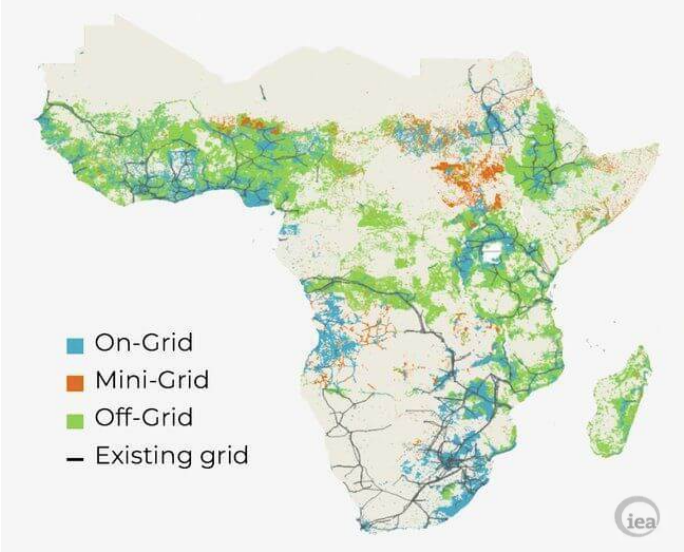
A new paradigm for Sub-Saharan electricity sectors : toward fragmented but more sustainable grids in cities ?

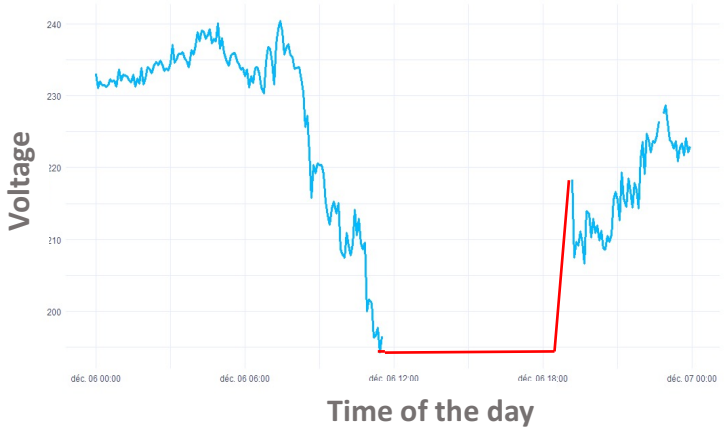
Hugo Le Picard,
Center for Energy & Climate, Ifri
30/09/2021

The grid is struggling to keep up with demand and the investment gap remains huge

Electrification plan : between grid extensions, mini-grids and SHS



A typical day on Nigeria's grid



The « classical » approach to electrification in SSA :

- Centralized grid for urban areas, mini-grids (disconnected from the centralized network) for peri-urban areas, individual systems for rural areas
- Depending on the existing grid and population density, electrification is mainly seen through this "prism"

Need to put back « electricity access » into context

- A typical Sub-Saharan business suffers an average of 77 hours of blackouts per month
- Nigeria experienced an average of 32 power outages per month, each lasting 12 hours on average
- Considerable negative effect on economic activities, representing a cost ranging from 1 to 5 % of African national GDPs

