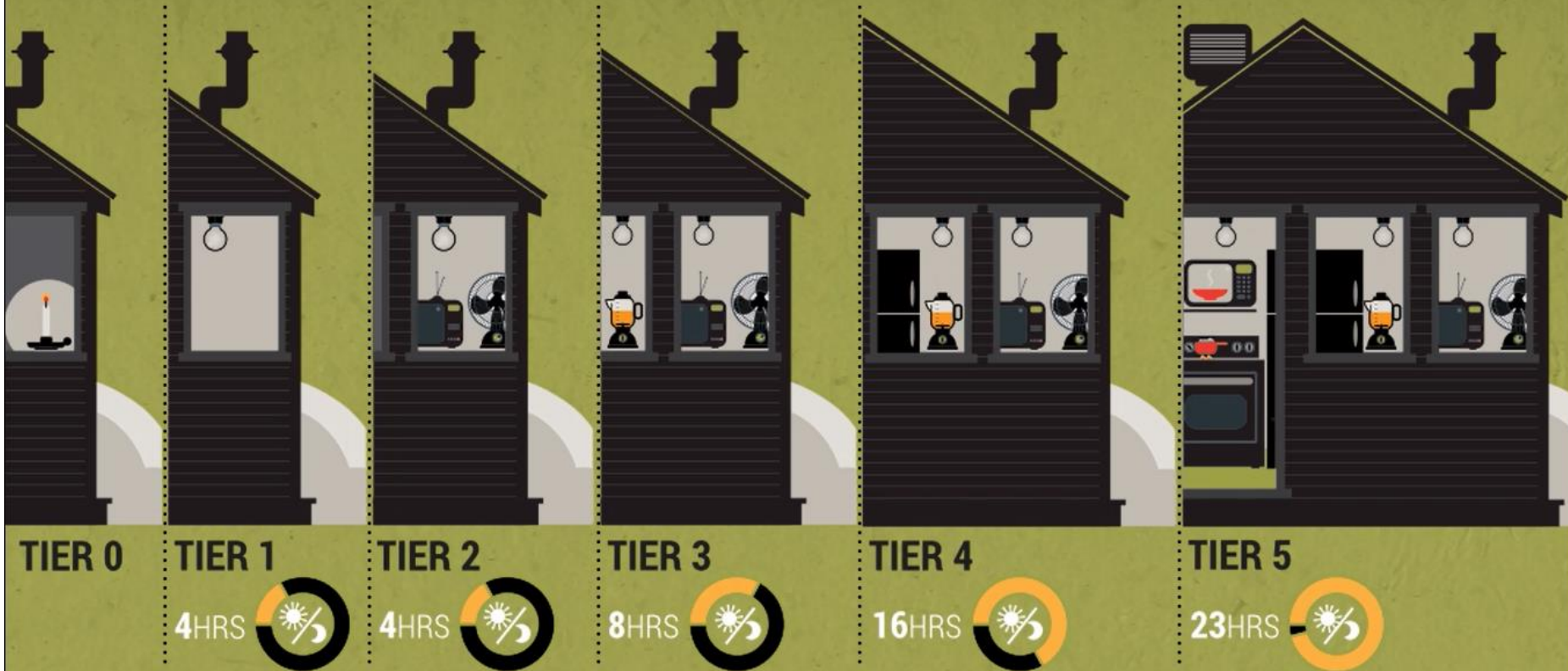


Energy for community facilities and productive engagements

Energy access can no longer be understood in terms of number of grid electricity connections.



Measuring energy access: the multi-tiers



Improving attributes of energy supply leads to higher tiers of access.

Tier calculation: Household electricity supply

		TIER 0	TIER 1	TIER 2	TIER 3	TIER 4	TIER 5
1. Peak Capacity	Power capacity ratings ²⁸ (in W or daily Wh)		Min 3 W	Min 50 W	Min 200 W	Min 800 W	Min 2 kW
			Min 12 Wh	Min 200 Wh	Min 1.0 kWh	Min 3.4 kWh	Min 8.2 kWh
	OR Services		Lighting of 1,000 lmhr/day	Electrical lighting, air circulation, television, and phone charging are possible			
2. Availability (Duration)	Hours per day		Min 4 hrs	Min 4 hrs	Min 8 hrs	Min 16 hrs	Min 23 hrs
	Hours per evening		Min 1 hr	Min 2 hrs	Min 3 hrs	Min 4 hrs	Min 4 hrs
3. Reliability						Max 14 disruptions per week	Max 3 disruptions per week of total duration <2 hrs
4. Quality						Voltage problems do not affect the use of desired appliances	
5. Affordability					Cost of a standard consumption package of 365 kWh/year is less than 5% of household income		
6. Legality						Bill is paid to the utility, pre-paid card seller, or authorized representative	
7. Health & Safety						Absence of past accidents and perception of high risk in the future	

