Sustainable Energy for All:
Challenges, Opportunities & Best Practices in South Asia

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Structure of the Presentation

- Energy Access situation in Asia-Pacific
- Some innovative delivery models
- Overcoming challenges
- Takeaways

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What is TERI

- A not-for-profit research & development and policy think tank;
- Established in 1974 in New Delhi;
- More than 1000 professionals, with centers spread across 5 cities in India; Overseas presence in London, Washington DC, Tokyo, Dubai and Addis Ababa

Working Areas

- Energy & Power
- Regulatory practices
- Habitats and transport
- Environment
- Water and NRM
- Climate policy
- Bio technology
- Social Transformation

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People lacking access to electricity

	Number of people lacking access to electricity (in million)	Number of people relying on traditional use of biomass for cooking (in million)
Africa	600	696
Sub-Saharan Africa	585	653
Developing Asia	615	1869
China	3	446
India	**306**	**818**
Other Asia	378	659
Latin America	24	68
Developing Countries*	1257	2642
World	**1258**	**2642**

Source: World Energy Outlook 2013

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Number of people without access to modern energy services by region in the New Policies Scenario, 2011 and 2030 (million)

	Without access to electricity		Without access to clean cooking facilities	
	2011	2030	2011	2030
Developing countries	1 257	969	2 642	2 524
Africa	600	645	696	881
Sub-Saharan Africa	599	645	695	879
Developing Asia	615	324	1 869	1 582
China	3	0	446	241
India	306	147	818	730
Latin America	24	0	68	53
Middle East	19	0	9	8
World	1 258	969	2 642	2 524

* Source: (IEA, 2013)

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Partnership Experiences

- Entrepreneur Driven
- Community Based
- Pro-Poor PPP

- Solar Charging Stations
- Solar DC Mini Grids
- Solar Multi Utility
- Solar AC Mini Grids

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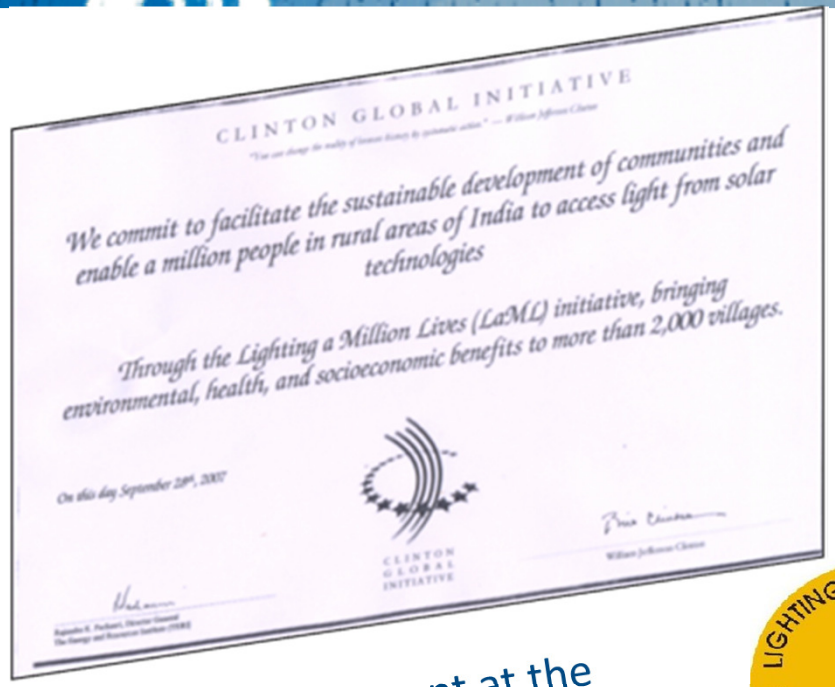
Lighting a Billion Lives (LaBL)


CLINTON GLOBAL INITIATIVE

We commit to facilitate the sustainable development of communities and enable a million people in rural areas of India to access light from solar technologies

Through the Lighting a Million Lives (LaML) initiative, bringing environmental, health, and socioeconomic benefits to more than 2,000 villages.

