ENERGY POVERTY AND SUSTAINABLE ON- AND OFF-GRID SOLUTIONS

“Program for Rural Electricity for Poverty Alleviation”

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Energy Poverty: bare minimum energy sources required to survive

Energy poverty is the lack of access to modern energy resources, mainly electricity, and refers to the bare minimum energy sources needed to survive (Barnes et al., 2011).
Energy Poverty Outlook: 1 bil +, ¾ rural, women affected more

Global Outlook:
According to World Energy Outlook 2018, worldwide, around one billion people have no access to electricity. Some 87% of these one billion people live in remote, rural areas far from electricity grids, in what is often called ‘the last mile’.

SAARC countries:
The developing world is worst affected by energy poverty, with SAARC countries comprising 34% of people who do not have access to modern energy services in the world (Renewables Global Status Report, 2015).

Gender Perspective:
The energy-poverty nexus has distinct gender characteristics. Of the approximately 1.3 billion people living in poverty, it is estimated that 70% are women, many of whom live in female-headed households in rural areas (Denton, 2001).
According to the International Energy Agency, to provide universal electricity for all, decentralised systems, led by solar PV in off-grid and mini-grid systems, will be the least-cost solution for three-quarters of the additional connections needed specially in the off grid and end of grid areas.
Why is reaching universal access still a challenge?

### Challenges: Grid-based Electricity
- Lack of sufficient power generation capacity
- Poor transmission and distribution infrastructure
- High costs of supply to remote areas
- Simply a lack of affordability - informal settlements etc

### Challenges: Off-grid Electrification
- Poor policies
- Inadequate regulations
- Lack of financing for off-grid entrepreneurs and affordability for poorer households
- Lack of standardisation of products
- Ensuring maintenance, repair and load management
- Lack of planning and institutional support
Achieving 100% electrification requires: politics, policies, governance, tech

- Sustained political commitment and financing
- Enabling policies and incentives
- Strong institutions
- The right balance of grid and off-grid
Since 2011, Off-grid: 6X people, 3X capacity, plus 80% industry & commerce

The number of people served by off-grid renewables globally has expanded six-fold since 2011, reaching nearly **133 million people** in 2016.

Off-grid renewable energy capacity has witnessed a spectacular three-fold increase from under 2 gigawatts (GW) in 2008 to over **6.5GW in 2017**.

While a proportion of the deployed capacity is to support household electrification, **83%** is dedicated for industrial, commercial and public end-uses.

Off-grid solutions deployed for **last-mile electricity access**, as well as to reduce costs and enhance energy security – a case of South America.

IRENA 2018
Scaling up off-grid solutions requires thinking about more than just electricity.
Innovation for off-grid in East Africa—still revolving around HH and/or applications

Leveraging these experiences, the private sector is...

Adapting delivery and financing models to now provide off-grid solar solutions in other sectors, especially agriculture.

Enabling Environment...
- Fiscal incentives
- Delivery and financing models
- Process of innovations in technology solutions

Pay-as-you-go solutions making large SHS affordable in Rural Areas...

Small-scale solar irrigation pumps...

Credit lines for solar-powered irrigation systems. (FAO, 2018).

An estimated 2000 solar borehole pumps and 1,000 solar surface pumps (under 2.5 kilowatts, kW) are in operation in Kenya.
China electrified its villages with areas using DG.

- **1949-1977**: Maoist Era of Central Planning
- **1978-1997**: Era of Market Reform (Dynamic Market Reform)
- **1996**: Brightness Electrification & Township Electrification Program
- **2011-2015**: Electricity For All
..using MHPs, mini-grids, other renewables, and other off-grid technology

Mini-grids and village networks using renewable energies were developed in areas with “clustered households and township infrastructure”

Other off-grid technology options in remote areas

Small- and micro-hydro in high hydro potential areas
Recognized rural electrification and rural development link and worked with devolved communities...

Success Factors

- Bottom up approach to electrification - development of decentralised power infrastructure with the possibility of integration into a larger grid
- Early recognition of rural electrification-rural development link
- Organizational arrangements-devolution of power & responsibilities to lowest governance tiers
- Pilot Projects and technical capacity programs
- Technological flexibility- right technology at the right place (mini grids, hybrid, SHS)
Public Private Partnerships facilitating the adoption sustainable energy solutions globally…

Role of Private Sector: Fostering Renewable Energy Entrepreneurs—Africa

Through the **Renewable Energy Entrepreneurship Support Facility, IRENA**, together with regional partners, strengthens the capacity of small and medium-sized enterprises in West and Southern Africa.

The **ECOWAS Renewable Energy Entrepreneurship Support Facility** provides advisory assistance to small and medium-sized enterprises in West Africa.

Tendering solar home systems in Peru

The contract is for 15 years, and the company is responsible for the design, installation, operation, maintenance and, if needed, replacement of the system.

At the end of the contract, ownership of the renewable energy systems is transferred to the State.

Success of public-private partnership model for Micro-hydropower development in Nepal

- The installed capacity of micro-hydro installations has risen from an estimated 37 MW in 2011 (AEPC, 2011) to around 50 MW in 2017 (IRENA, 2018a).
- Public private partnership model.
- Community users register a cooperative or a private company to apply for subsidy.

IRENA 2018
Global policy makers predict that 7th SDG—energy access to all—will be met primarily by Distributed Generation (DG) relying on localized grids.

Bloomberg NEF predicts that micro grids and DG are the future of electricity.
Bloomberg NEF estimates that micro grids relying on solar alone will be a USD 64bil market by 2030.

Global policy makers predict that 7th SDG—energy access to all—will be met primarily by Distributed Generation (DG) relying on localized grids.

(Source: Navigant Research)
For rural electrification and energy poverty reduction; connecting the Grid is not only obsolete and leads to power sector debt, but also expensive and will take too much time...

- Power sector debt exists due to the basic issue of losses and need for full cost recovery (generation + transmission + distribution + losses) which implies unaffordable tariffs.
- E.g. South Africa's power sector debt is 27bilUSD (Pakistan is at 10bilUSD)
- Connecting MEMs to grid and addressing circular debt almost accumulates to 1/4th of Pakistan’s current external debt!

<table>
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<tr>
<th>Time to connect a HH to grid</th>
<th>9 years</th>
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<tr>
<td>Cost to connect a HH to grid</td>
<td>1500 USD (SSA Estimates)</td>
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<tr>
<td>Cost to Connect 70 Million MEMs to grid</td>
<td>15 Billion USD (if done in a single investment)</td>
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<tr>
<td>Time to connect MEMs to the grid with current 9 Yrs. /HH</td>
<td>Quarter of a century or more! Almost tripled the cost!</td>
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On-grid and Off-grid in harmony...

Grid Connected Renewable Energy Based Microgrids provide uninterrupted supply of power at affordable price with minimum T&D loss and high recovery levels

Reliable low-cost generation, low tech loss, improve RR

Replace high cost generation with low cost solar
Value Proposition – Grid Connected Solar DG

High cost of serving

Low cost solar distributed generation during solar hours
Summary = 100% electrification: politics, policies, governance, tech

- Sustained political commitment and financing
- Enabling policies and incentives
- Strong institutions
- The right balance of grid and off-grid
THANK YOU.