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FSR ENERGY

Florence School of Regulation

Integrated pathways to provide universal access to energy

Swetha RaviKumar Bhagwat

Head of FSR Global Relations

IIT Kanpur – Center for Energy Regulation

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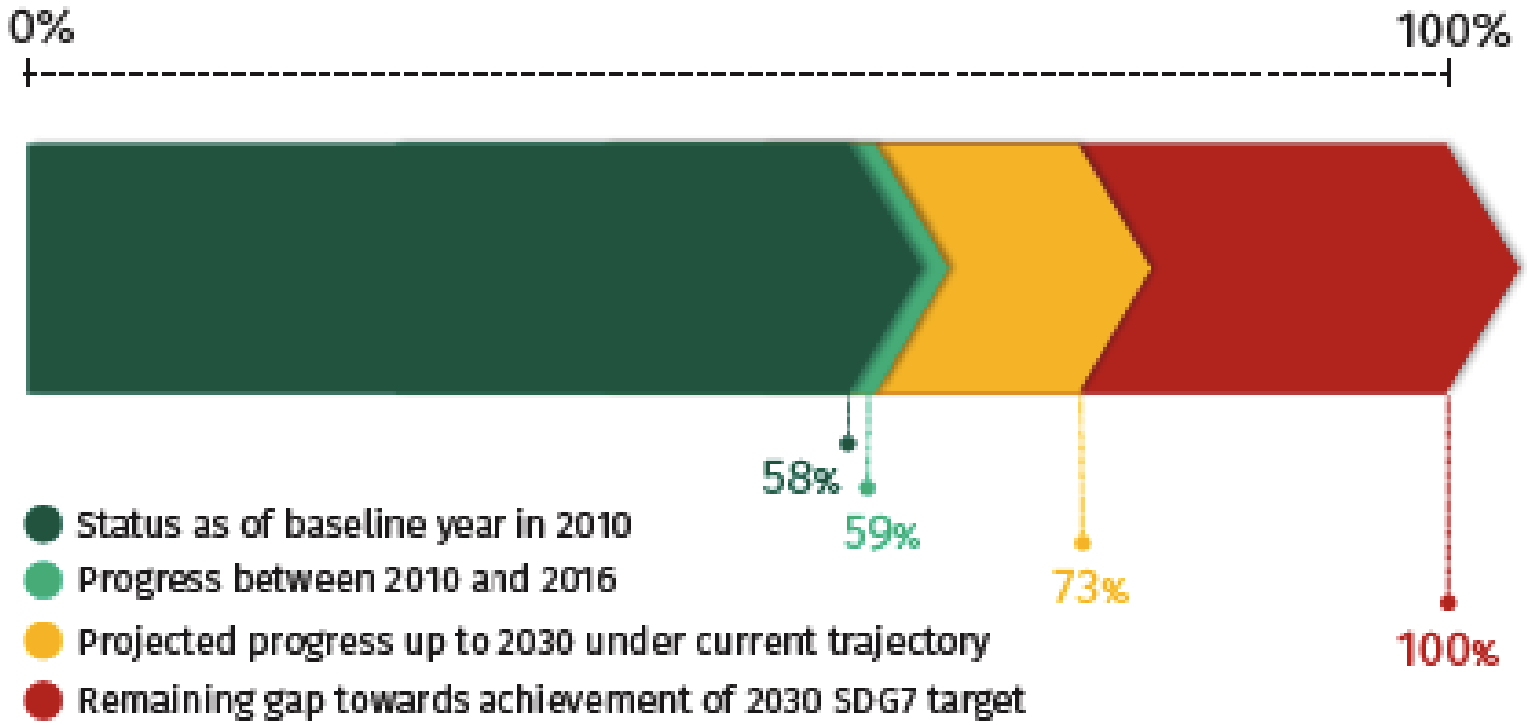
Population with access to electricity

Source: World Bank, 2016

Population with access to clean cooking



Source: World Health Organization, UN Population data

“the provision of one light to poor people does nothing more than shine a light on poverty”

Kandeh Yumkella, Director-General

UN Industrial Development Organization, 2009

What do we mean by “universal energy access”?

The IEA defines energy access as:

"a household having reliable and affordable access to both clean cooking facilities and to electricity, which is enough to supply a basic bundle of energy services initially, and then an increasing level of electricity over time to reach the regional average”

What would you say is to have “access to electricity”?

- To be **connected** to the grid?
- To have at least a reliable supply for **two lights & a phone charger**, a few hours per day?
- To have a supply that allows the use of **all the appliances that each household can afford?**
- To have a supply that allows the use of **essential** appliances plus **productive** & **community** uses of electricity?