Tier calculation: Household cooking solutions

		LEVEL 0	LEVEL 1	LEVEL 2	LEVEL 3	LEVEL 4	LEVEL 5	
ATTRIBUTES	1. Indoor Air Quality	PM _{2.5} (µg/m ³)		[To be specified by a competent agency, such as WHO, based on health risks]	[To be specified by a competent agency, such as WHO, based on health risks]	[To be specified by a competent agency, such as WHO, based on health risks]	< 35 (WHO IT-1)	< 10 (WHO guideline)
		CO (mg/m ³)					< 7 (WHO guideline)	
	2. Cookstove Efficiency (not to be applied if cooking solution is also used for space heating)			Primary solution meets Tier 1 efficiency requirements [to be specified by a competent agency consistent with local cooking conditions]	Primary solution meets Tier 2 efficiency requirements [to be specified by a competent agency consistent with local cooking conditions]	Primary solution meets Tier 3 efficiency requirements [to be specified by a competent agency consistent with local cooking conditions]	Primary solution meets Tier 4 efficiency requirements [to be specified by a competent agency consistent with local cooking conditions]	
	3. Convenience:							
	Fuel acquisition and preparation time (hrs/week)				< 7	< 3	< 1.5	< 0.5
	Stove preparation time (min/meal)				< 15	< 10	< 5	< 2
	4. Safety of Primary Cookstove	IWA safety tiers		Primary solution meets (provisional) IWA Tier 1 for Safety	Primary solution meets (provisional) IWA Tier 2	Primary solution meets (provisional) IWA Tier 3	Primary solution meets (provisional) IWA Tier 4	
OR Past accidents (burns and unintended fires)						No accidents over the past year that required professional medical attention		
5. Affordability						Levelized cost of cooking solution (inc. cookstove and fuel) < 5% of household income		
6. Quality of Primary Fuel: variations in heat rate due to fuel quality that affects ease of cooking						No major effect		
7. Availability of Primary Fuel						Primary fuel is readily available for at least 80% of the year	Primary fuel is readily available throughout the year	

Linkage between MTF attributes and SDG 7

“Ensure...”

- Electricity
 - Capacity
 - Duration
- Cooking solutions
 - Air Quality

Access to

Affordable

- Electricity
 - Affordability
- Cooking solutions
 - Affordability

- Electricity
 - Reliability (outages)
 - Quality (voltage)
- Cooking solutions
 - Quality of Fuel
 - Availability of Fuel

Reliable

Modern

- Cooking Solution
 - Convenience
 - Efficiency

- Electricity
 - Legality
 - Safety

- Cooking solutions
 - Safety

...energy for all” (SDG 7.1)

Piloting of MTF – Status & Strategy

We surveyed almost 10,000 HH to pilot the methodology

Survey Status	Country	Area	Sample size	Topic
Completed	DRC	Kinshasa area	2505 HH	HH cooking, HH electricity
Completed	Uganda	National	3335 HH	HH Cooking
Completed	Ethiopia	Amhara Region	Small sample Validation of the software	HH cooking, HH electricity
Completed	India	Bihar (6 districts)	4870 HH	HH cooking, HH electricity
Completed	Malawi	Lilongwe area	70 HH Validation of the questionnaire	HH cooking, HH electricity, Productive uses, Community uses

Pilot - Kinshasa City

Household energy survey done in Aug-Sept, 2013

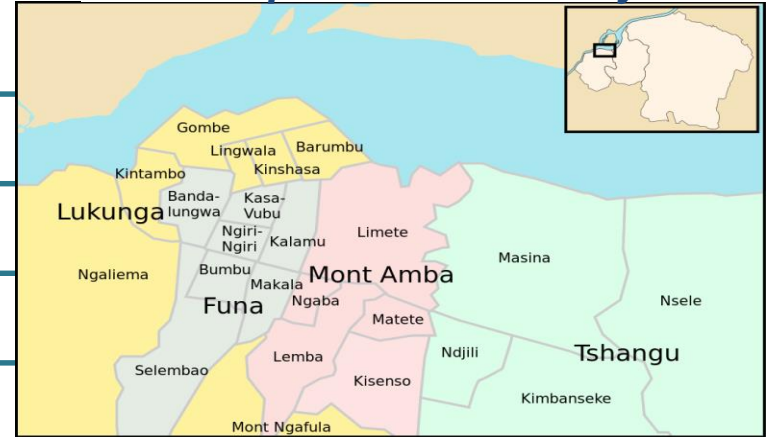
Covered all four districts : Lukunga, Funa, Mont Amba, Tshangu

