International Conference on Micro Perspectives for Decentralized Energy Supply

Enabling Energy Supply for Low Income Markets through Mini-Grid Solutions

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Experiences from the field: Barriers & Solutions

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Off-grid Access System in South Asia

The OASYS Project Objectives:

- ✓ Are there cost-effective and reliable off-grid electricity supply solutions that can meet the present & future needs, are socially acceptable, institutionally viable and environmentally desirable?
- ✓ Do these local solutions have the scaling-up and replication potentials and can these solutions be brought to the mainstream for wider electricity access in the developing world?

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Mini-Grids in India

- Pioneer of Mini-Grid system
  - First solar mini grid commissioned in 1996 in Sunderbans Islands
- State-of-the-art system designs & use of components (converters & inverters), continuing till date
- Cooperative model of service delivery
  - Involvement of local community from planning stage
- Policy enablers from time to time
- Around 5000 villages covered through mini-grids, serving more than 50,000 HHs
- Multiple technology adopted

Why mini grids in India

- Technically, mini-grids are preferred for remote areas over other options such as solar home systems,
  - as mini-grids provide electricity services for lighting & for powering various appliances, whereas SHSs typically provide only lighting services
  - Can support small productive applications
- Organisationally, managing mini-grids are easier compared to individual systems due to their centralised operation through a proper institutional arrangement