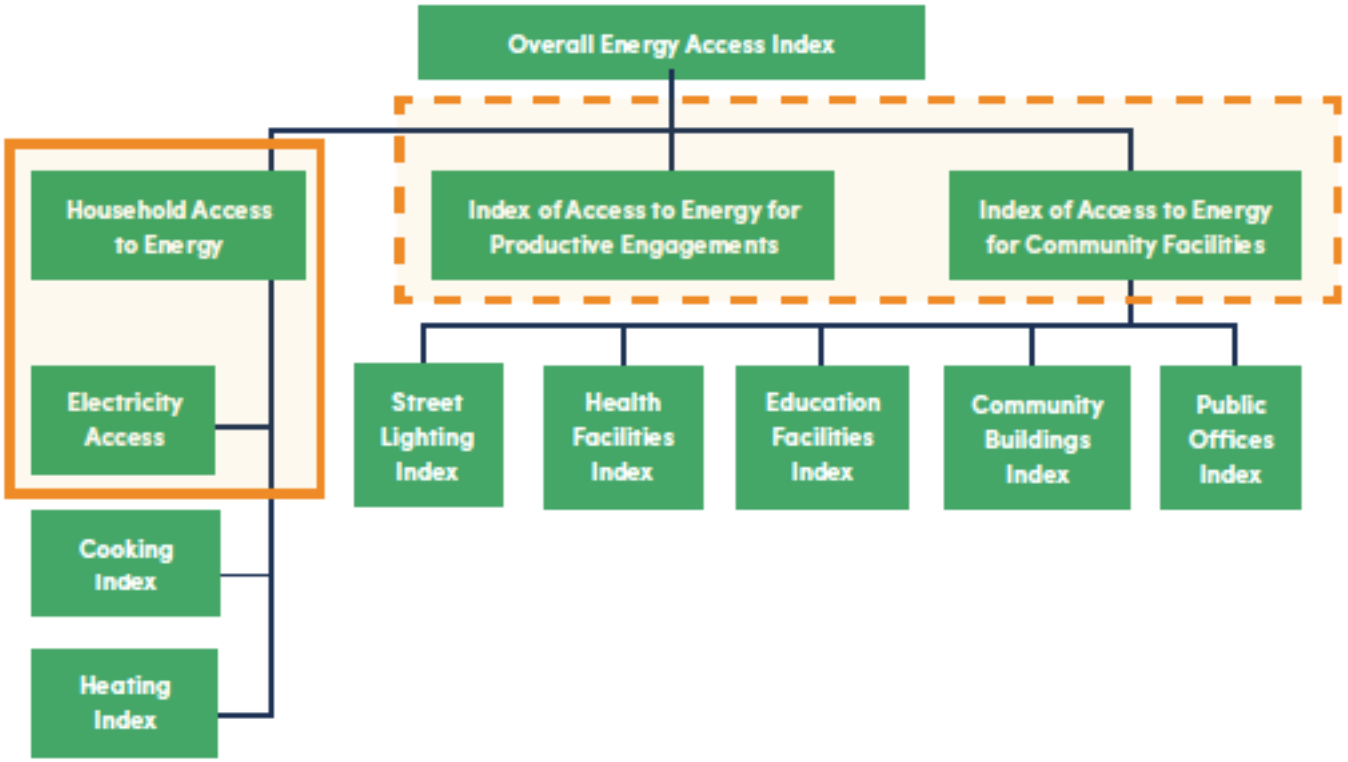
There is no indisputable answer valid for all cases

- For instance, what is the actual value of grid connection... if it is not reliable?

- Often off-grid systems (like solar home systems and micro-grids) can provide more predictable electricity supply, but typically only for some hours per day

- Perfect electricity access should not limit the consumption that the consumers can afford (both in terms of utilization of the existing appliances or the ones that the consumer can afford to purchase, at household, community, commercial & industrial levels)

For what use?



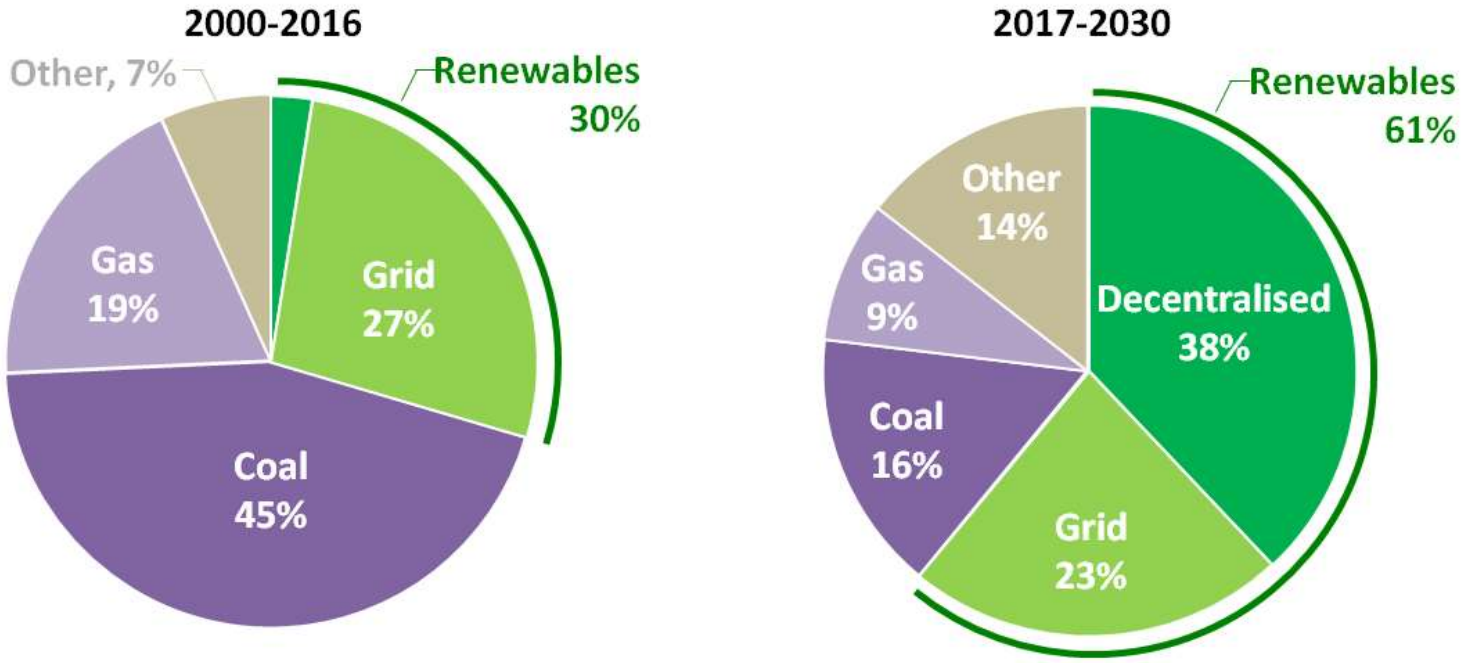
Source: Beyond Connections: Energy Access Redefined, SEforALL and World Bank ESMAP, 2015


