

# Electricity Access and Economic Development in Sub-Saharan Africa

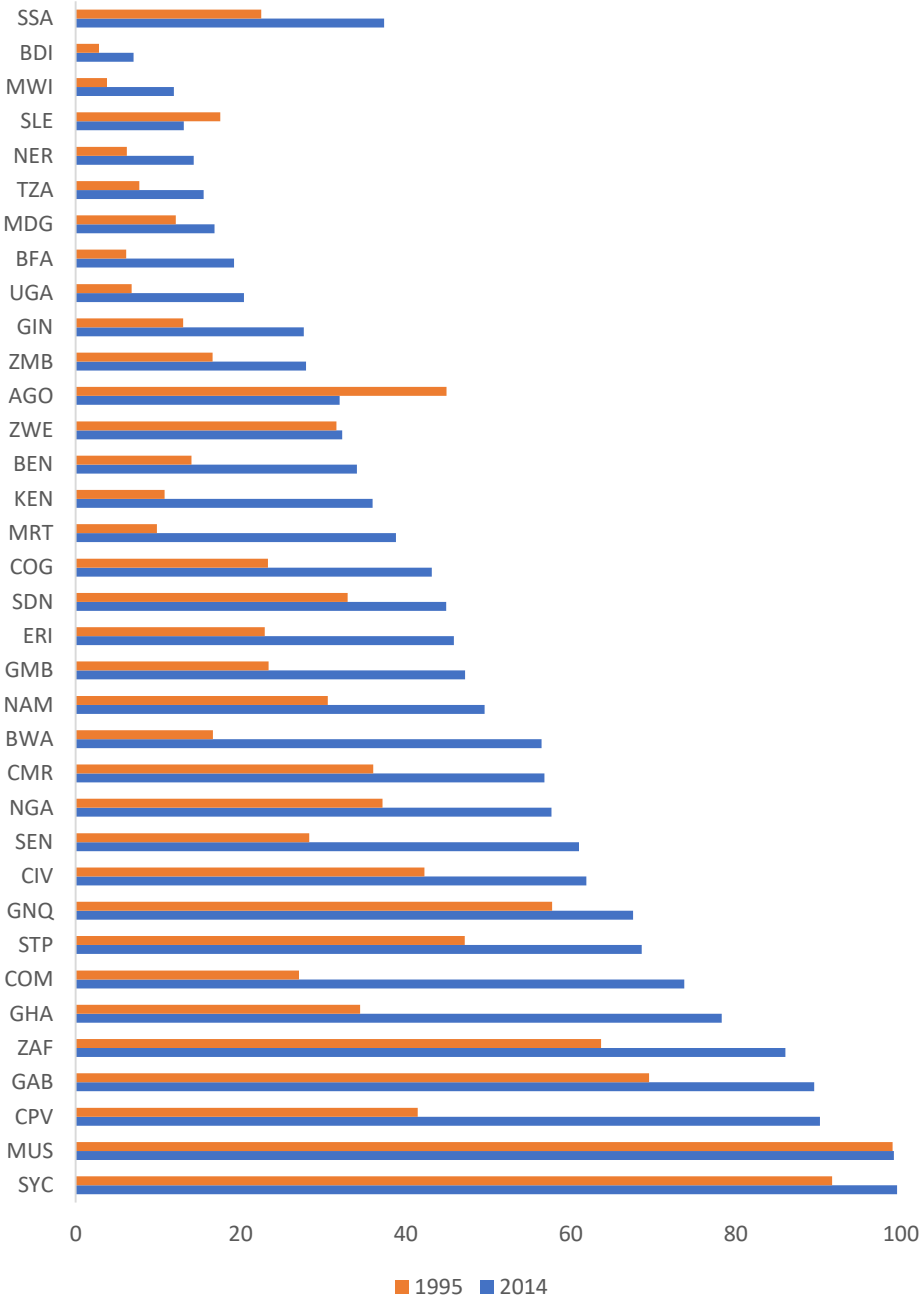
Michael Toman, Jevgenijs Steinbuks, Jörg Peters, Justice Mensah, Govinda Timilsina  
USAEE Conference, Crystal City VA, September 2018

