Grid Interconnection of Mini-Grids

Club-ER, Benin

6 December 2018

PowerGen
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PowerGen at a Glance

- Founded in **2011**
- **100+** full-time employees
- Leading micro-grid company in Africa, managing **10,000 customers**

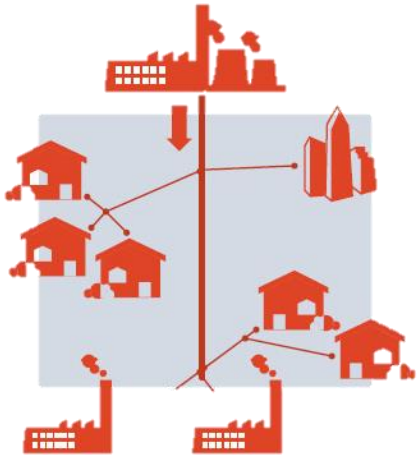
Offices in 4 Countries, and Growing

Core Competencies

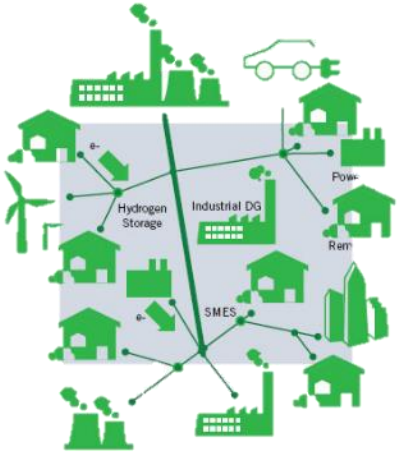
- **GIS Analytics**: proprietary gird mapping, design, and analysis tools
- **On-the-Ground Site Surveying**: thousands of sites physically surveyed in East and West Africa
- **Demand Assessments**: algorithms and methodologies developed for projecting demand
- **Building and Operations**: over micro-grid 10,000 connections built and under operation
- **Financing**: over $15m of capital raised for micro-grids
- **We are available to conduct national mini-grid mapping** (sslaughter@powergen-re.com)

Interconnected Mini-Grids as the Future of the Energy System

What does the future power system look like?



Mono-directional	→	**Multi-directional**
Centralized	→	**Decentralized**
Analog	→	**Digital**
Carbon-based	→	**Decarbonized**
Infrastructure-centric	→	**Consumer-centric**



Technologies Driving this Transition

- Smart Metering & Controls
- Rooftop Solar
- Low-cost Energy Storage
- Electric Vehicles
- Micro-Inverters
- Blockchain

Micro-grids are becoming the “building block” of this future architecture

FINANCIAL TIMES

‘Mini-grid’ household energy sharing begins to take off

Network of 20,000 German homes selling to each other shows new distribution model

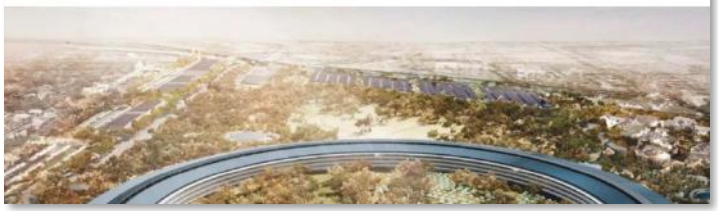
Harvard Business Review

TECHNOLOGY

How Utilities Are Using Blockchain to Modernize the Grid

Apple has just become an energy company, looks to sell excess electricity into the grid and maybe more

Seth Weintraub - Jun. 9th 2016 8:18 am PT @illsethj



SIEMENS

Smart energy supply for the University Campus of Savona

University of Genoa, Italy

The Economist

Light-bulb moment

Mini-grids may be the best way to illuminate the “bottom billion”

Governments need to rethink what is meant by a national grid

Illinois Project Opens the Door for Non-Utility-Owned Microgrids

Statement from EDF’s Christie Hicks and CUB’s David Kolata

February 28, 2018

The Illinois Commerce Commission (ICC) today approved Commonwealth Edison’s (ComEd) $25-million microgrid project and agreement to create a first-of-its-kind tariff, which will give non-utilities the opportunity to use ComEd’s existing wires to develop microgrids.