Solar PV Mini-grid

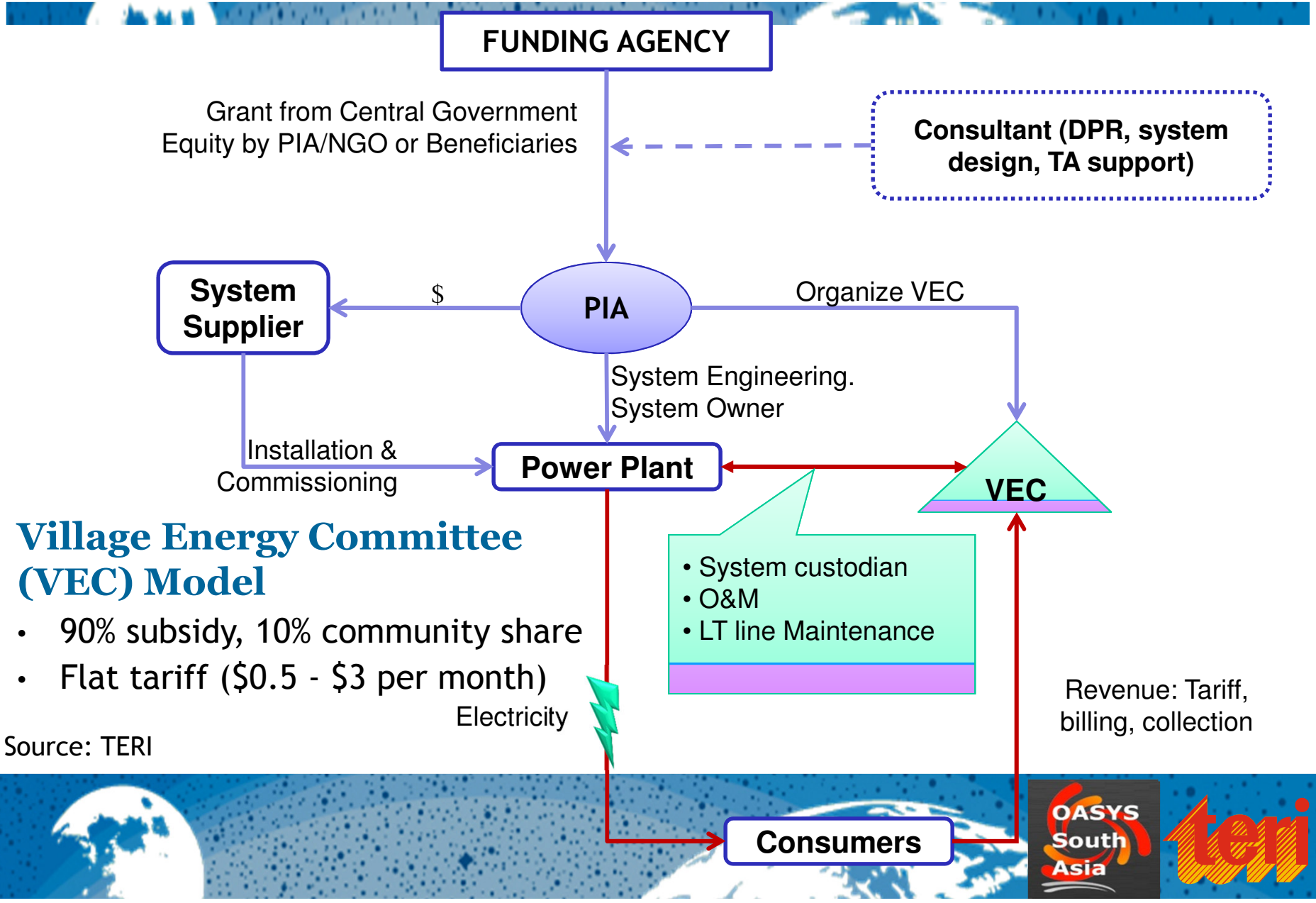
Source: CREDA and TERI

Biomass Gasifier Power System

- Fuel Preparation
- Biomass Gasifier
- Cooling cleaning train
- Engine – Alternator
- Biomass drying
- Power evacuation

Source: TERI

Managing Mini Grids: Earlier Model



Village Energy Committee (VEC) Model

- 90% subsidy, 10% community share
- Flat tariff ($0.5 - $3 per month)