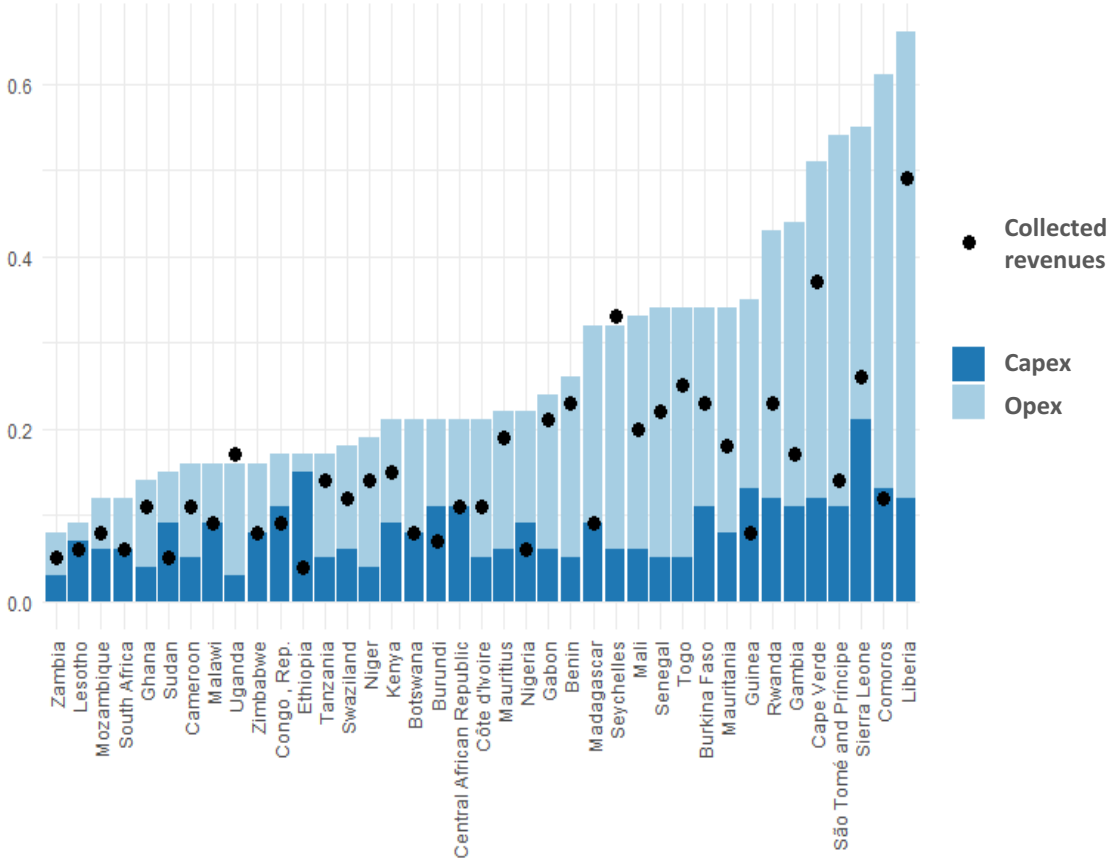
➢ **A colossal need for investments, which depend on the levels & quality of electricity access to be provided to the population**

➢ **Level 5 access = 120 billion $ per year until 2040 would be necessary, half of which in networks**

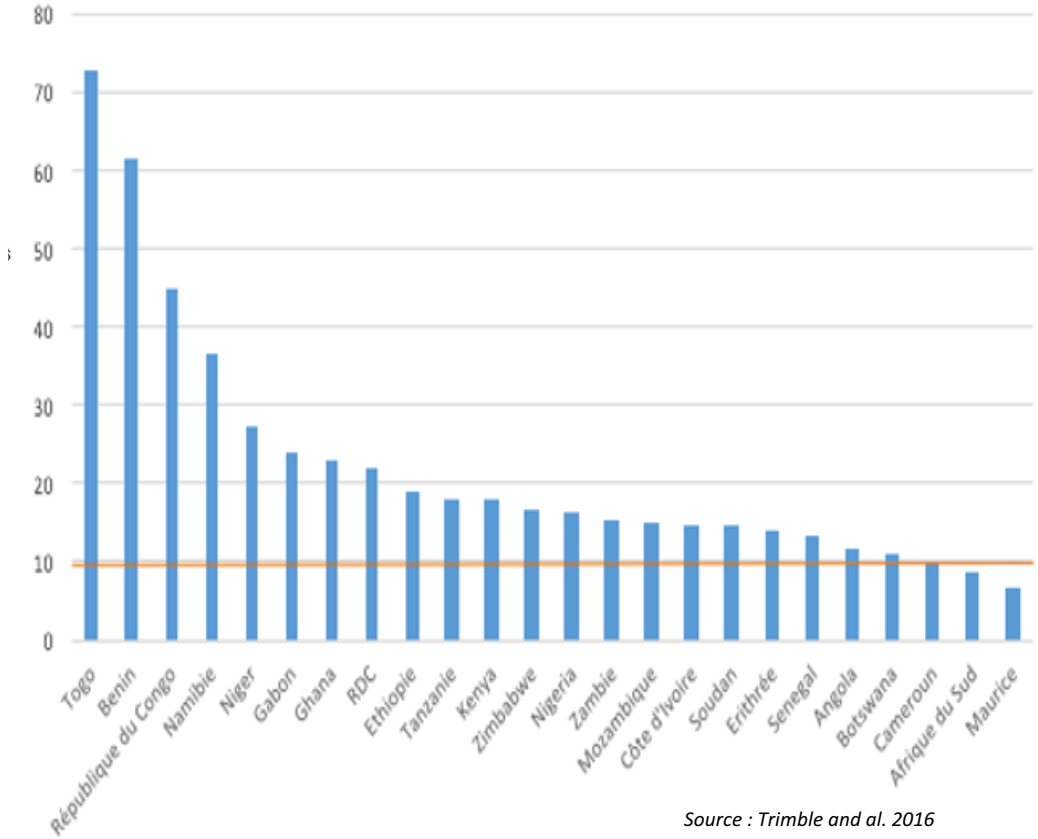
➢ **But in 2019, only 25 billion $ were invested, of which only 1/3 in networks**