Food-processing services (milling, grinding, drying, etc.)
Access to market
Cold storage for food preservation
Water pump and micro-irrigation system
Training center for local farmers and entrepreneurs
Access to quality inputs (seeds and other agricultural products)
Local entrepreneur managing the hub
Off-grid generation plant

There are different modes of electrification…
… that could gradually evolve into improved levels of access

A shift in the electricity access paradigm

Population gaining access by source



Declining cost of renewables and innovative off-grid business models are transforming the way access is delivered, especially in rural areas

Lack of access comes in multiple forms

A large diversity of situations with lack of access

- **Latin America** (reduced number of mostly isolated rural communities)
- **India** (very large number of non electrified houses in densely populated large areas “under grid” or not far from grid)
- **Sub Saharan Africa** (very large number of non electrified aggregates of houses with long distances among them and to the grid)

The villagers have contracted the service (one PV panel & battery) with an independent entrepreneur…

Uttar Pradesh, India, July 2014

… but the village is not far away from the power grid of the incumbent distribution company

The origin of the problem in distribution

- **Subsidized tariffs** (below supply costs) → poor financial condition of the distribution company → difficulty to invest & to use advanced technologies

- **High distribution costs** in regions with disperse & low demand + subsidized tariffs → more grid connections mean more losses for the distribution company

- Insufficient investment in distribution → poor quality of supply → **disaffection of consumers** → theft, bills non paid, potential grid defection → more losses for the distribution company

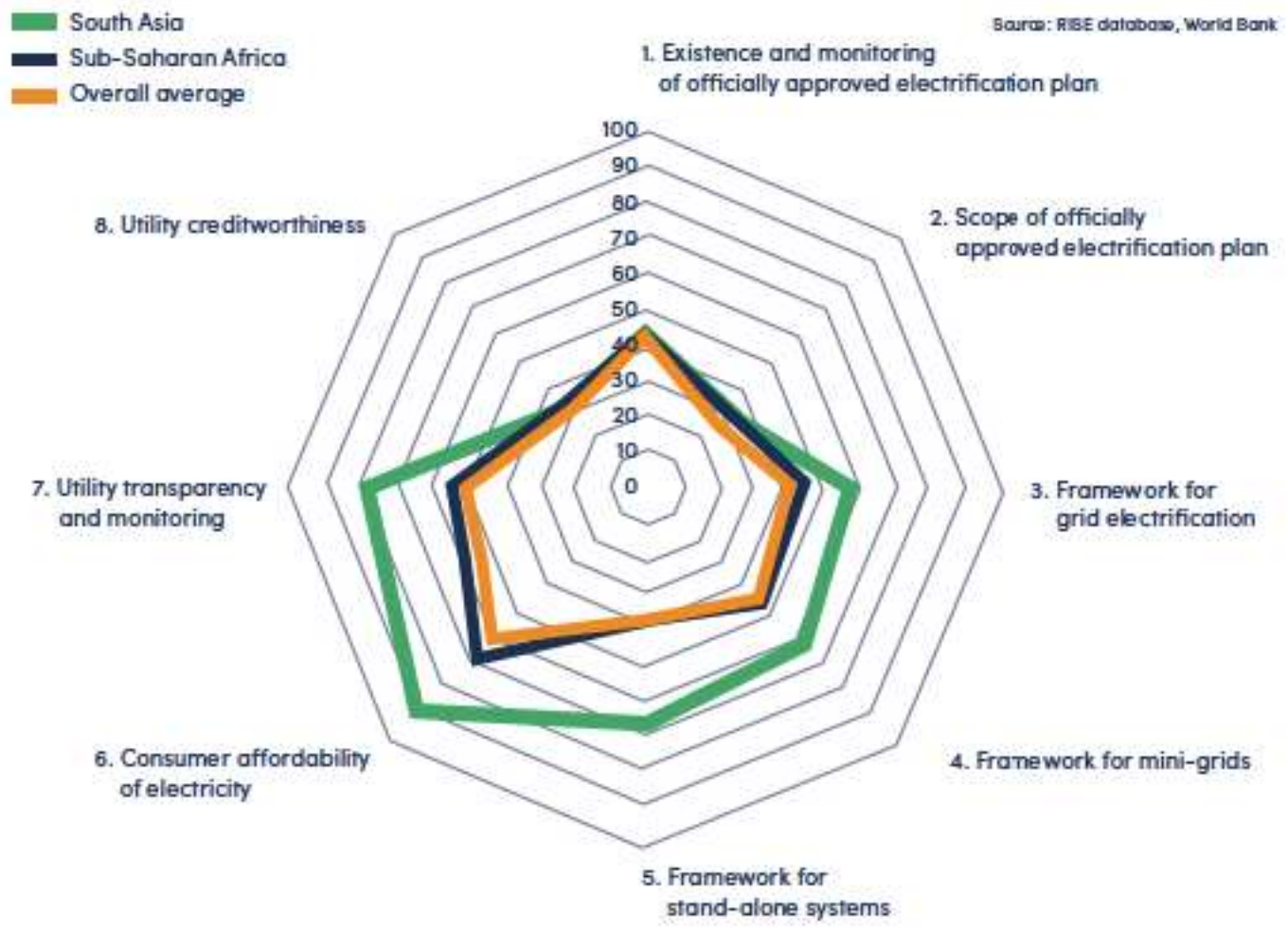
Nearby other villages have much better microgrid supply

Grid compatible microgrid facilities

Source: TARA Urja, India

It is **all** about regulation!!!