Source: TERI

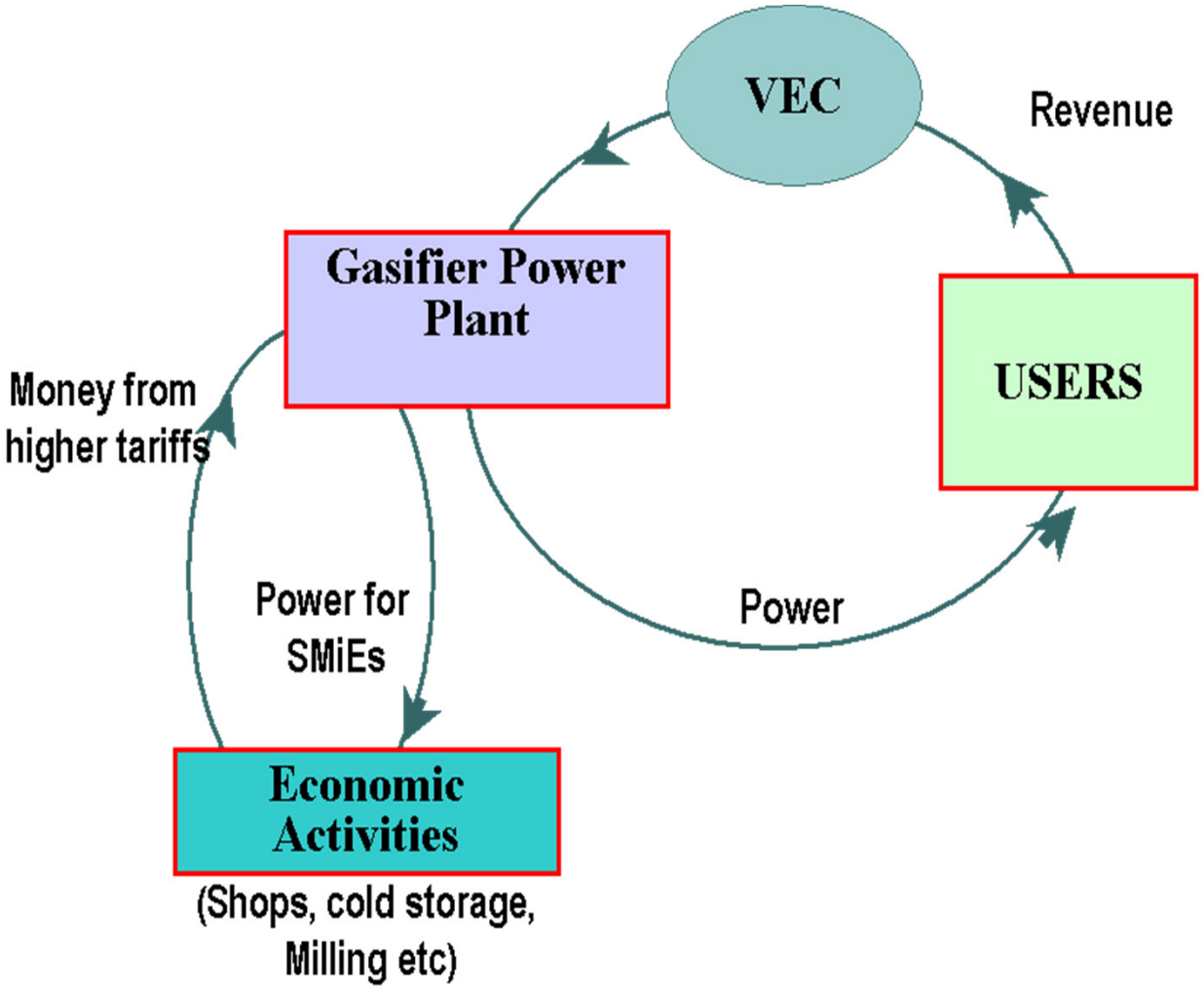
Hybrid System

55 kW Solar and 3.5 kW Wind Electric Generator based hybrid system

Wind Diesel Hybrid system

Source: TERI

Managing Mini Grids: Addressing low load



Source: TERI

Emerging Models

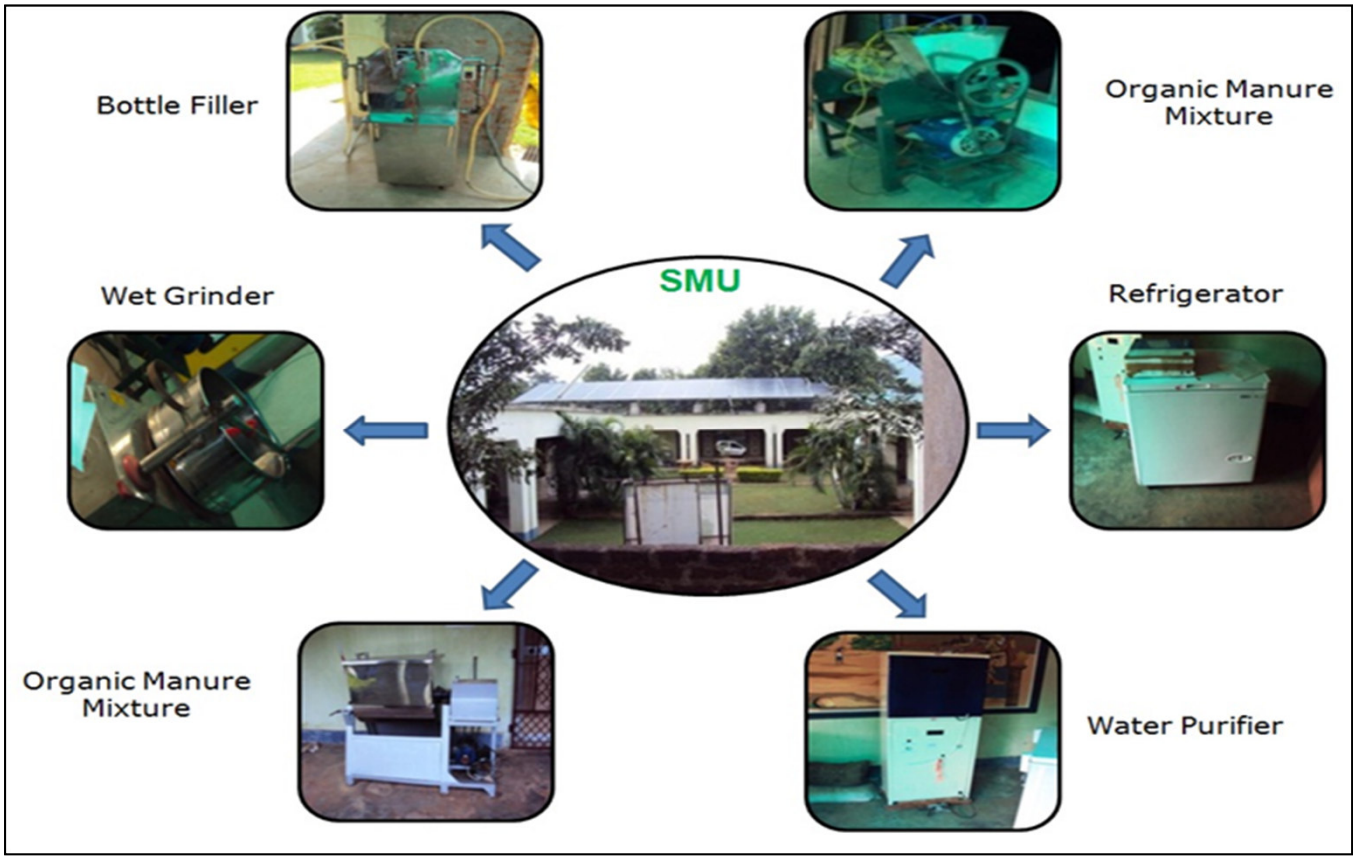
Solar Charging Station

Charging stations are expandable to solar energy hubs providing :

- Battery charging
- Mobile charging
- Lantern charging