Sample of 2505 Households

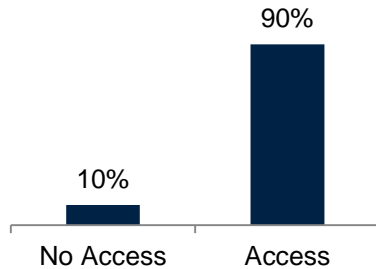
Data used for multi-tier analysis

Data also used to prepare a draft Energy Access Diagnostic Report

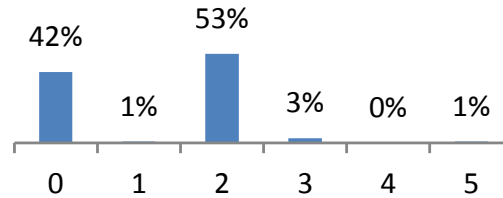
Map of Kinshasa City



Binary Measurement



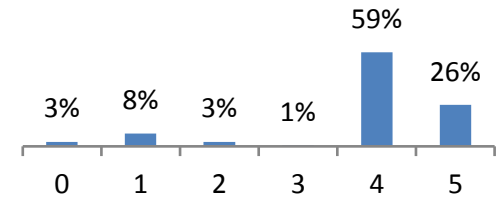
Multi-tier Measurement Of Access To Electricity Supply



24.2/100

Index of Electricity Access

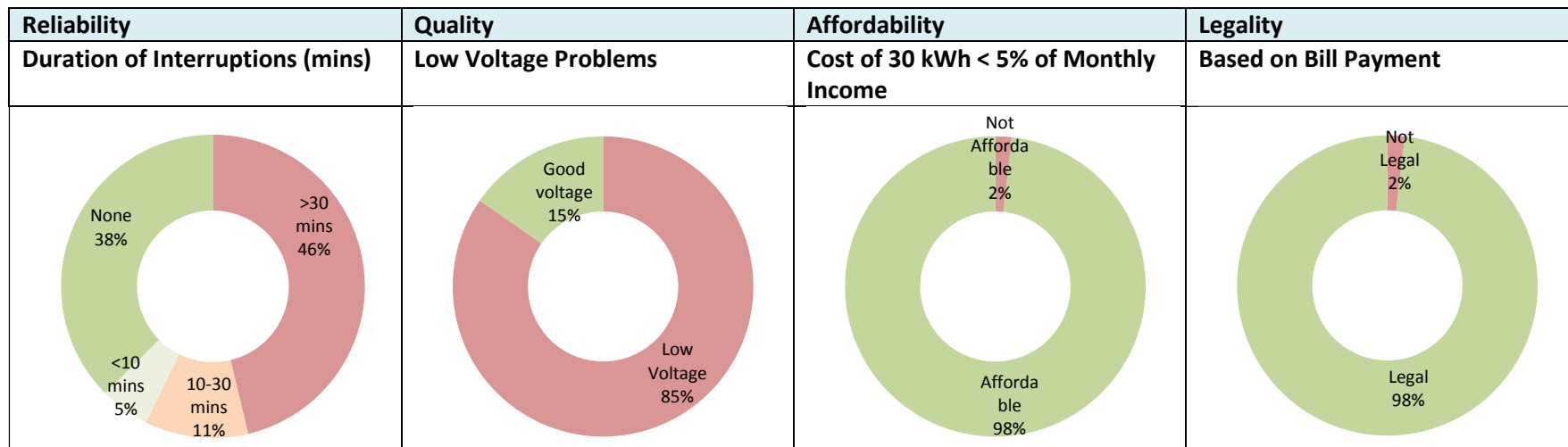
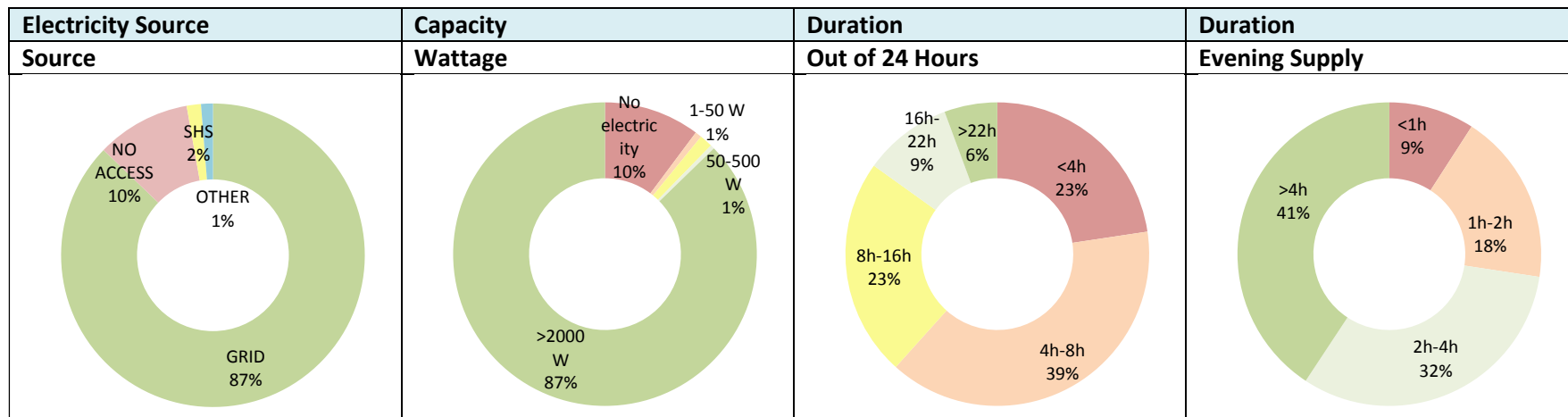
Multi-tier Measurement of Access to Electricity Appliances