Media contact

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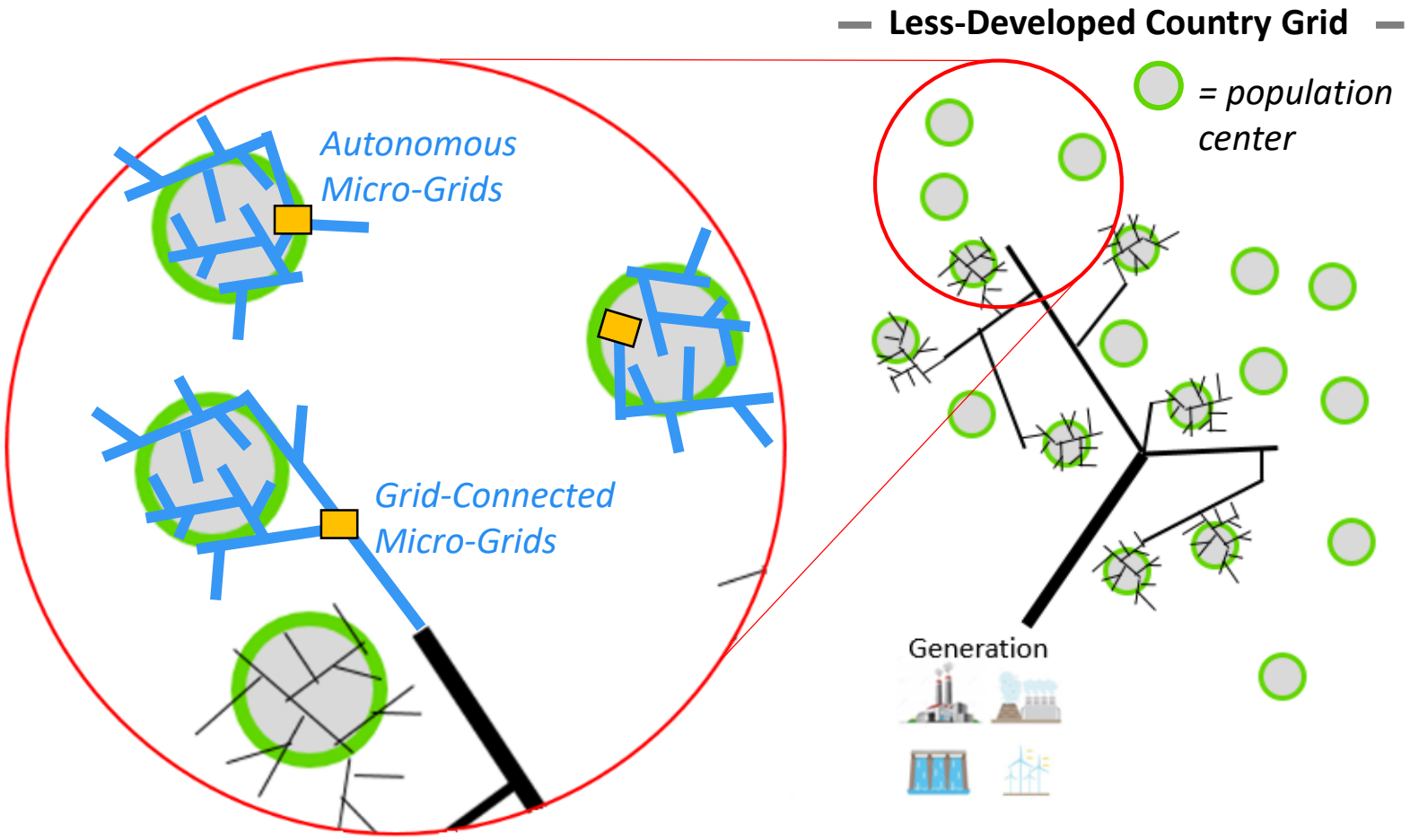
MIT Technology Review