- Water purification

Solar Multi Utility

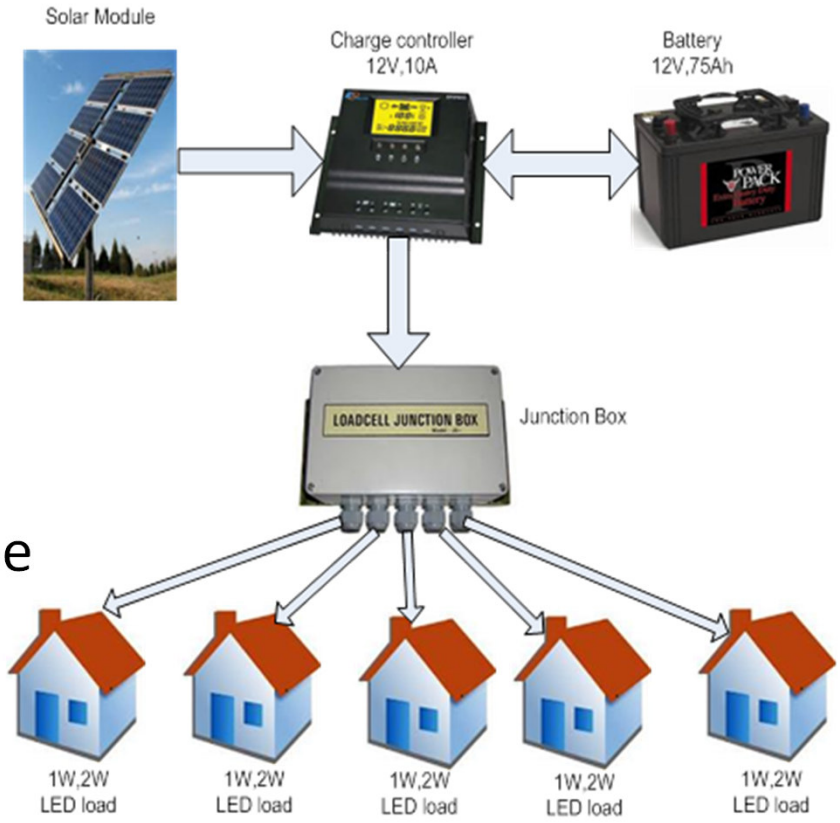
Self Help Groups, Farmer's Associations & Individuals from the surrounding villages access the SMU & utilize services for a fee.



Source: TERI , 2012

Solar DC micro grid

DC distribution lines (voltage varies depending on distance) run along rooftops from the battery bank to households over a short distance to power lights, mobiles etc.