On this day September 28th, 2007

CLINTON GLOBAL INITIATIVE

Commitment at the Clinton Global Initiative 2007

Official Launch by Hon'ble Prime Minister of India 2008

LIGHTING A BILLION LIVES

teri

We commit to enable a billion lives
to access light from solar technologies

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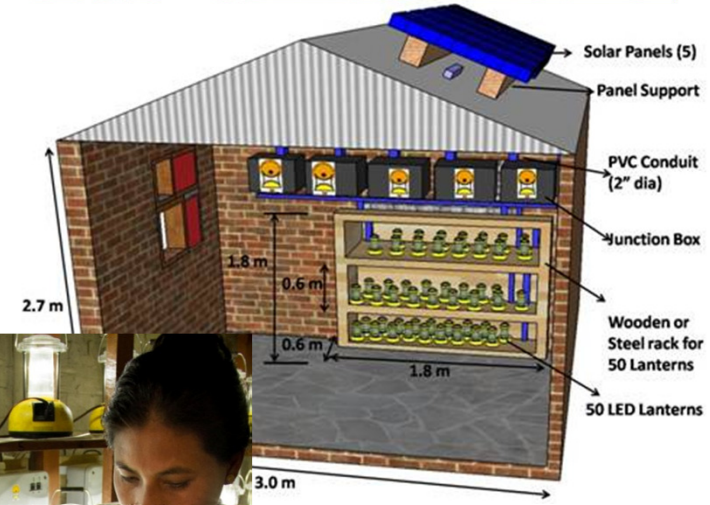
OASYS South Asia

Solar Charging Station

Local Entrepreneur Driven

Lighting a Billion Lives initiative *facilitates setting up of micro solar utilities*, which offer clean lighting solutions to energy poor villages

- Provides reliable and clean illumination
- Replaces the use of polluting kerosene as a lighting fuel
- Catalyzes rural solar market
- Equips local human resources with technical and managerial skills



Source: TERI , 2008

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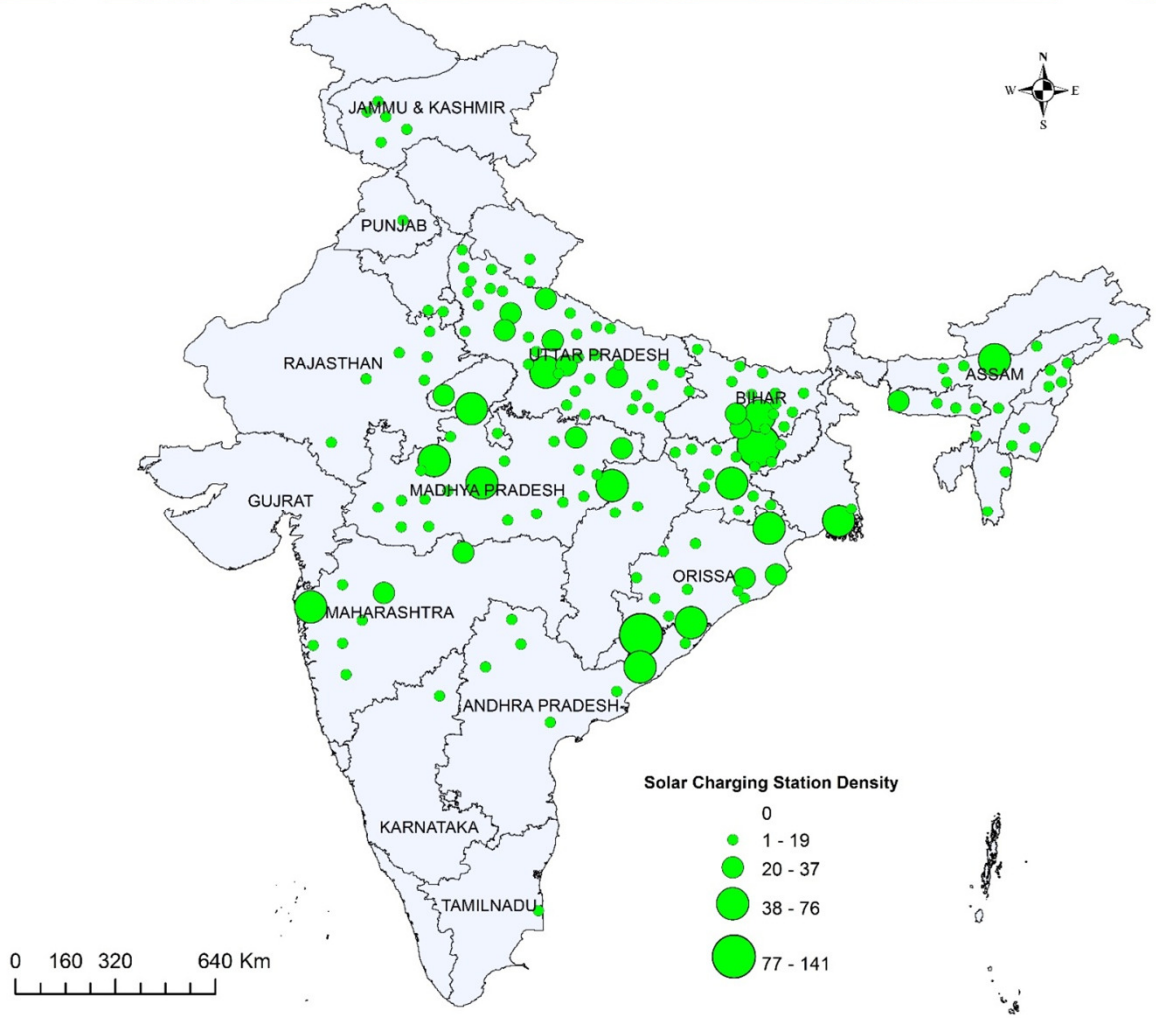
LaBL National Presence