Blockchain Is Helping to Build a New Kind of Energy Grid

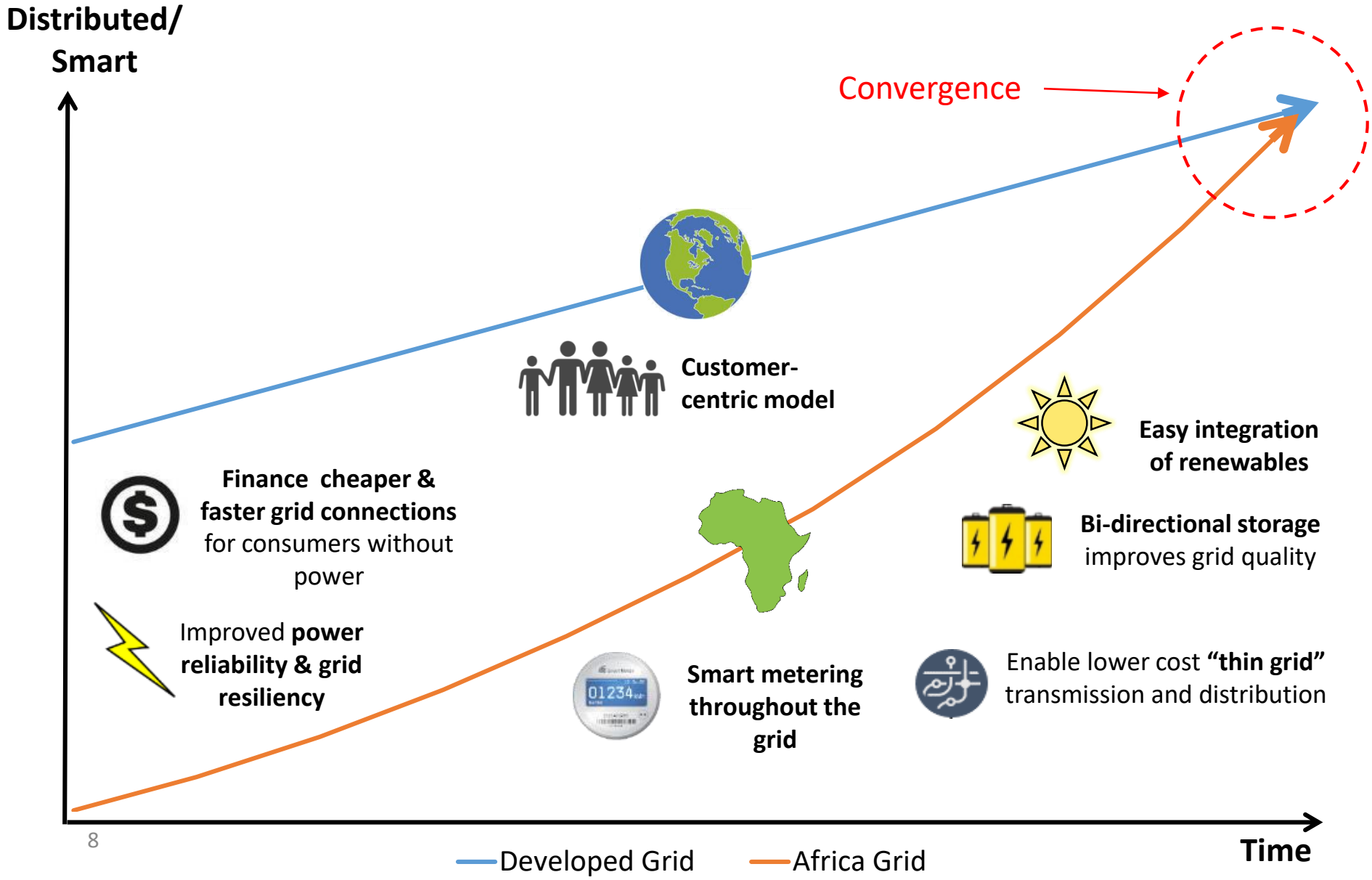
Using the technology behind Bitcoin, participants in the Brooklyn Microgrid are buying and selling locally generated renewable energy over a peer-to-peer network.