Regional performance



Source: World Bank Rise Report

The key factors for their success!

There is a national program to promote adoption of stand-alone technologies;

There are subsidies or duty exemptions in place;

There is no legal limit on the price stand-alone home system retailers and service providers can charge;

There is formal adoption of international quality standards and test methods

Questions about off-grid regulation

What level of regulation (if any)?

How location is decided

Regulation of entry

Retail tariff setting

Subsidies

Service standards

Technical standards

If the main grid arrives

Off-grid electrification options may be regulated or not

If regulated

- the technology is subject to minimum conditions
- the tariff determines the revenues for the developer
- the regulator may assign a subsidy to cover the costs
- the conditions for an eventual connection to the main grid are established

If not regulated

- the tariff is negotiated with the customers
- the technology may not be grid-compatible
- high uncertainty if “the main grid arrives”

Business models **critically depend** on these factors

Note that solar lanterns & kits must be considered appliances & only their standards of quality could be subject to regulation

BUT lack of regulation has shortcomings

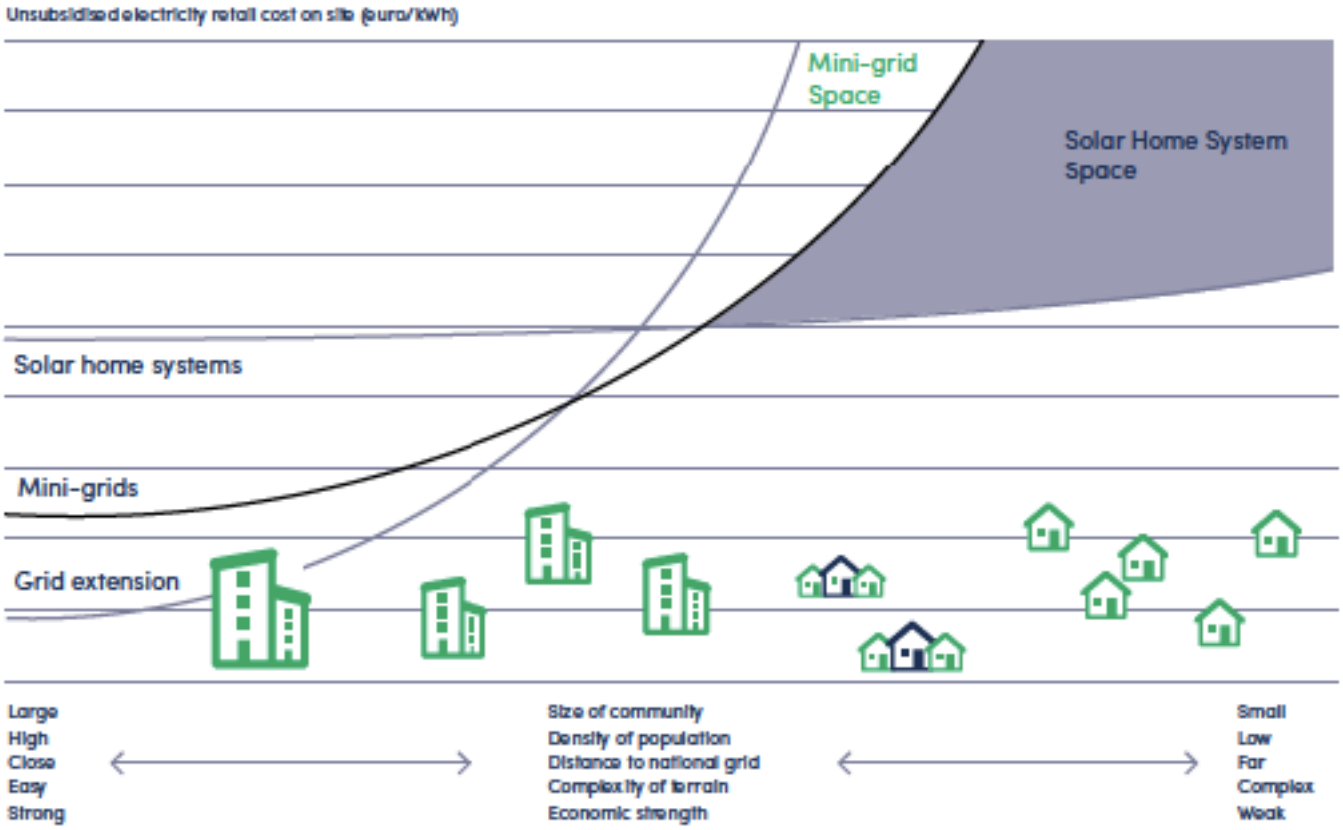
Off-grid facilities **are being deployed** in many developing countries outside the scope of regulation

- **Non-standard & non-grid compatible** technologies
  - Investor is exposed to risk of grid connection
  - Pressure to recover investment costs ASAP
  - Wasted assets if grid connection happens & microgrid is not grid-compatible
  - Then, local (renewable?) generation will be replaced by centralized generation mix
- Possibility of **monopolistic behavior &/or poor quality** of service
- May **lock-in** a technology that has supply limits ➔ permanent energy poverty condition

How could regulation help?