> 1 million lives impacted

2222 villages covered

22 states

100,000 + Households

> 100 NGOs involved

> 2300 green jobs created

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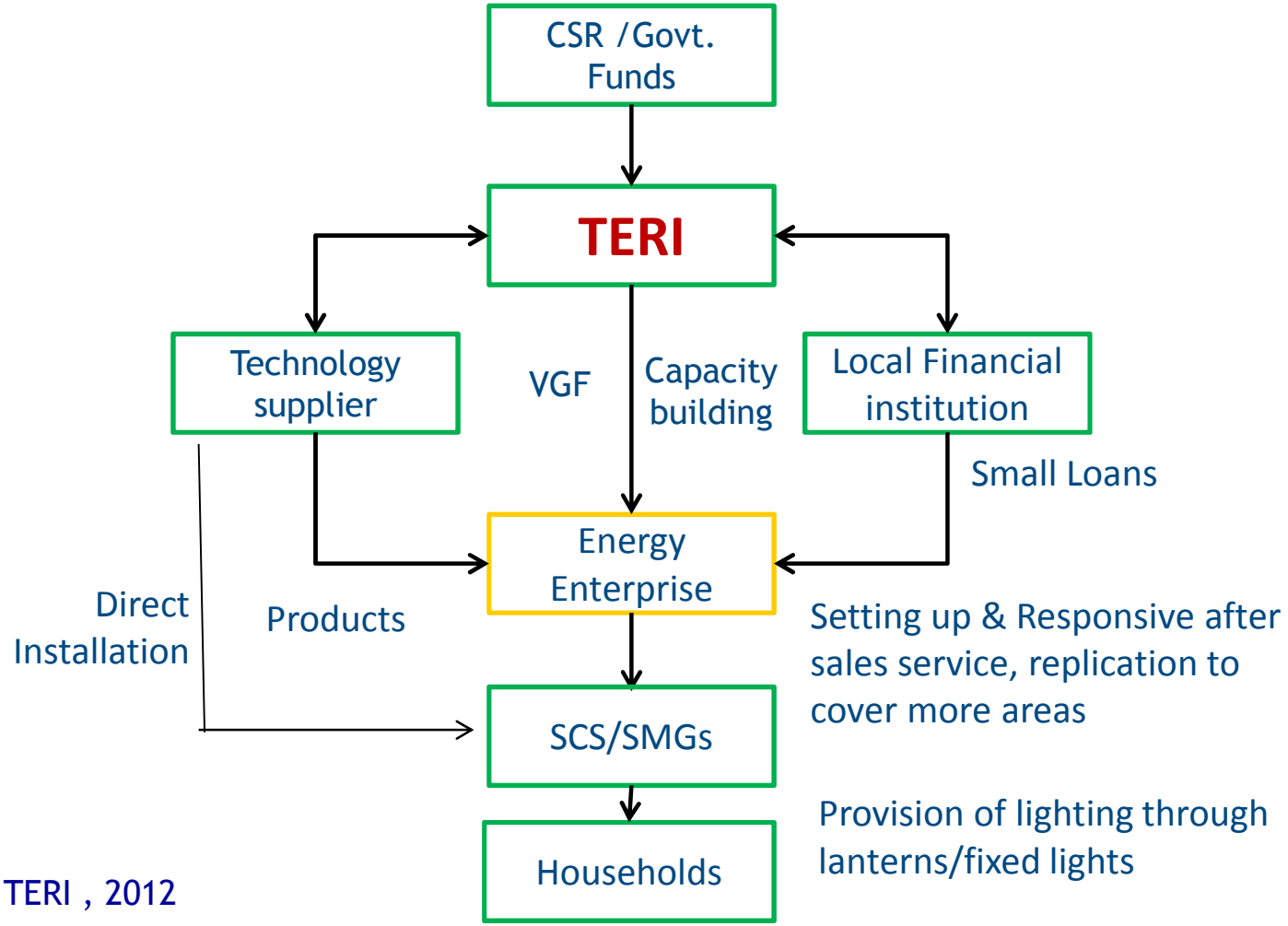
What does TERI do?