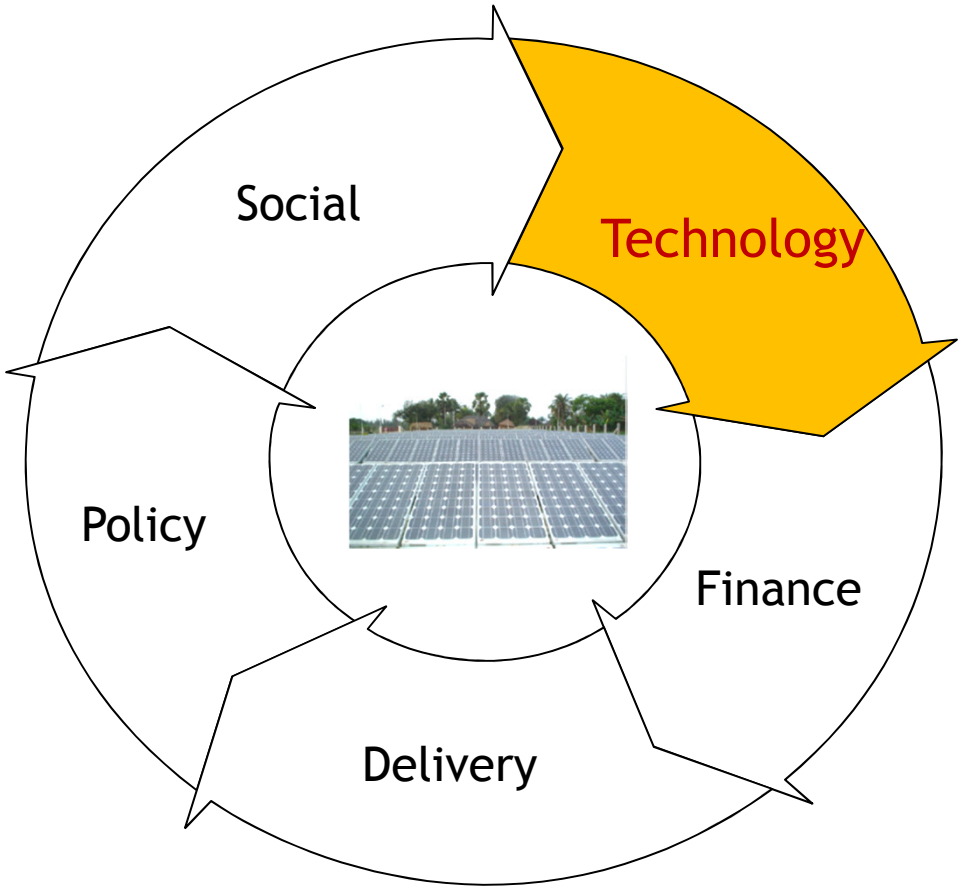
Running time : 5-6 hours

Installation Cost: $ 65 – $ 80 per HH

Tariff: $ 2-3 per month, charged by the operators

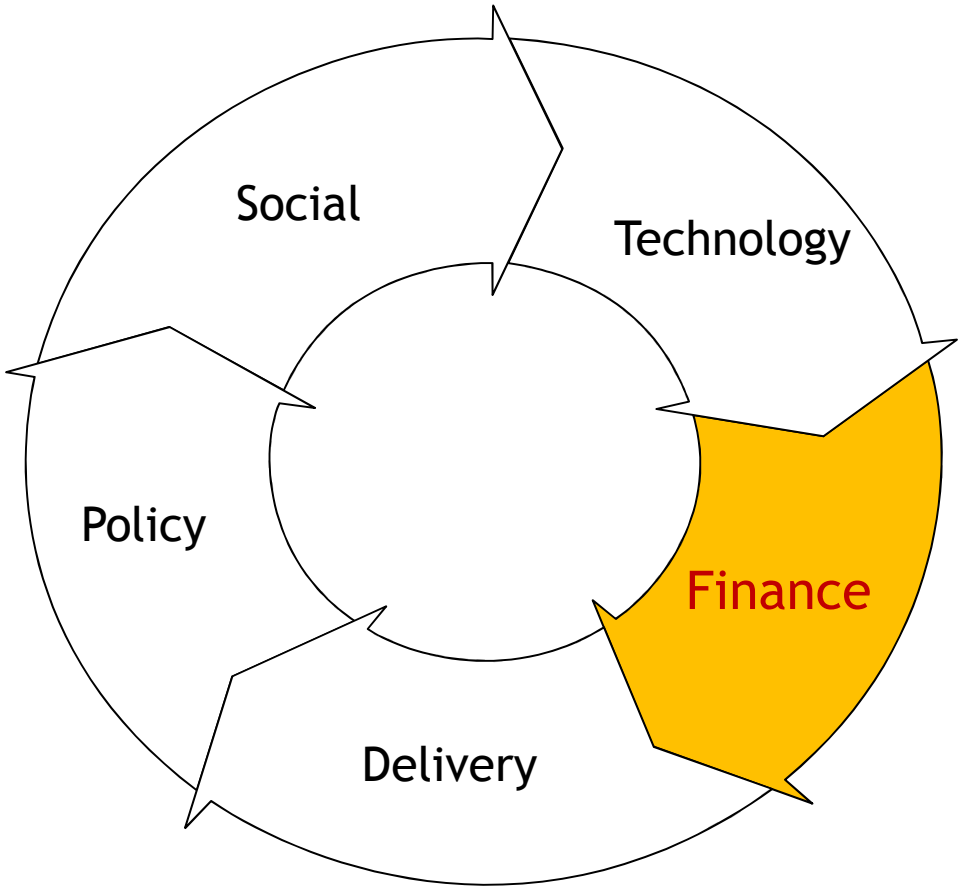
Barriers & Solutions

Technology ……