Regulation could create a low-risk regulated business model to deploy **grid-compatible off-grid solutions** in those places where the grid may arrive

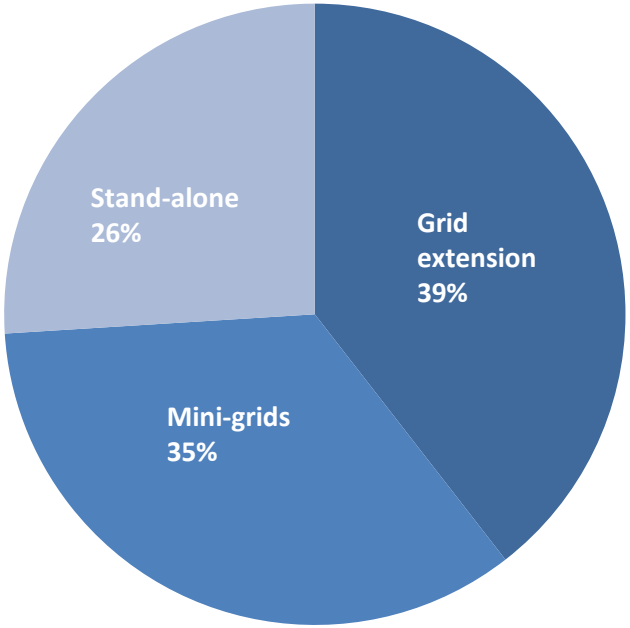
Which solution?



Source: Adapted from Mini-Grid Policy Toolkit, EU Energy Initiative Partnership Dialogue Facility (EUEI-PDF) and REN 21, 2014

Off grid market potential

Contribution of stand-alone systems, mini-grids and grid extension towards universal access



Renewable energy will play a crucial role

Source: Based on IEA, (2017) and IRENA

The role of micro-grids in electrification

Off-grid micro-grids are necessary for **isolated** *(far away or difficult to reach)* **communities** with low electrical demand, since this is the lowest cost option

Grid-connected micro-grids can be the best solution for consumers connected to very unreliable networks, since they can autonomously cover their internal demand

Off-grid and grid-connected micro-grids can be a **bridge solution** towards grid connection, when the incumbent distribution company does not have the funds or managerial capability to proceed with universal electricity supply

Policies and regulations for private sector renewable energy mini-grids

Key policy and regulatory aspects

‘Risk’ of main-grid arrival

Mitigating main grid arrival ‘risk’

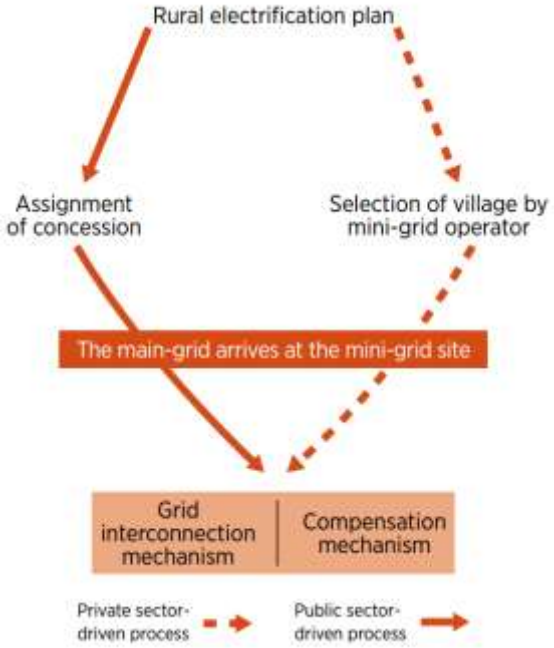
- Regulations must address the risk to mini-grids investors created by the arrival of the main grid.

Rural electrification plans provide valuable guidance

- Information on location and timeframe for grid extension, as well as population density, productive loads and existence of other licensees.
- Benefits for developers (in a bottom-up, market-driven approach) and public authorities (in a top-down concession scheme).

Interconnection/compensation mechanisms allay risks

- Several interconnection options exist – transition to small power producer, distributor, tail-end support.
- Most suitable approach largely depends on generation costs.
- Interconnection or compensation: full information about tariffs and depreciation scenario should be available in early stage.



Again the AC vs DC dispute

DC technology has many advantages and many efficient **DC appliances** are now available

Compatibility of DC grids with the main AC grid should be mandatory if there is the possibility of future grid connection

Business model revolution - PAYG

- PAYG enables customers to access higher levels of energy service by paying over time, typically for between 1-5 years
  - By enabling customers or agents to make payments via mobile money.
  - By enabling companies to control assets and services remotely, using machine to machine (M2M) connectivity.
  - By enabling communication between companies, agents and customers through mobile, SMS or apps.
- PAYG solar generates close to 1.6 million mobile money transactions per month

Mobile + Finance

Enables to collect data on customer power, consumption patterns, and create credit history for the unbanked

- In the case of M-KOPA in Kenya, positive credit reports have been transferred for more than 160,000 customers, enabling previously unbanked customers to gain access to institutional loans with low interest rates