Source: TERI , 2012

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Innovating at LaBL

- CONTINUOUS IMPROVEMENTS in solar lantern designs with reputed technology partners, driving down cost, improving efficiency & quality
- CHARGING STATIONS EXPANDABLE TO SOLAR ENERGY HUBS, providing services like water purification, mobile & battery charging
- TECHNOLOGY RESOURCE CENTRE, an after-sales service network for responsive repair services through local community representatives

Source: TERI , 2010

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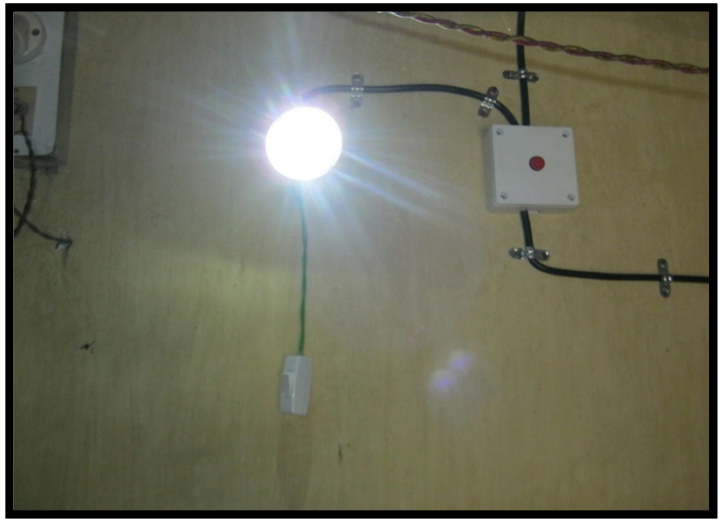
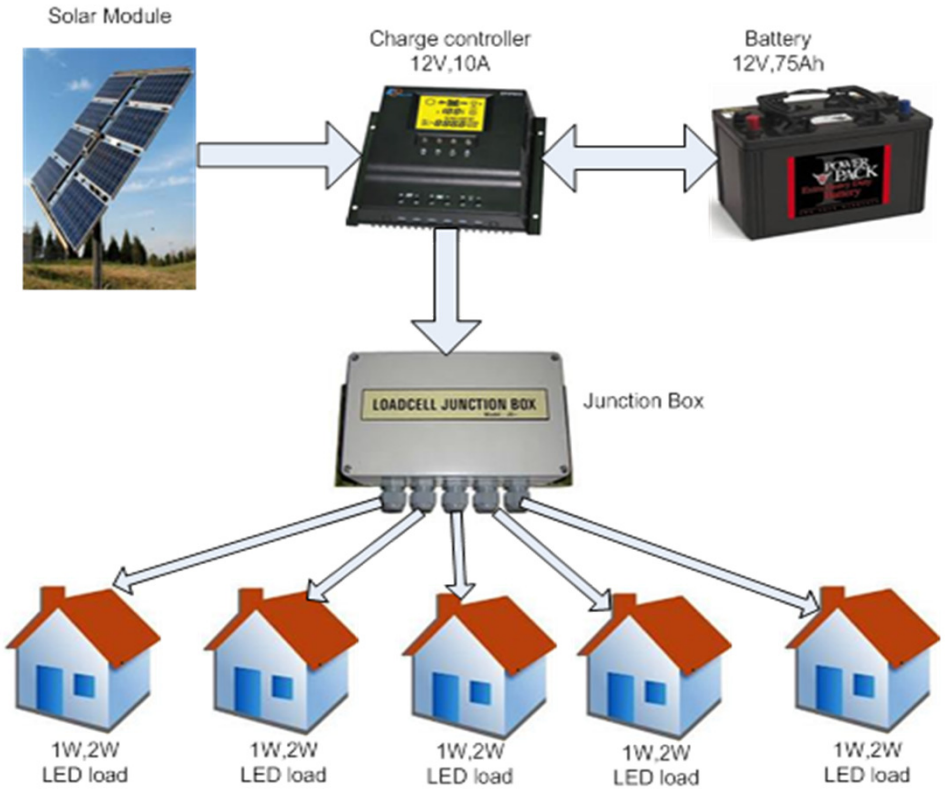
Solar DC micro grid

Local entrepreneur driven

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.