A vicious circle maintaining obsolete grids : low operational efficiency and financial viability (1/2)

Electricity supply cost and revenue collected in $ per kWh billed, most recent data available



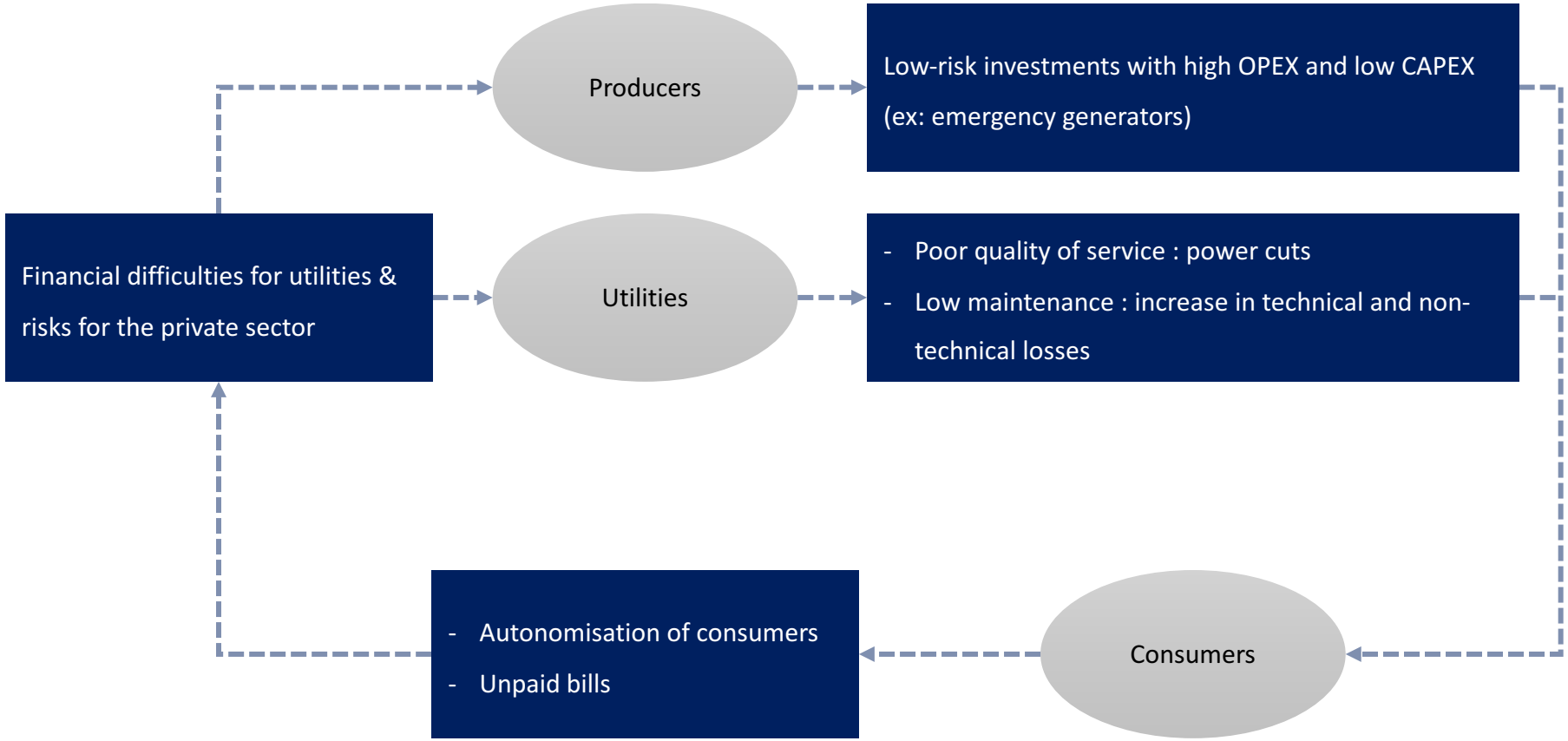
Transmission losses in a selection of countries (%), most recent data available