76.6/100

Index of Access to Appliances

Electricity - Attributes Summary Sheet

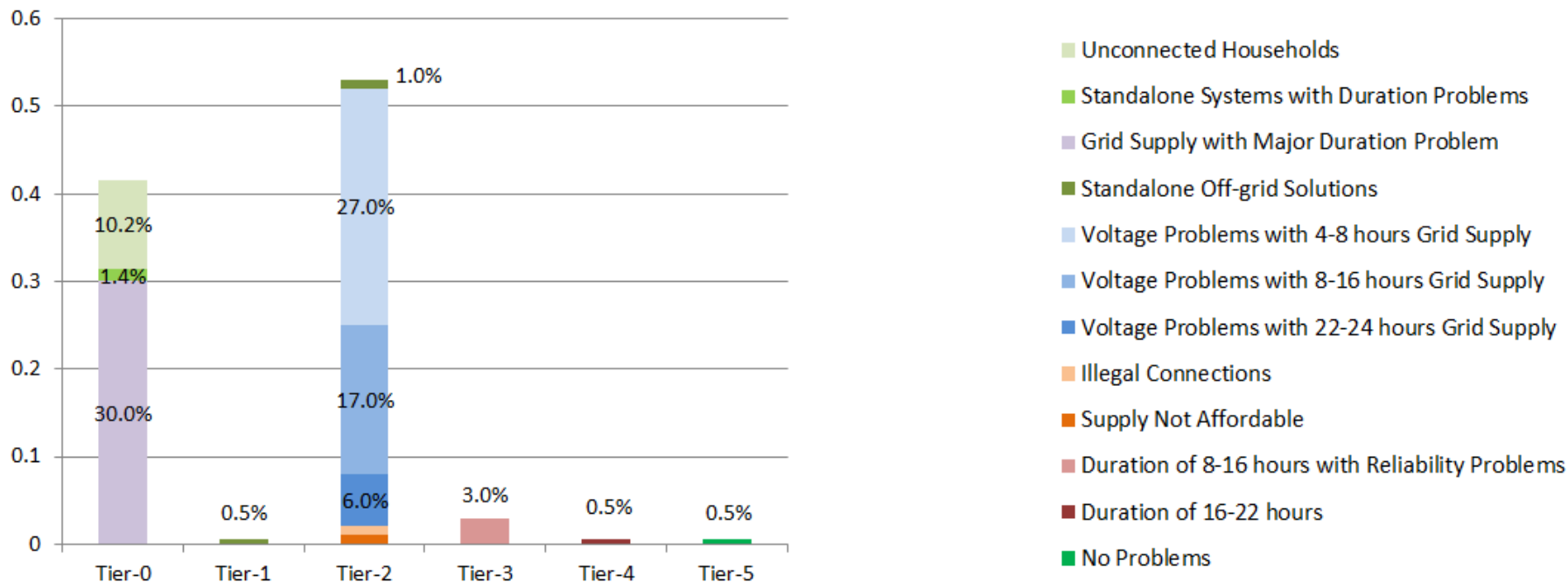


Less than 8 hours per day for 62% of the household

Unscheduled interruptions are longer than 30 minutes for more than 57% of the household