Source: TERI , 2012



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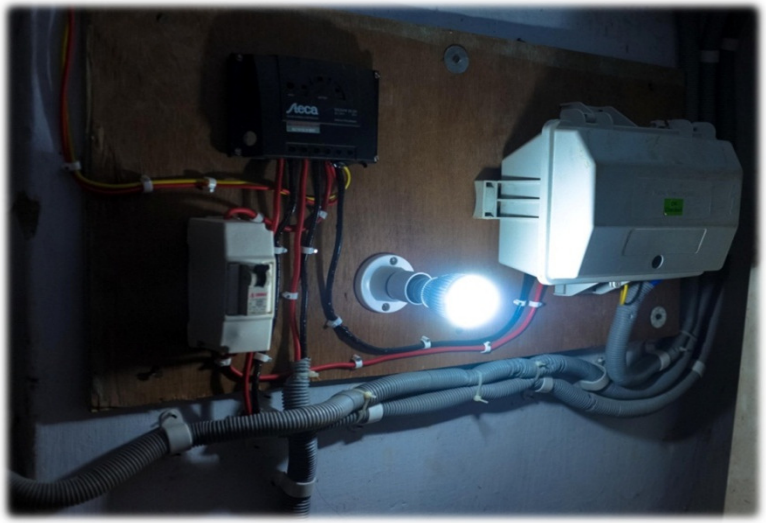
Operation

No of connections per SMG: 10, 20, 40, 80, 100

Running time : 5-6 hours; 2 LEDs and Mobile charging

Installation Cost: $ 65 - $ 75 per HH

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



Source: TERI , 2012

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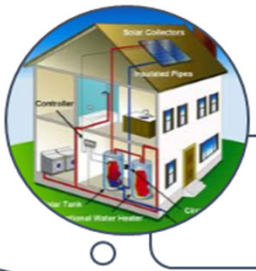
The Energy Access Continuum

Scaling up basic lighting

LaBL Plus



LEVEL 3: MODERN SOCIETAL NEEDS
Domestic appliances, cooling heating, transportation etc.

LEVEL 2: PRODUCTIVE USES
Agriculture, water pumping, mechanized tilling, cottage industry energy needs etc.

LEVEL 1: BASIC HUMAN NEEDS
Ligting, health, education, communication, community services, Modern cooking etc.

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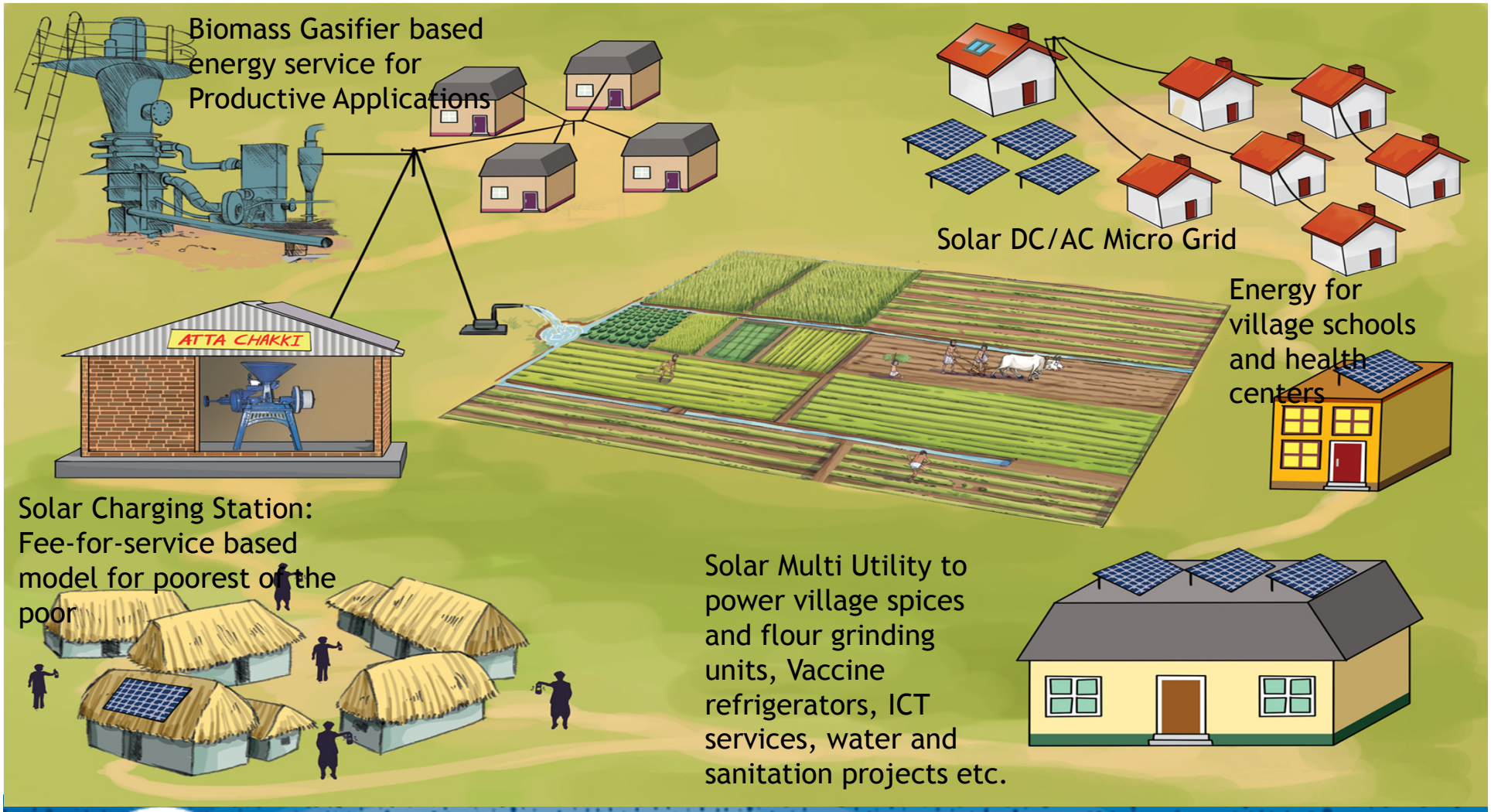
LaBL Plus Approach



