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International Scenario of Mini-Grid

23rd ISA SUN Meet

September 19, 2019

Mini Grids: Present Global Scenario

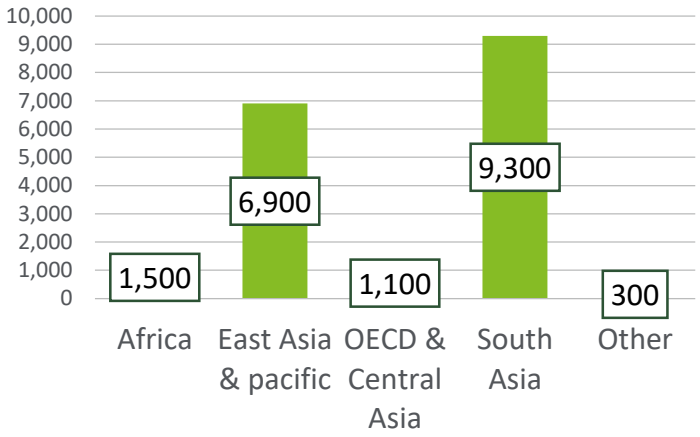
Reaching the remaining unserved people, including those connected to frail and overburdened urban grids

Around 840 million without electricity access

Mini Grids: By the Numbers

- 19,000 Mini Grids
- 47 Million People Connected

Installed Mini Grids by Region



Mini Grids: Current Financing

$ 28 billion — Cumulative **global investment** in mini grids to date

$ 5 billion — Cumulative global **investment in Africa and South Asia** in mini grids to date

$ 259 million — **Private-sector investment** in mini grid developers in **low-income countries** since 2013

Top 5 Countries by Installed Mini Grids

- Afghanistan (4,980)
- Myanmar (3,988)
- India (2,800)
- Nepal (1,519)
- China (1,184)

Top Developers of Mini Grids

Private Sector

- PowerGen (7 countries in Africa) > 100 mini grids
- OMC (India): 99
- Husk Power (India): 45

Utilities

- NPC-SPUG (Philippines): 750
- RAO (Russia): 500
- Jirama (Madagascar): 96

Source: ESMAP Technical Report, 2019

Mini Grids: Futuristic Scenario

Long-term goal: Universal Access by 2030

By the Numbers

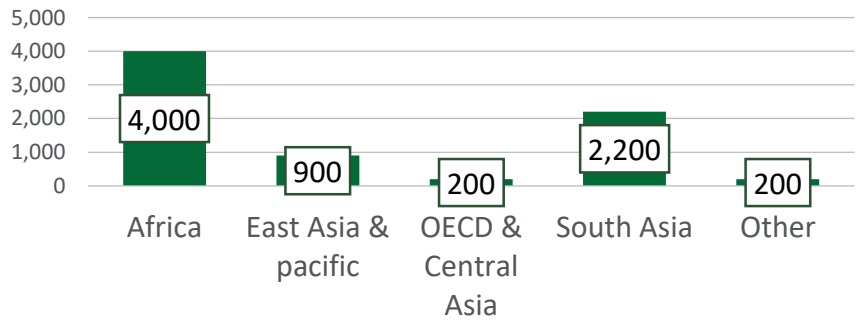
- 490 Million People served at least cost
- Construction of 210,000 Mini Grids requiring an investment of $220 Billion

Cost Issue

- Cost of Unsubsidized Solar-Hybrid Mini Grid (LCOE) : **$0.55/kWh**
- $0.42/kWh with income generating machines to achieve 40% load factor
- $0.22/kWh with income generating machines & expected 2030 costs