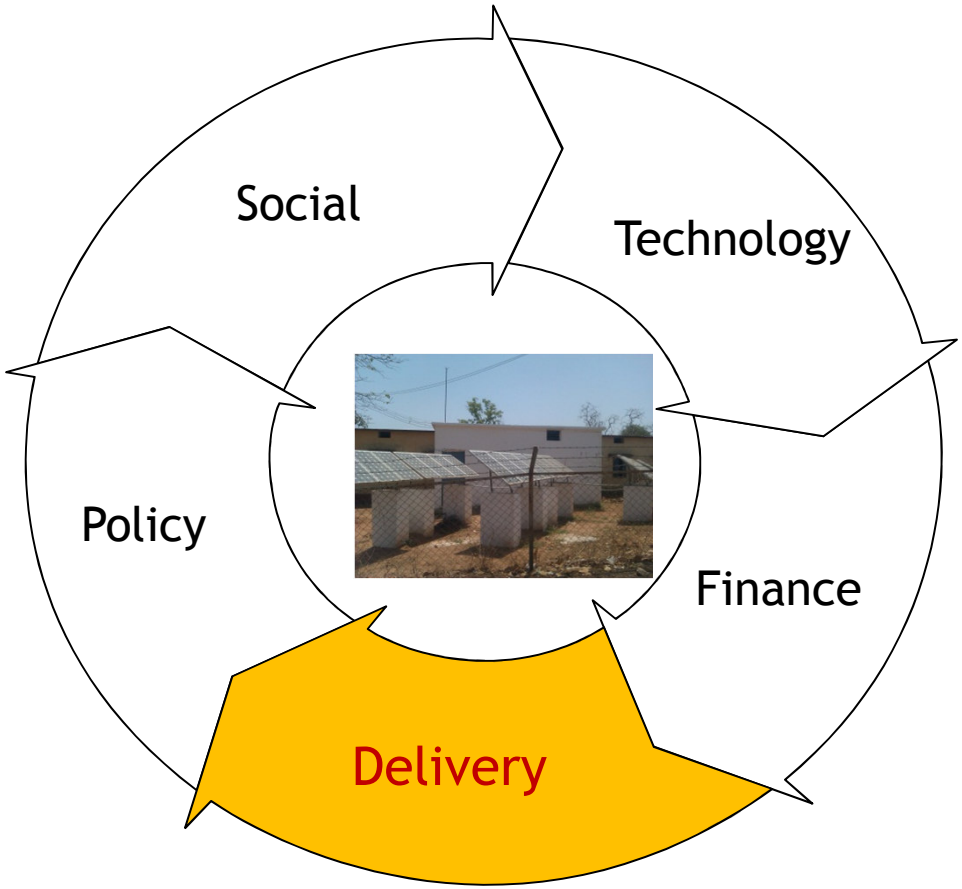
- Untested products/Absence of performance benchmarking/ standards
- Generation not as per design - quality issues of solar panel
- Limited local technical capacity
- Battery technology still vulnerable (over drawl by most consumers)