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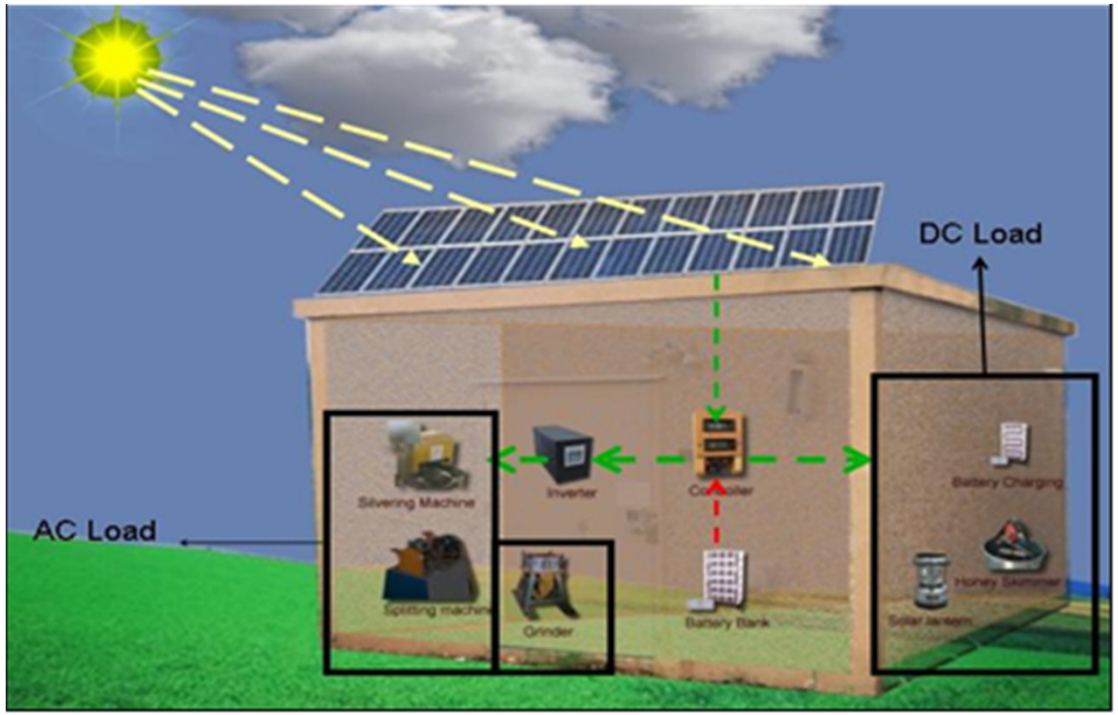
Solar Multi Utility

Community based model



Multiple Energy Sources

- Solar PV
- Wind Aero Generators
- Biomass Gasifier
- Hybrid Systems

Multiple Applications

- Charging lanterns
- Powering computers,
- Charging cell phones
- Water purification
- Micro enterprises

Located near the energy utilization points in a village to provide electricity services as per the community's need