Source : Trimble and al. 2016

A vicious circle maintaining obsolete grids : financial lock in = carbon lock in (2/2)

A vicious financial circle that constrains large scale renewable deployment



➢ **Improving the financial viability of the sector is an essential condition for taking advantage of the centralized renewable potential of the region**

Discrepancies between supply and demand : an old market for diesel generators, a new market for solar ?

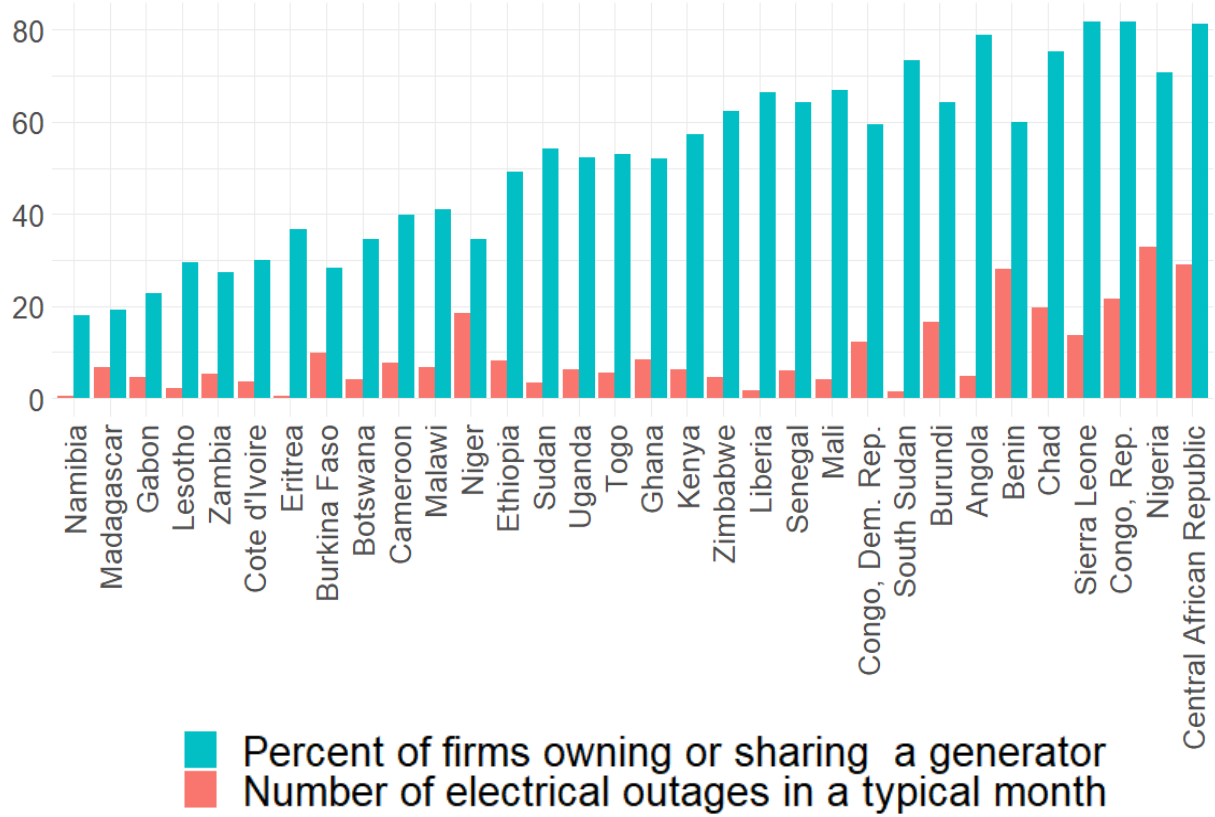
In countries where the network is unreliable, without quality improvement of services, populations and business are encouraged to use autonomous means of electricity production