(views expressed are the authors' alone)

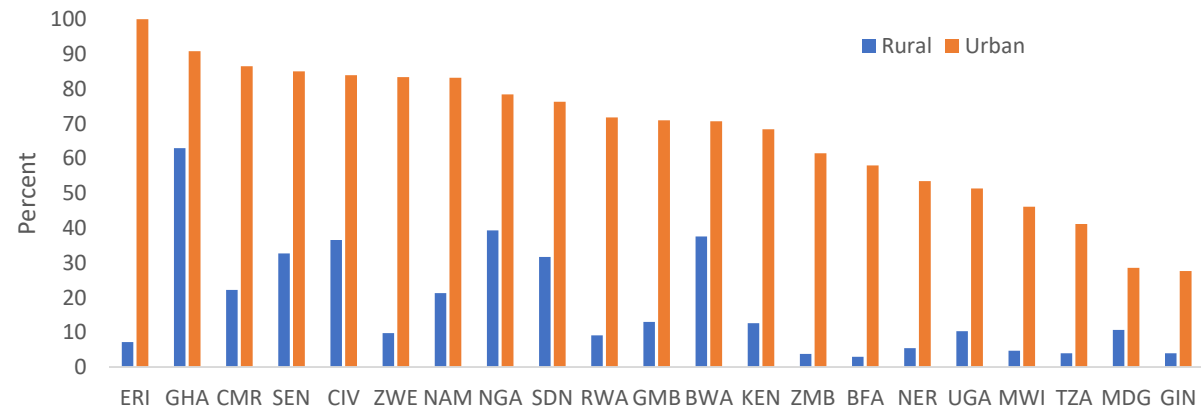
# Troubled state of electricity companies & systems in SSA

- Access to electricity has increased over time, but it remains low in most countries and in almost all rural areas
- Concern about expanding generation capacity to meet growing demands, but existing capacity utilization is low in most countries
- This in turn is a reflection of chronic revenue shortages that have led to under-maintenance of existing capacity as well as new investment
- Lack of adequate maintenance also is reflected in high outage rates, due to under-maintained and too-small transmission and distribution capacity as well as problems with generation
- The region has undertaken some reforms toward greater regulatory independence and unbundling, but how well that works in practice is very much open to question

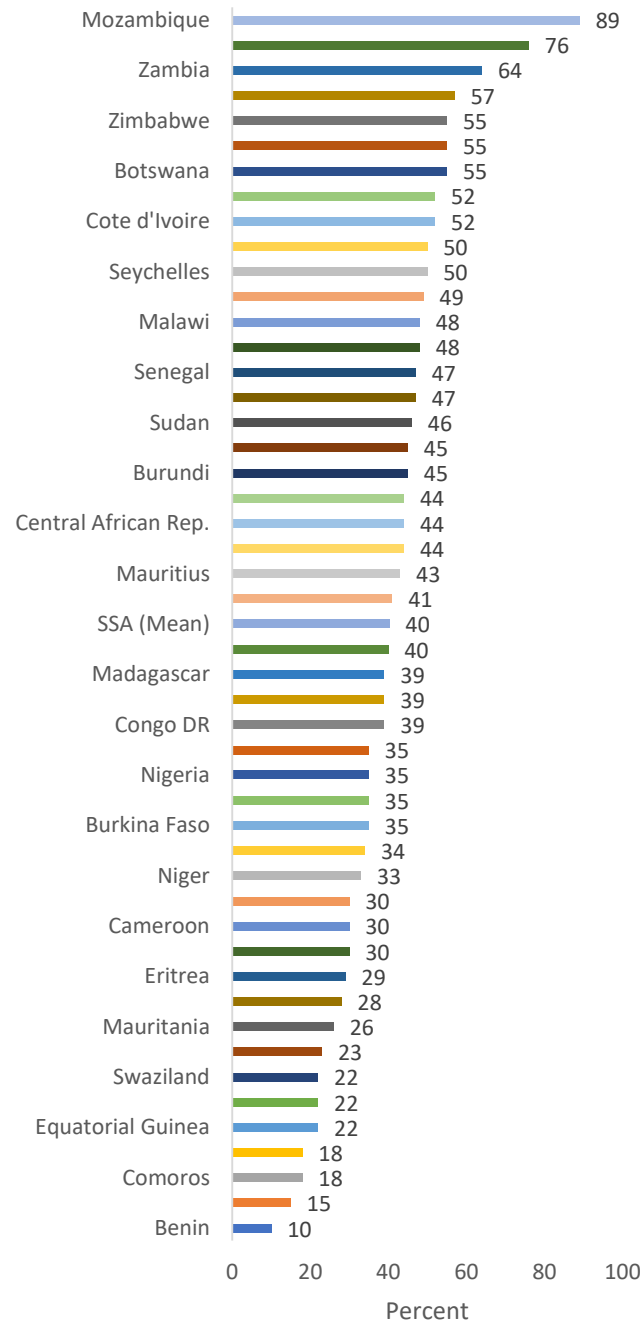
Progress in Electricity Access in Sub-Saharan Africa (source: World Bank 2016)