Stand alone systems Business models

Rental

Pre-payment

Perpetual lease

Lease to own

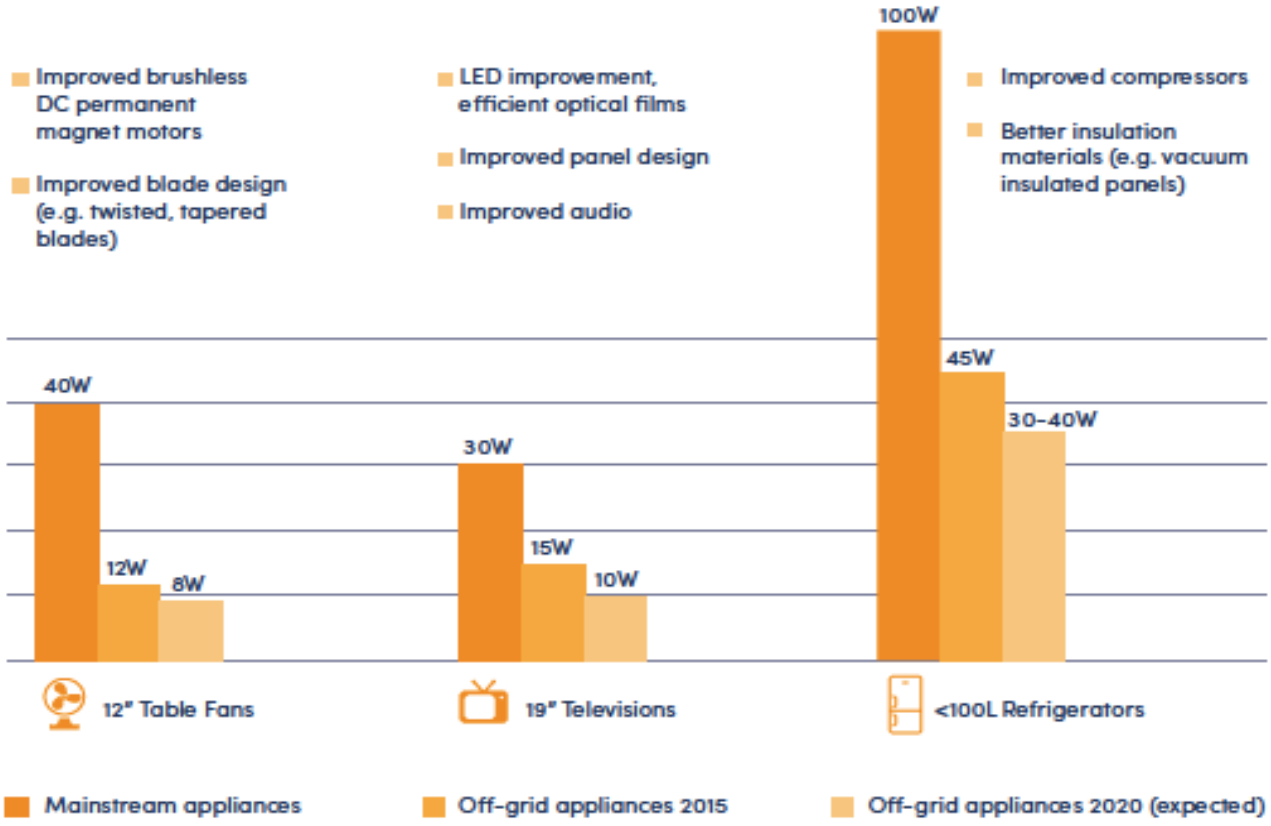
Upfront sales with financing partners

Direct sales

The last mile is KEY!

- Proprietary Distribution Channels
- Distributor-Dealer Channels
- Institutional Partnerships
- Franchise Model
- Rental / Leasing System

Appliance Efficiency



Efficient appliances already consume 50-70% less energy than mainstream appliances, and by 2020 these are expected to consume up to 80% less

Source: State of the Global Off-Grid Appliance Market, Global LEAP, 2016

Socio-economic benefits

- **Household level:** Basic solar lights replace kerosene lamps, battery powered torches or candles, leading to cost savings of around 4% of total household income for those in the poorest quintile.

- **National level:** As off-grid solar markets grow, for countries that import kerosene, batteries, torches, or candles there will be a positive impact on the balance of payments and on foreign exchange reserves, as these imports are replaced by off-grid solar.
  - For countries that subsidize kerosene for lighting, there will also be significant savings on kerosene subsidies.

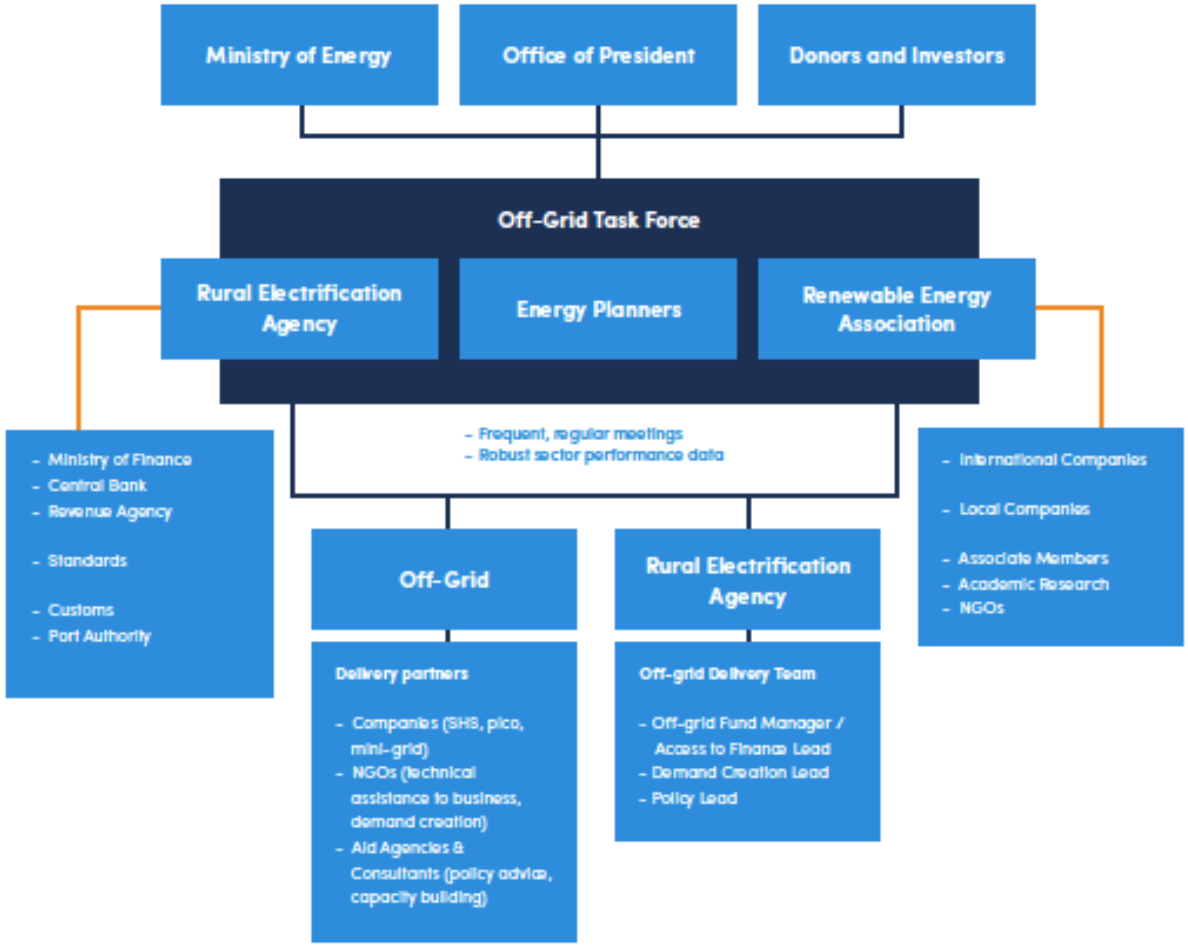
- **Job creation:** Off-grid solar employs around 30 people per 10,000 people living in rural areas, compared to just one person per 10,000 people in the case of kerosene
  - Globally, the decentralized renewable energy industry, including both mini-grids and standalone solutions, is expected to directly employ 4.5 million people by 2030