Compared to $0.27/kWh average across 39 utilities

Upcoming Mini Grids by Region

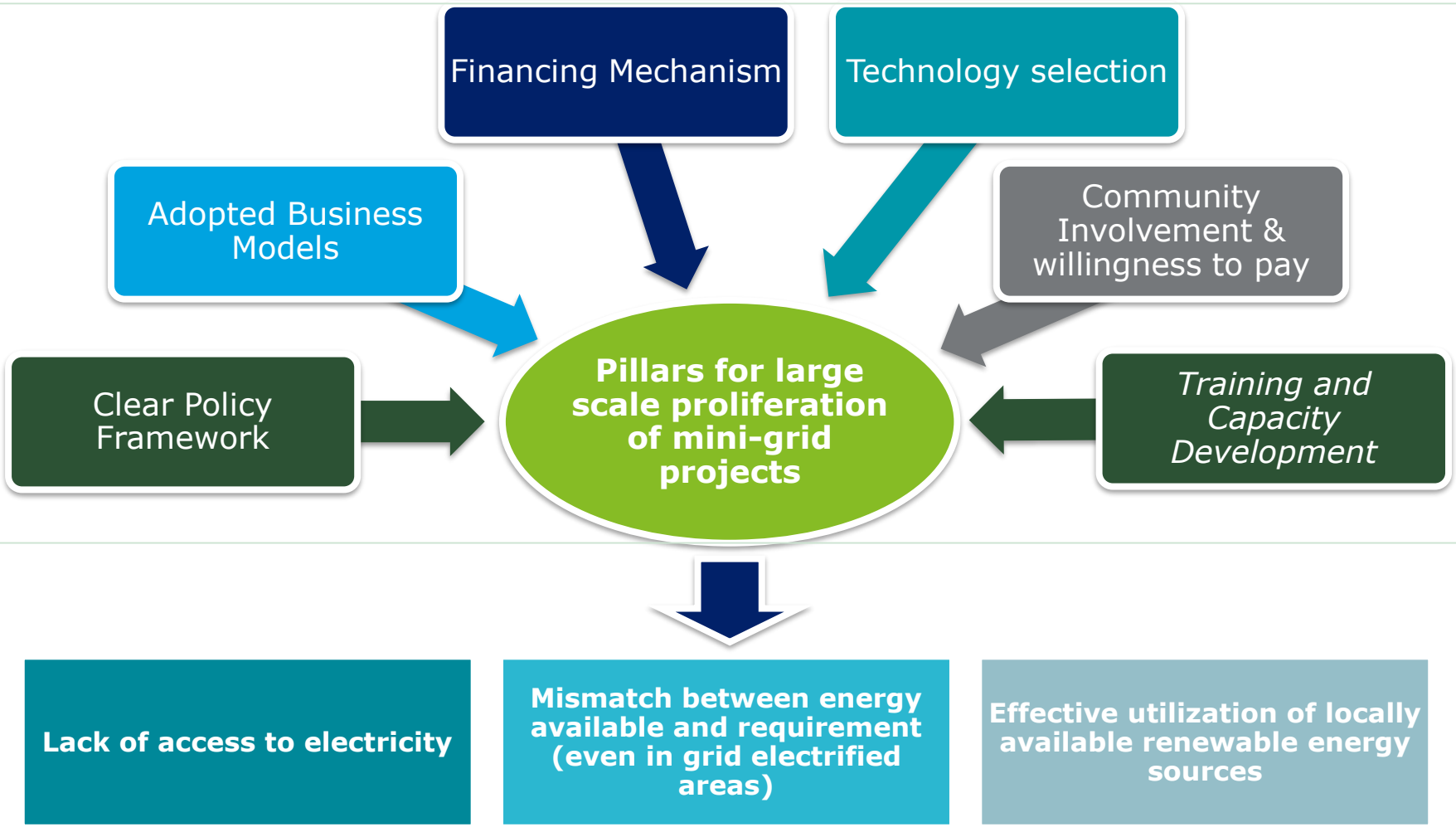


Top 5 countries (by no of planned mini grids as of 2019)

1. India (1,905),
2. Senegal (1,217)
3. Nigeria (879)
4. Indonesia (506)
5. Tanzania (301)

Source: ESMAP Technical Report, 2019

Success of mini-grid projects is a combination of technical, commercial and community related aspects



Mini Grid Operator Models - International Perspective (1/2)

Utility Operator Model

- State Utility is responsible for mini grid operation
- Financing is secured from government and is operated in similar manner as national electricity network

- Power is generated by the utility, fed into the distribution grid and supplied to the consumers, usually at the **same rates paid by the utility's customers** connected to its main grid.
- Ex: Thailand, Tunisia, Morocco

Community Based Model

- Local community owns, operates and manages the system and provides all services for the benefit of its members

- Financing is typically highly grant-based with some community contributions
- Planning, procurement of equipment, installation and commissioning is often done by third parties
- Ex: Morocco, Senegal, India

Kenya

- Rural Electrification Authority (REA) owns 19 public mini-grid stations, operated by Kenya Power & Lighting Corporation (KPLC);
- O&M: Done by KPLC
- PPA: 10-15 Years
- O&M costs covered through retail electricity tariffs from both main grid and mini grid retail customers
- No functional difference between grid & mini-grid tariffs, determined by regulator

Sri Lanka

- Micro Hydro Enabled :Electricity Community Society Mini Grid Solutions were developed in Sri Lanka
- Ownership of Project, Operation & Maintenance: Community
- Tariff Setting: Not by the regulator, but by the engaged community
- Government keeps some control over technical specifications and safety
- PPA Agreement: 10-15 Years

Mini Grid Operator Models - International Perspective (2/2)

Private Operator Model

- Private Utility is responsible for mini grid operation
- Funding depends on private equity and commercial loans as well as some form of

Scalable private sector model includes:
- Franchisee approach
- Anchor based community (ABC) approach
- Clustering approach
- In places without energy infrastructure or regulatory framework, private companies negotiate profitable cost-reflective tariffs, Ex: Somalia, India, Philippines

Hybrid Operator Models

- It is combination of private, utility and community based mini grid model
- Investment, ownership and operation might not be carried out by the same entity.