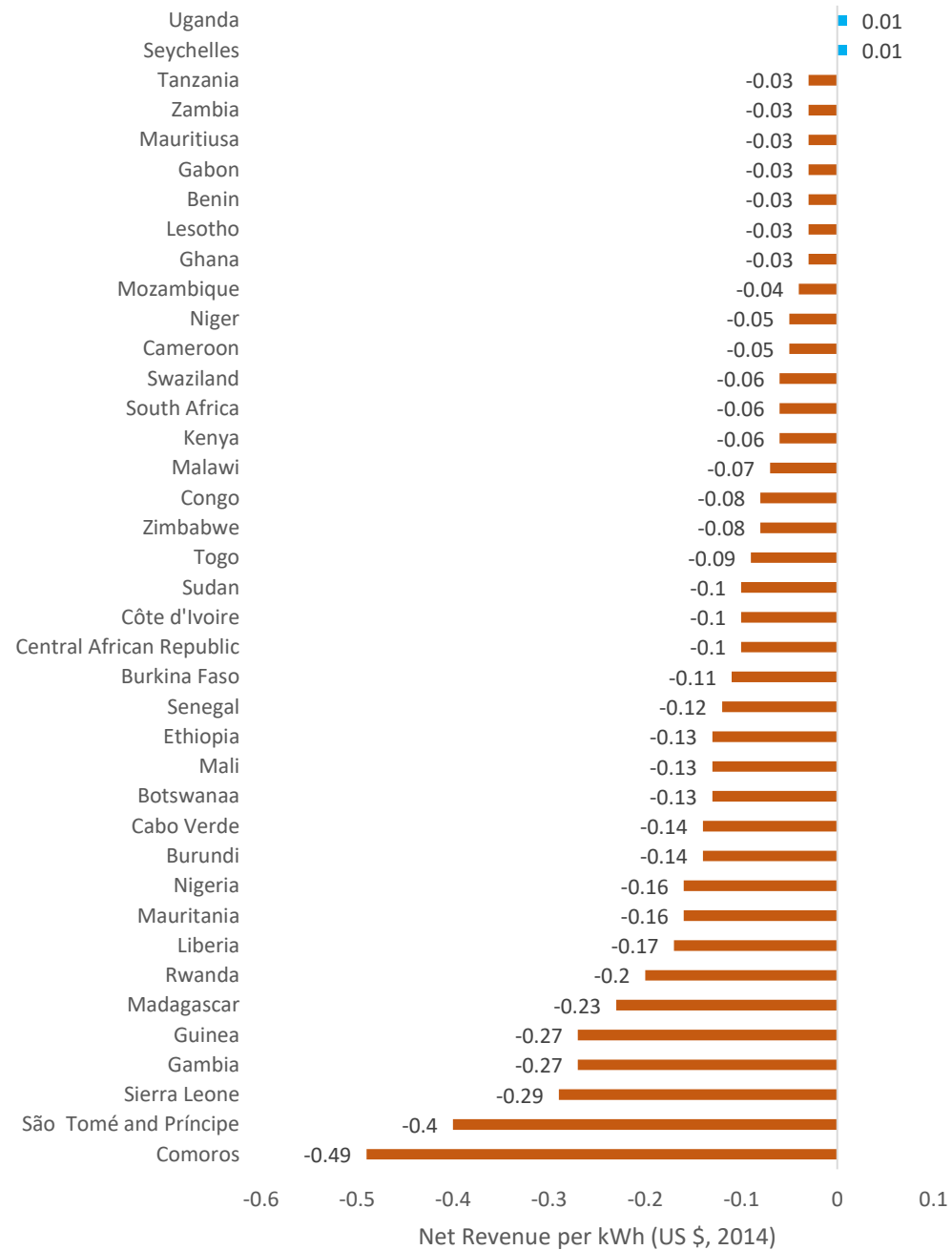
## Rural-Urban Differences in Electricity Access in Sub-Saharan Africa (source: World Bank 2016)