Almost 85% of the household experienced low voltage

Electricity – Gap Analysis and Interventions



Gap analysis at Glance:

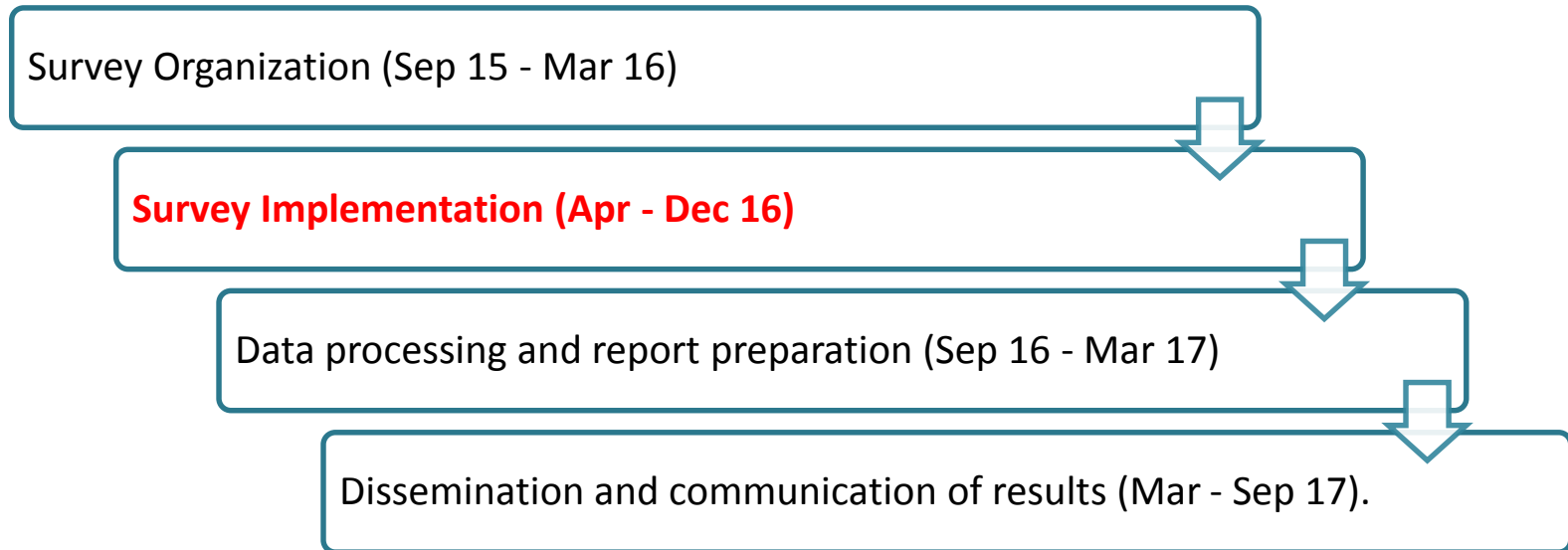
Connections: About 100,000 households are neither connected to the grid nor have any other electricity solution. The problem is observed more in peri-urban areas and in the district of Tshangu. Being in a city area, these households can be connected to the grid.

Duration of Supply: Nearly 30% of the households are grid-connected but receive less than 4 hours of supply or less than 2 hours in the evening. If supply can be rationed systematically then these households could move to Tier-2. Additional generation and transmission to augment peaking supplies may be needed to achieve this.

Voltage and Duration Problems: Low and fluctuating voltage is a critical problem in all districts. It affects nearly 50% of all households. About half of them reported reliability problems as well. A transformer renovation and maintenance program, and better load management can help improve voltage, as well as reliability and remove illegal connections.

MTF Implementation plan

- **Three types of implementations:**
 1. Global MTF roll-out: Carry out stand-alone survey in 15 countries
 2. Incorporate MTF energy module into national HH surveys
 3. Collaborate with regional banks to implement MTF survey
- **Timeline of Global Roll-out implementation:**



Global survey will cover 15 highest access deficit countries



Policy relevance of MTF

- 1 The MTF enables policy makers to set clear and specific targets of energy access
- 2 The MTF provides a baseline to track the improvement across various attributes of energy access under SDG and SE4All initiative
- 3 Demonstrates that any intervention along the energy supply chain can improve access
- 4 Yields detailed analysis to diagnose current energy usage and status as well as evaluation of energy intervention in a selected area
- 5 The MTF enables detailed analysis of current energy usage and yield a gap analysis. Provides a solid basis for identifying the most cost-effective energy access approach