- Generation and distribution may be split and carried out separately by different entity
- Responsibilities can be split according to who builds, owns, operates and maintains the system
- Ex: India

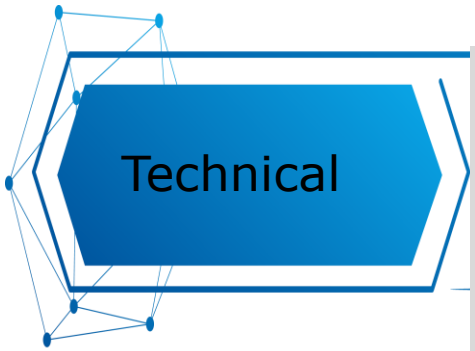
Senegal

- ERSEN project of Senegal, supports private sector concessions for the implementation of hybrid renewable energy mini-grids
- Ownership of the project: Government
- Concession provided to: Private Entity for operation, maintenance, and repair
- Concession period is of 15 years
- Regulatory commission CRSE defines the tariffs which provides adequate return to the developers

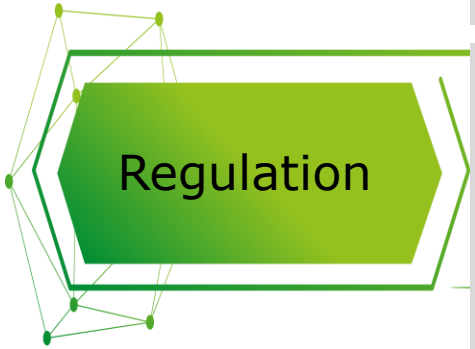
Lao PDR

- Sunlabob is hybrid operator mini grid project in Lao PDR. The key features of project are:
- Ownership of generators (solar, hydro and diesel)- Private energy provider
- Public funding- Village infrastructure and grid
- O&M to be performed by private entity
- PPA signed with the village for 25 years targeted to provide an IRR of 15 %

Creating the environment for take-off of mini grid portfolios(1/2)

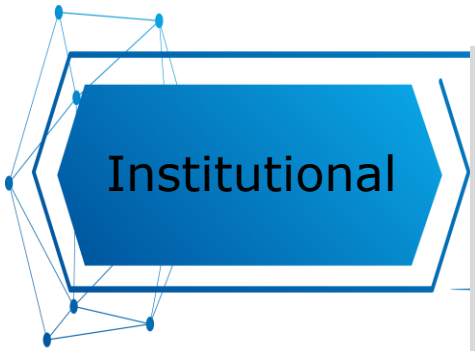


- For electrification planning at a national level, data collected through geospatial route can be mapped for preparation of database
- Spatial modeling would then deliver a least-cost plan that would identify the optimal grid or mini-grid technology



- Mini grid regulations should explicitly state the options for what happens when the main grid arrives in case of an expansion, & provide clarity regarding future course of action
- Incentivizing private-sector investments

Creating the environment for take-off of mini grid portfolios(2/2)



- Adopting a comprehensive, multi-stakeholder approach can increase the impact of government efforts for uptake of mini-grid
- Institutional framework must be flexible enough to address the diversity in mini-grid delivery models

- Community engagement strategies can help increase productive uses of electricity and stimulate demand for mini grid services
- To reduce knowledge and skills gap present in each stakeholder group in the mini grid ecosystem, capacity building programs are required

Key Learning's

- Policy to provide **long term clarity** and performance based incentive for driving sustainable models
- Regulation to support policy on aspects related to **framework for integration with main grid** (Technical & Commercial)
- Ensuring **adequate demand & clarity** will enhance financing of the sector – else it may remain a short term solution (comparing 25 year like of solar panels)
- Anchor loads increase **commercial viability** – good to have better mix
- **Smart Technologies** can facilitate scoping up of new areas for employing mini grid solutions and also performing load management for such applications
- Local technicians **training** at a local level to handle preventative maintenance
- Quality of the power needs to be upheld so as to **retain consumer and market**
- **Involvement of Distribution company** in contracts can help enhancing long term attractiveness
- **Battery storage technological** developments to be a game changer

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