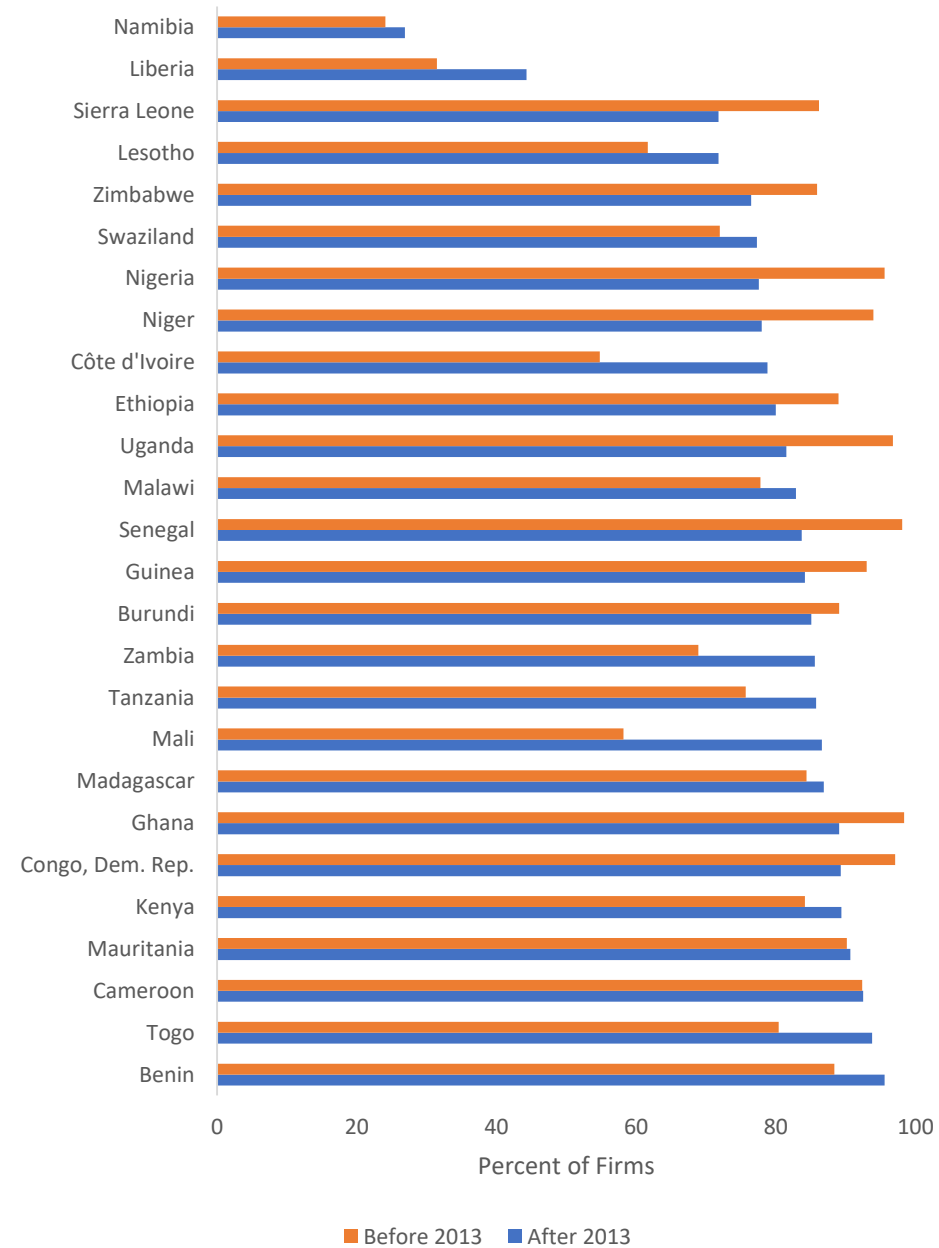
## Capacity Utilization in Electricity Generation in Sub-Saharan Africa (source: United Nations 2015)