Finance ……



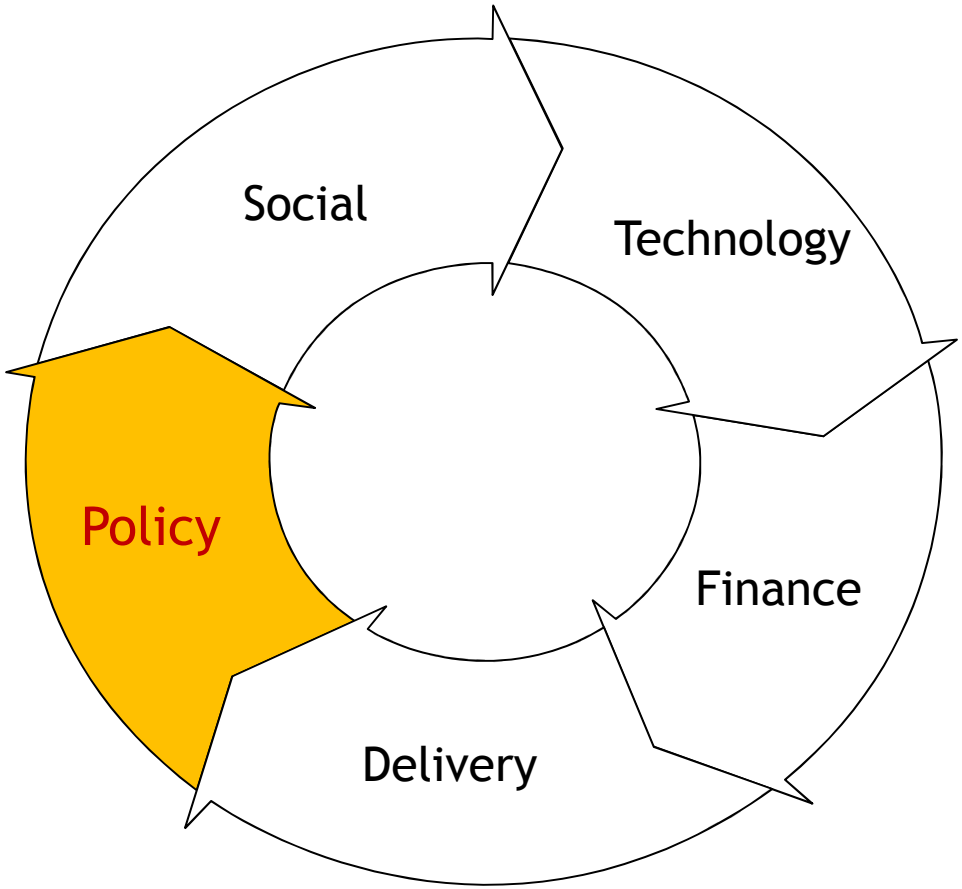
- Financial mechanisms are not in line with income level of poor HHs (the section w/o electricity access)
- Debt financing from banks difficult due to higher perceived financial & technology risks in rural setup
- Capital subsidy inadequate for ensuring long term sustainability
- Non flexibility in financial instruments

Institutions/delivery ……



- Absence of organized delivery model (e.g. involving DISCOMS)
- Inability to meet increased demand
- Lack of standard process and metrics for scaling up
- Last mile access for products and (spares) - missing link
- Social issues – tampering, non payment etc.

Policy……



- Dissemination suffers from uncertainty in political framework conditions
- Absence of clear regulation for off-grid sector
- Cross- subsidy in grid electrified villages – a deterrent for solar PV
- No clarity on LT grid connection, rules out grid as an anchor load

Key Lessons

For any model to be sustainable, scalable & socially acceptable

- ✓ Choice of technology – Size vs. Demand?
- ✓ Financing – Capital & Operational
- ✓ Electricity tariffs – Regulated or Negotiated
  - Access to electricity is merit good
- ✓ Service delivery
  - Management
    - Community based or Private
    - Organized vs. Un-organized approach
  - Community participation – What should be their role – Operator/Local Regulator/??
  - Contrary to prescribed community based models, top-down approach/ organized structure seems to be working better
  - Customer service – How do we define?
- ✓ Socio economic benefits –
  - Productive applications – Is economic linkages essential for sustainability
- ✓ Strong govt. support and political will

Framework for Mini Grid