Building the Energy System of the Future in Africa from the Grid Edge Inwards

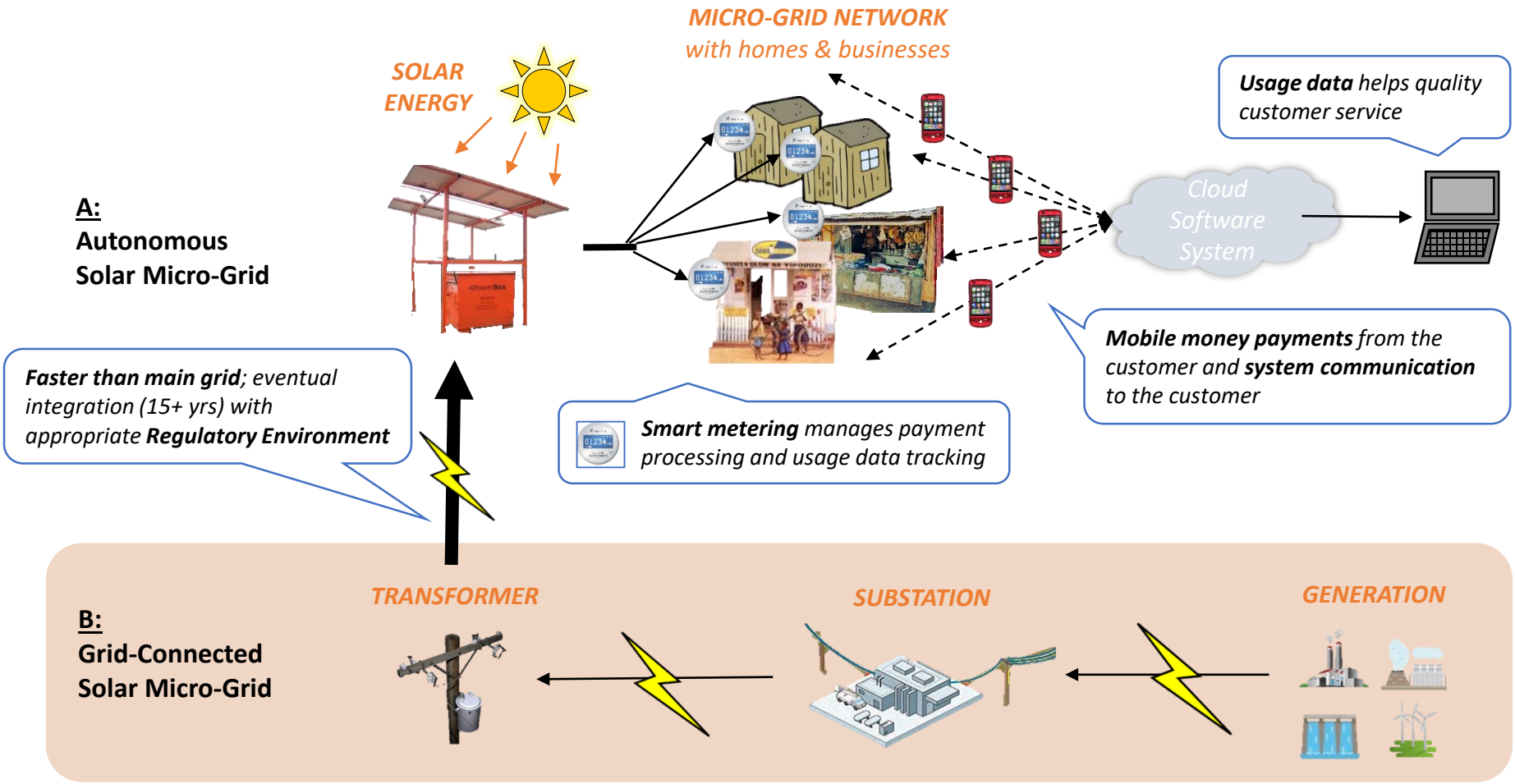
In Africa we can build this grid of the future from the grid edge, inwards – using micro-grids



Ultimately this will allow African grids to converge with their evolving developed market counterparts



Standalone Micro-grids are the current focus of Private Utilities, but long-term they will grid-integrate…



… Private Utilities may also offer "Smart Grid-as-a-Service" to legacy distribution networks

Challenges to Overcome

Key elements of integration

1. Technical – **Not an issue**

2. Legal – **Unresolved**

3. Commercial – **Unresolved**

Legal

A Legal right for grid-connected mini-grids (sometimes called “SPDs”) to **distribute power**