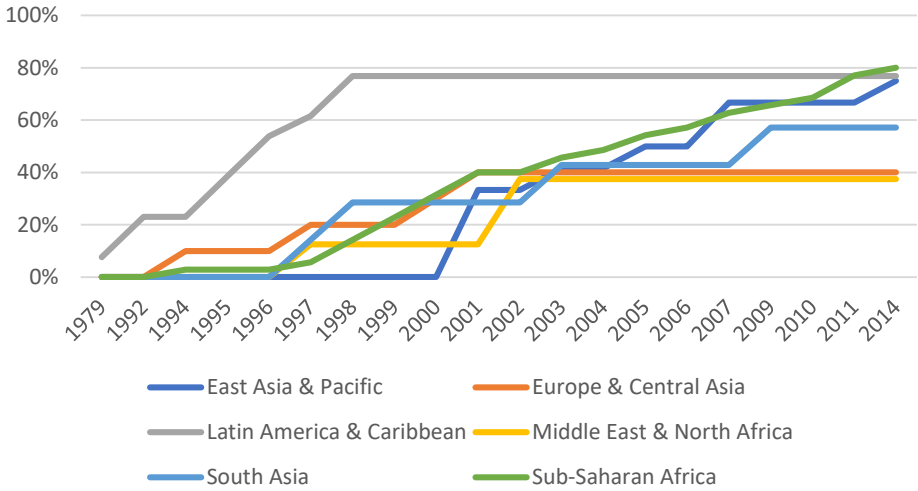
Net Revenue per Unit (2014  
\$ per kWh billed) (source:  
Trimble et al 2016)



Percentage of businesses reporting electricity outages in Sub-Saharan Africa (source: World Bank *Enterprise Surveys*)



Shares of Countries with Legal Provisions for an Independent Electricity Regulator, by Region  
 source: Foster et al 2017)





# Some reasons for these unfortunate circumstances

- Weak policies and institutions:
  - Problematic tariff structures, leading to poor financial viability of electric utilities
  - Lack of regulatory capacity
  - Policy and institutional weaknesses in sector regulation & governance
  - Lack of commitment to advance electricity sector restructuring
  - Lack of transparency, credibility, and accountability more generally
- Underlying economic challenges
  - Rural electrification to provide increased access is costly
  - When household or business incomes are low, so is electricity demand

# Conceptual issues

- How can increased access to/availability of electricity affect economic progress?
  - Even very small amounts from e.g. household solar systems can produce significant improvements in quality of life – but the power thus provided is too little for just about all productive uses
  - Constraints on larger-scale electricity availability could be a limiting factor on economic expansion in “modern sectors:” more power available => can create and use more capital
  - Such constraints also can slow economic progress through modernization – expansion in sectors that use modern types of capital as well as energy