- More than half of businesses have or share a generator: more than 80% in the Republic of Congo, Sierra Leone and the Central African Republic, and more than 70% in Chad, Angola and South Sudan
- Nigeria, the aggregate installed capacity of diesel generators is estimated to be around 14 GW, two to three times the available capacity of the central grid at around 6 GW for 2019

Factors :

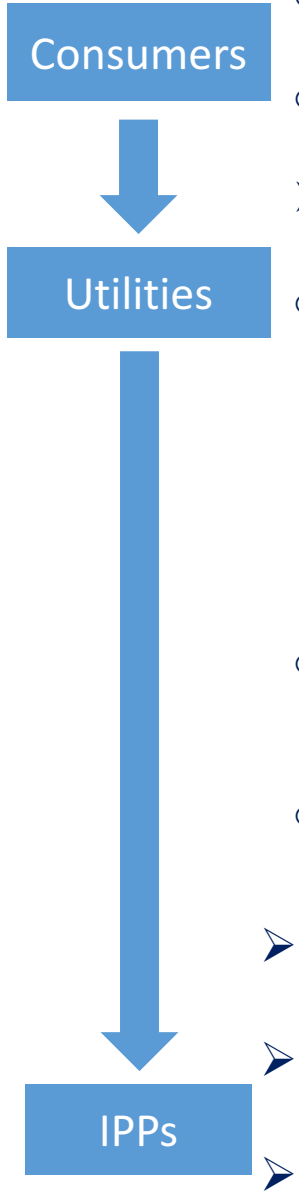
1. Power outages : encourage businesses and households to invest in additional resources to meet their needs during blackouts
2. High cost of electricity : encourage these investments in order to reduce energy bills (SHS in particular)
3. Facilitated by higher purchasing power in urban areas
4. Environmental reasons (marginal)

Distribution of generators among businesses and number of monthly power cuts, most recent data available



Source : World Bank, World Development Indicators

Medium and long term trends and impacts of the crises



- Trend is reducing income from the sale of electricity to consumers less dependent on the central grid and makes consumers more likely to refuse to pay or dispute the invoice
- From the analysis it appears that lucrative consumers in urban areas tend to invest in solar amongst other factors
- **IMPORTANT** consequences on the strategy of deploying central grid to poor consumers through cross subsidies
- **The future role of utilities**. Depending on the country different model will appear :
  - Utilities could disappear
  - Utilities manage to find ways to fully integrate those new uses in the system, notably through the use of “smart grid” technologies (strong and reliable electricity sectors such as Togo’s)
  - Between those two :
    - Reliable and modern electricity sector in central urban areas
    - Hybridization of electricity use and partial withdrawal of utilities in weak grid areas
- **Prospects of large centralized projects (IPPs)**
  - Overall a reduction in big sized projects (+ 50 MW) limited near economic areas
  - Increase in number of medium to small sized projects (20 MW +)
- The development of renewable plants backed by large storage (South Africa / Senegal) and industrial areas (Togo)

- The rapid urbanization along with new technologies emerging on the backdrop of an unreliable network incite consumers to become less dependent on the central grid.
- It could generate a bottleneck effect which would reduce the demand for electricity and thus in turn squeeze the development of the IPPs market.
- International funding agencies could help integrate those new uses into the grid by investing particularly in grid infrastructures which remain the backbone of the continent’s power sector

Center for Energy & Climate

lepicard@ifri.org

27, rue de la Procession, 75740 PARIS CEDEX 15
Tél. +33 (0) 1 40 61 60 00 • Fax : +33 (0) 1 40 61 60 14
www.ifri.org