B Legal right to **set tariffs**

C Legal **protection from main grid** building lines “over the top” of SPD

D **Right to buy/sell power** from/to main grid

Commercial

SPDs won't be able to compete with the main grid unless there is a level playing field for subsidies

This is the most important issue

A **Subsidy parity**: Capex and Opex subsidies

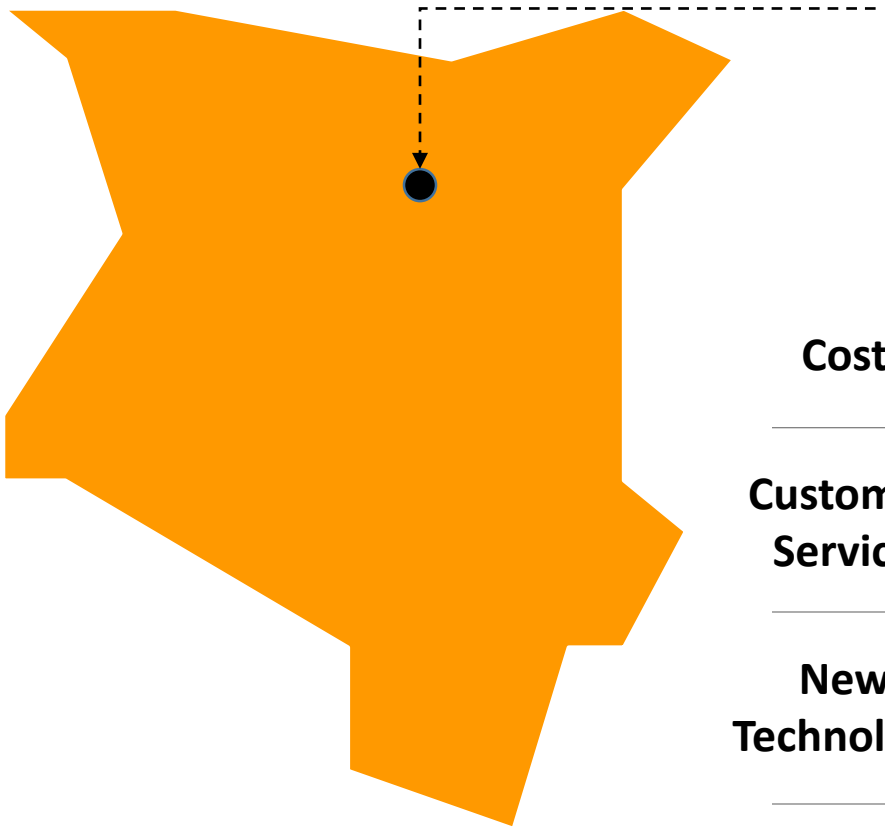
B **Fair price setting for asset purchase** (asset purchase from public grid is generally not the preference of developers)

C **Buying price of power** from the main grid

D **Selling price of power** back to the main grid

The Choice Between Public and Private Utilities

Example: Public vs. Private Option for Rural Electrification



Remote Town/Village
(or cluster of towns/villages)

	Option 1: Public Utility	Option 2: Private Utility
Cost	↑	↓
Customer Service	↓	↑
New Technology	↓	↑
Financing	Add more government/ utility debt OR high tariff	Add less government/ utility debt OR high tariff

Why should government want private utilities and mini-grids?

Whether public grid or private grid is utilized, ***somebody needs to pay*** *(either government or customers through higher tariffs). The difference is* ***with private grids, governments can often get better value for money****.*

1

Lower cost of infrastructure (more value per invested dollar)

2

Higher level of service for consumers (reliability and demand stimulation)

3

Vector for bringing **future technologies** into the African grid

Summary

1. ***The future global grid is a network of interconnected mini-grids****.*
2. *Because mini-grids can and should be connected to the main grid, the discussion should be more about* ***private utilities and public utilities*** *(instead of main grid and mini-grid).*
3. *Whether consumers (through higher tariffs) or governments (through taxpayer or donor revenue)* ***somebody has to pay for rural electrification****.*
4. ***Private utilities can deliver better value for money*** *for governments: lower cost, better service, future technology.*


Thank you!
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