## Conceptual issues (2)

- On the other hand, many other factors can limit demand for productive uses of electricity, and thus its impact on growth:
  - Limits on availability of complementary infrastructure, esp. transport
  - Limits on availability/high cost of financing business development, even if electricity is available
  - Human capital constraints
- Accordingly, there are some serious macro-level identification problems in separating out these various influences on the electricity – growth nexus
- A *partial* understanding of these problems can be gained by looking at micro-level data

Evidence is mixed on how electricity access improves income, employment, growth

- Cross-country panel data on aggregate income, infrastructure, other factors show that there is a positive relationship between income and electricity, and other types of basic infrastructure
- A huge number of time series studies with aggregate data have been done, but reviews indicate that none of this work has yielded really robust findings

## Evidence is mixed on how electricity access improves income, employment, growth (2)

- A number of instrumental variables studies have been done using panel data over households and micro-enterprises with differing access to/use of electricity:
  - Electricity is a significant determinant in a number of Asian countries (India, Vietnam, Philippines)
  - Almost no well-designed studies of this type have been done yet in Africa
  - However, a 2018 World Bank regional report finds strong, suggestive correlations between availability of electricity and availability of other factors (road access, micro-finance, educational attainment)

## Evidence is mixed on how electricity access improves income, employment, growth (3)

- Small but growing body of experimental research in Africa raises questions about importance of electricity per se for income, employment
  - Rwanda: even heavy subsidization of (reliable) grid connection in rural areas had little impact on economic activity, though household utility improved
  - Tanzania: similar finding – even with connection, actual electricity use was no more than with a solar home system except in already well-off households
  - Benin: careful comparison of micro-business formation in areas with and without electricity found almost no increase in number of enterprises or jobs
- All of these studies have limited ability to pick up impacts of broader-scale access in denser-populated areas that could e.g. support industrialization

# The Role for Mini-Grids? (A Hot Topic Today)

- Mini-grids were an important part of previous electricity sector development in e.g. USA
- There are some examples of operating mini-grids with varying degrees of success, from which some basic conclusions can be drawn:
  - Mini-grids inherently do not provide the scale economies of the main grid, but they can be much less costly than stand-alone individual systems for providing electricity for productive uses
    - Especially for PV, with more opportunity going forward with falling storage cost
    - Allow for more targeted and cost-effective access than willy-nilly grid extension
  - To successfully function financially at that scale, there is need for one or more reliable sources of larger-scale commercial demand, not just households
  - Governance is critical and can be difficult (community versus private business provider service, temptations of local govts to keep prices below cost)
  - Regulatory changes for governing relationships between mini-grids and main grid also are critical (e.g. stranded asset issues)

## The Role for Mini-Grids? (2)

- So far mini-grid investment in Africa is quite limited
  - Tanzania (hydro), Senegal (solar)
- However, a number of countries are reforming their policies governing mini-grids
  - For example, Kenya, Uganda
- Notwithstanding the potential economic development benefits that mini-grids might provide, the basic issue of the extent to which electricity access leads or follows development remains
  - If delivered cost of electricity is high, that will limit use by lower-income households and businesses
  - Other drivers (roads, finance, education) also need to be considered
  - Political economy issues related to regulation and accountability



Thank you! I look forward to comments and questions.

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Link to full report:

<http://documents.worldbank.org/curated/en/292931523967410313/Africas-pulse>

# Sources of data in charts

Foster, V., S. H. Witte, S. G. Banerjee, and A. Vega Moreno. 2017. “Charting the Diffusion of Power Sector Reforms across the Developing World.” Policy Research Paper 8235, World Bank, Washington, DC.

Trimble, Christopher Philip, Masami Kojima, Ines Perez Arroyo, and Farah Mohammadzadeh. 2016. “Financial Viability of Electricity Sectors in Sub-Saharan Africa: Quasi-Fiscal Deficits and Hidden Costs.” Policy Research Working Paper 7788, World Bank, Washington, DC.

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