Source: TERI , 2012

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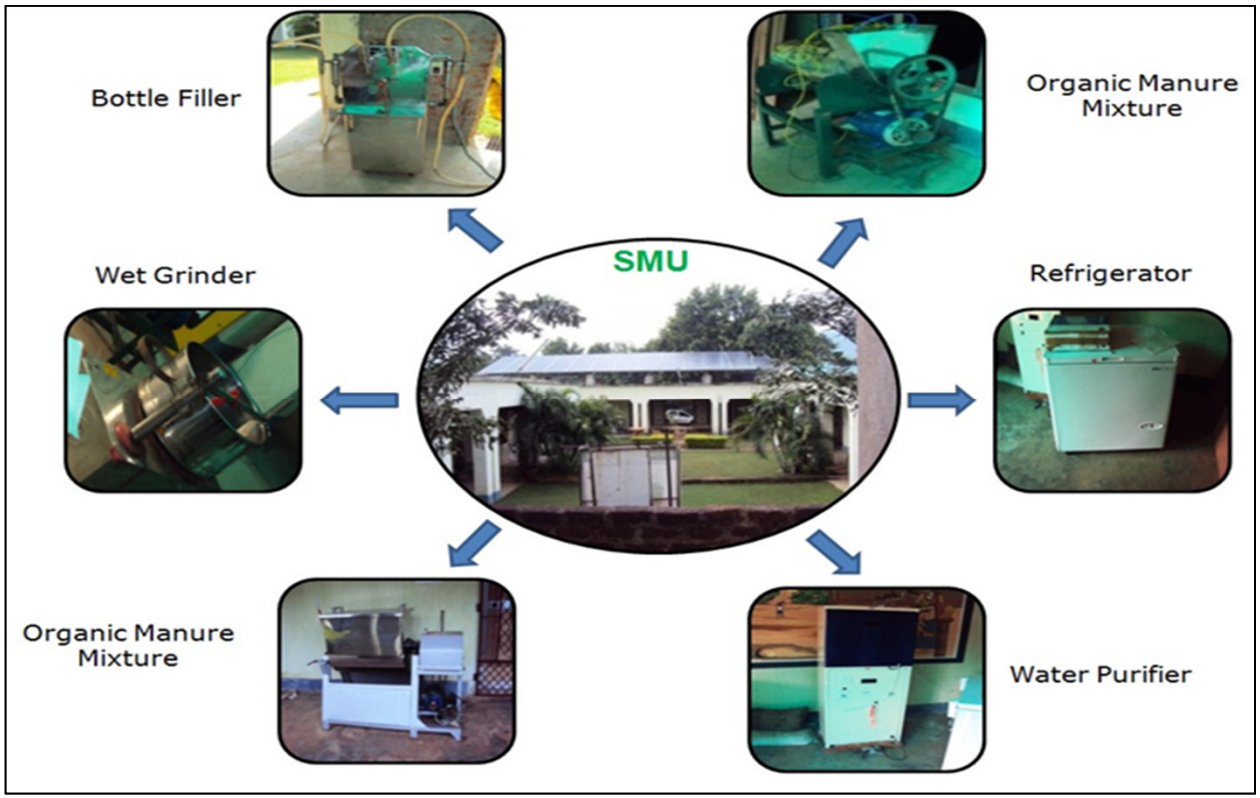
Solar Multi Utility (SMU)

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



Source: TERI , 2012

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Sustainability – going beyond technology

Technical/ Social

- Need based design (SCS, SMG, SMU etc.) with standard procedures for operation
- Energy efficient system & intelligent load management for reduced peak demand
- Involvement of local youths as entrepreneurs

Financial

- Variable Grant (CSR): Equity (Operator) : Debt (Local Rural Banks) ratio
- Customized pricing strategies/rent to suit particular end-uses and livelihood activities

Institutional

- Creating linkages with local developmental programs/ marketing agencies
- Catalyze local capacities for operation, management & post installation maintenance service

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IDCOL Solar Home System Program