Source: GOOGLA

Use of public funding to unlock the market

Source: GOOGLA

Coordination of off grid players



Also talk to the NETWORKS

Source: Power for All, 2017

Integrated Distribution Company

Key features of the IDC

- Define the distribution activity as a zonal franchise, i.e. a company with a comprehensive obligation of electricity supply in the assigned territory, by any electrification mode
- The necessary managerial, financial & operational change will be possible by some form of **PPP with a large private global energy firm** & the **participation of local companies** with the capability of effective consumer engagement
- Recognize the different nature of the "**physical network assets & operation**" *(i.e. strict distribution)* & the "**consumer interaction**" *(i.e. retail)* components of the traditional distribution company

IDC – Distribution

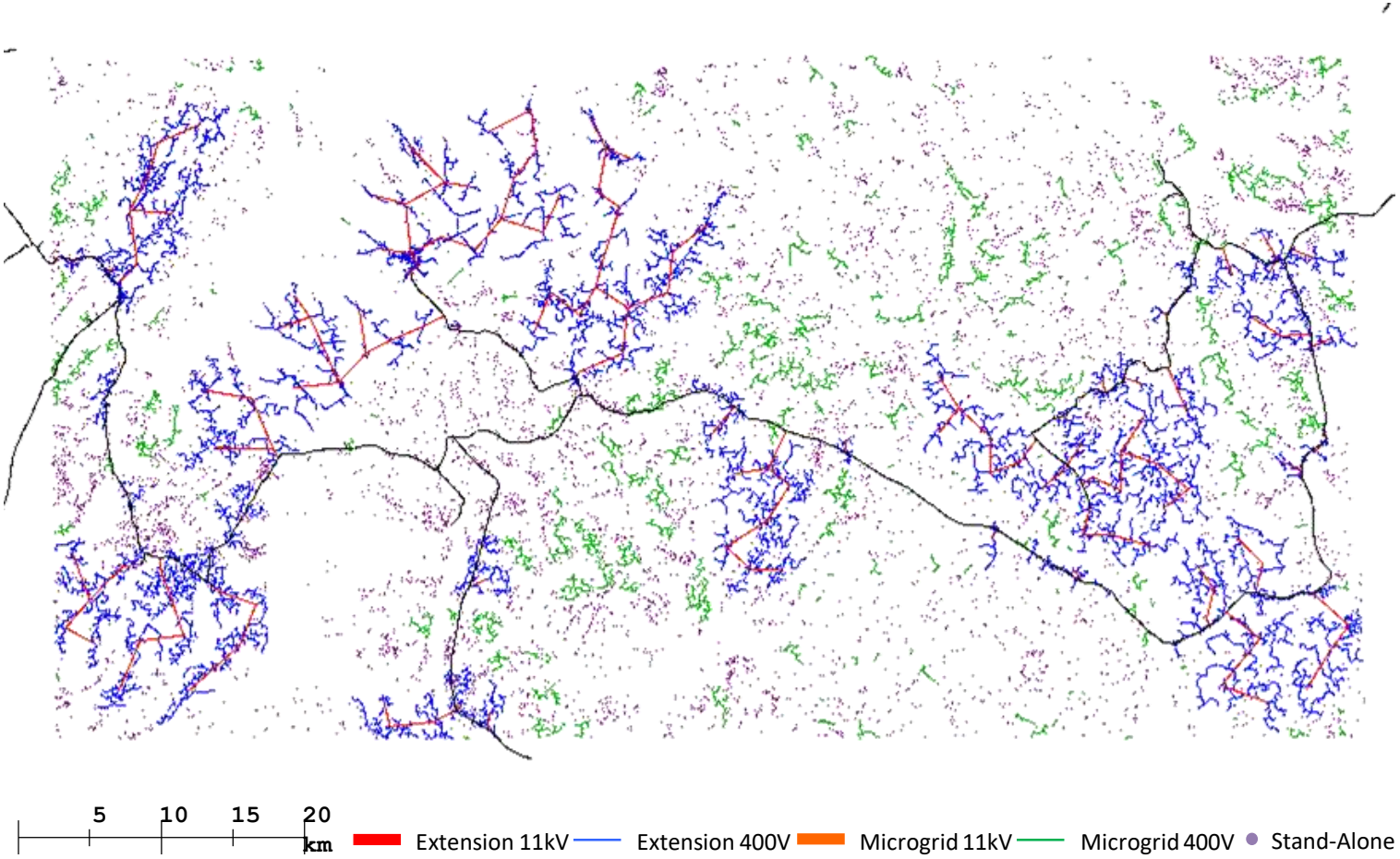
Functions of IDC – Distribution

- Perform an integral electrification planning in the zone of concession (electrification mode, QoS, Access level under budget constraint)
- Build, maintain & operate the main grid and microgrids specified in the electrification plan (some by external developer)

Regulation of IDC - Distribution

- The regulator establishes in advance the annual remuneration of the distribution company until the next electrification plan review (e.g. 4 years), based on the current assets & the accepted plan.
  - Guarantee of cost recovery
  - Incentives to be efficient and maintain service quality

Uganda – Planning



Uganda – Southern territories - Results obtained with the REM planning model http://universalaccess.mit.edu/#/main

IDC – Retail

Functions of IDC – Retail

- Collect metering data and bill
- Perform activities necessary to reduce theft and unpaid bills
- Established a legally separated outsourced company to provide standalone systems and appliances

Regulation of IDC - Retail

- Metering and billing will be regulated under cost-of-service regulation
  - Performance-based incentives to reduce theft and unpaid bills
- Outsourced company will not be regulated

Societal benefits of IDC

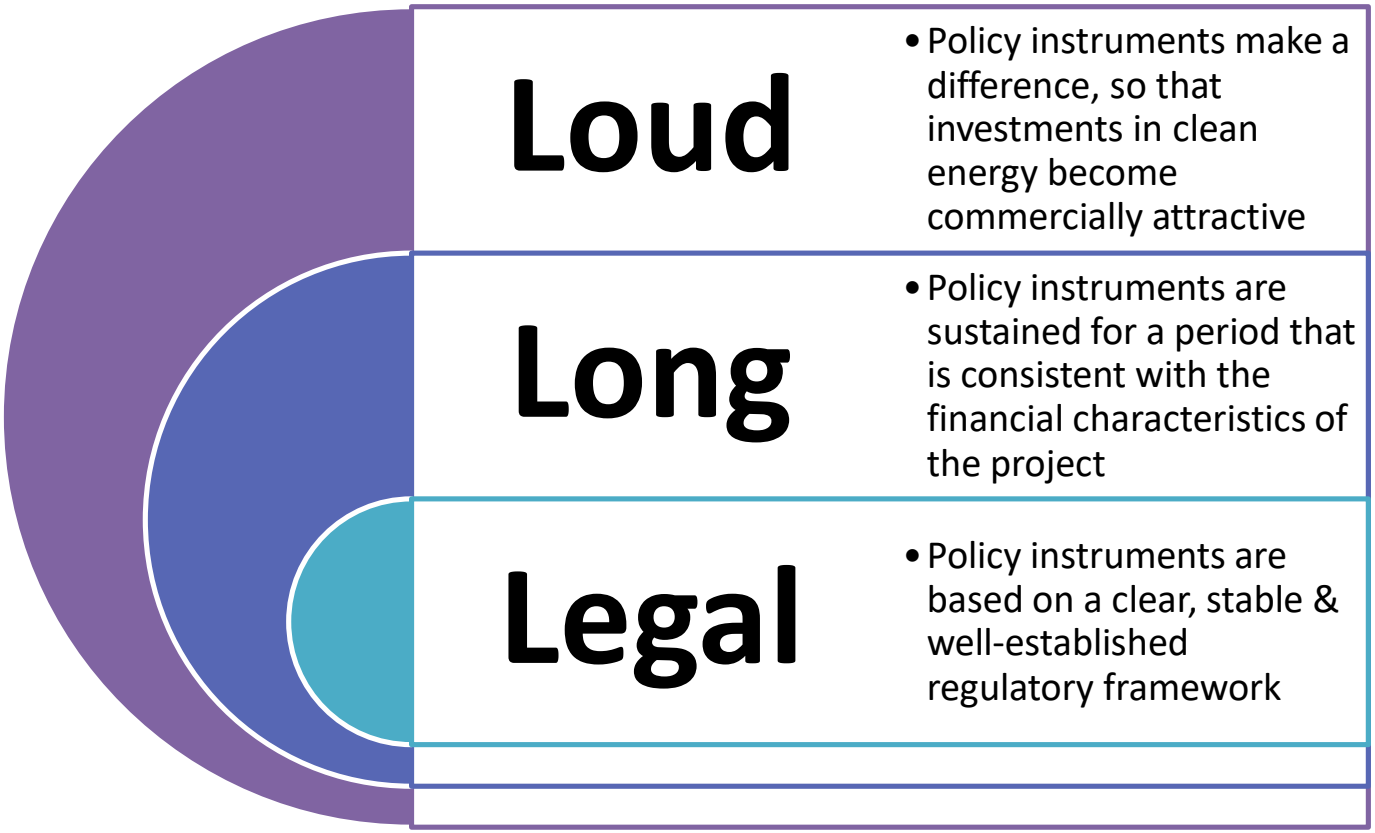
- Guarantee that electrification will eventually **reach everybody** in a gradual & planned strategy
- **More efficient use of resources**, avoiding duplication & waste
- Proposed unbundling of activities will result in better risk allocation, with **lower cost of capital** for the expensive investment in network assets & **specialized local management** of consumer engagement
- Targeted performance incentives *(losses, connections, sale of solar home systems, etc.)* for each unbundled company

Challenges for IDC to work

- Political and social acceptability
- The concept may require regulatory reforms
- The entire IDC business model will not be viable until a solution is given to how to cover any existing viability gap

Any examples?

Policy needs to be **“loud, long & legal”**



PART OF A BIGGER PICTURE!

Thank You !