Largest decentralised energy program in the world

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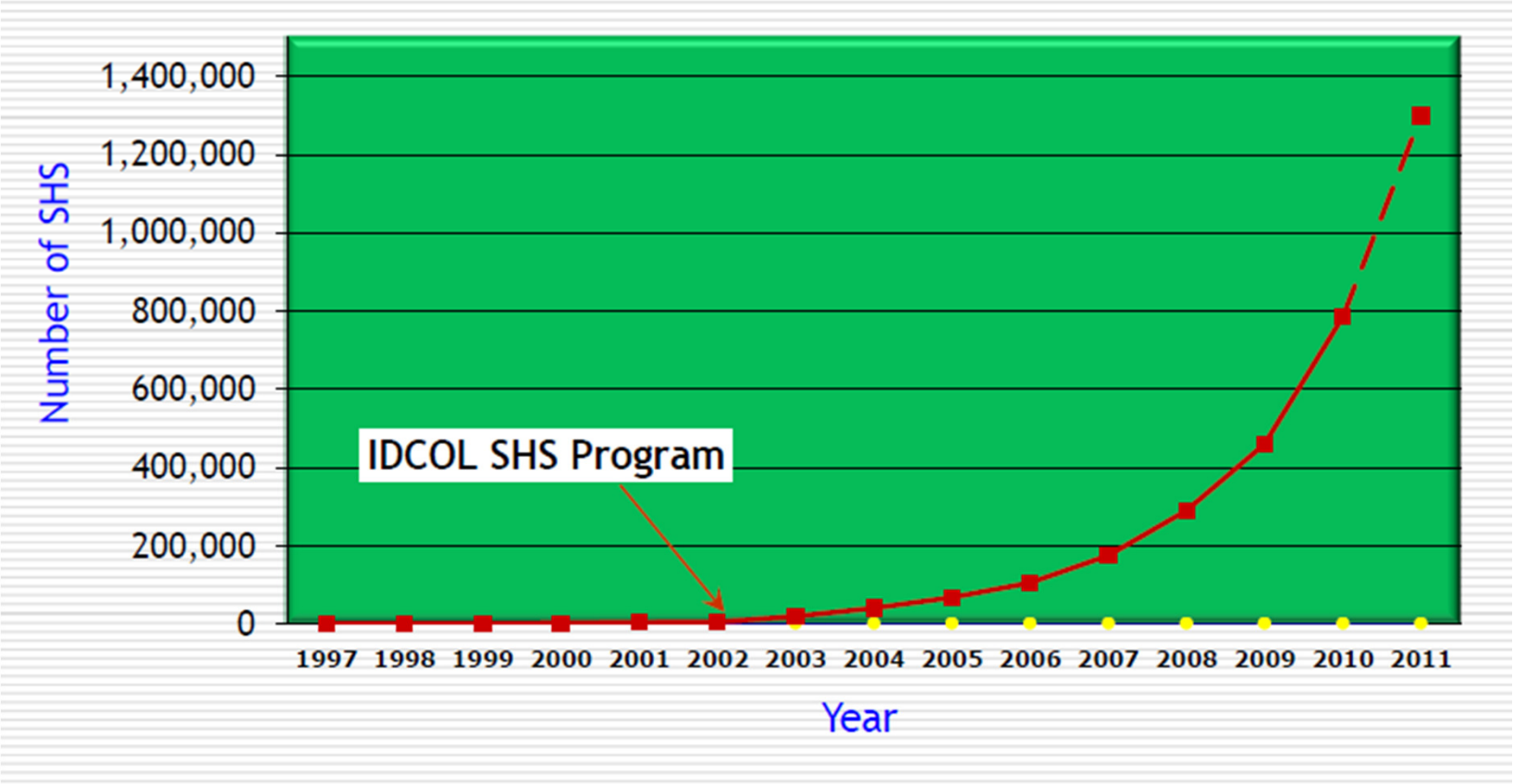
Growth of IDCOL program



Source: IDCOL, 2012

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Success factors for IDCOL

- Key factors contributing to IDCOL's success:
  - Single window – Access to technology, finance and service
  - Low cost, long tenure capital to IDCOL from FIs and IDCOL to Pos
  - Standardized procurement, delivery and after sales processes
  - Incentives to POs against set targets and for building their capacity and networks through IDG
  - Phased reduction of grants – leading towards commercialization
  - Also piggy bagging other interventions such as biogas and improved cookstoves to increase their reach

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The IDCOL Story: Beyond SHS

- Graduate from SHS to solar solutions – Multiple solar designs
  - Solar Home Systems
  - Solar DC/AC micro-grid
  - Solar Multi Utility
- Convert all CFL lamps of older systems to LEDs to use more aspirational appliances using same solar capacity
- Develop more flexible model to reach the poorest of poor – service
- Create rural entrepreneurs for service delivery

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Green Mini Grids

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Mini-Grids in India

- Pioneer of Mini-Grid system
  - First solar mini-grid commissioned in nineties in Sunderbans Islands
- State-of-the-art system designs available & use of components, continuing till date
- Mostly 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

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Mini-grids

- Either AC or DC
- Typically 1kWp to 500 kWp
- Technologies
  - Solar PV
  - Biomass gasifiers
  - Mini/micro hydro
  - Biogas
- Usually community managed
- Covers around 50 - 500 households

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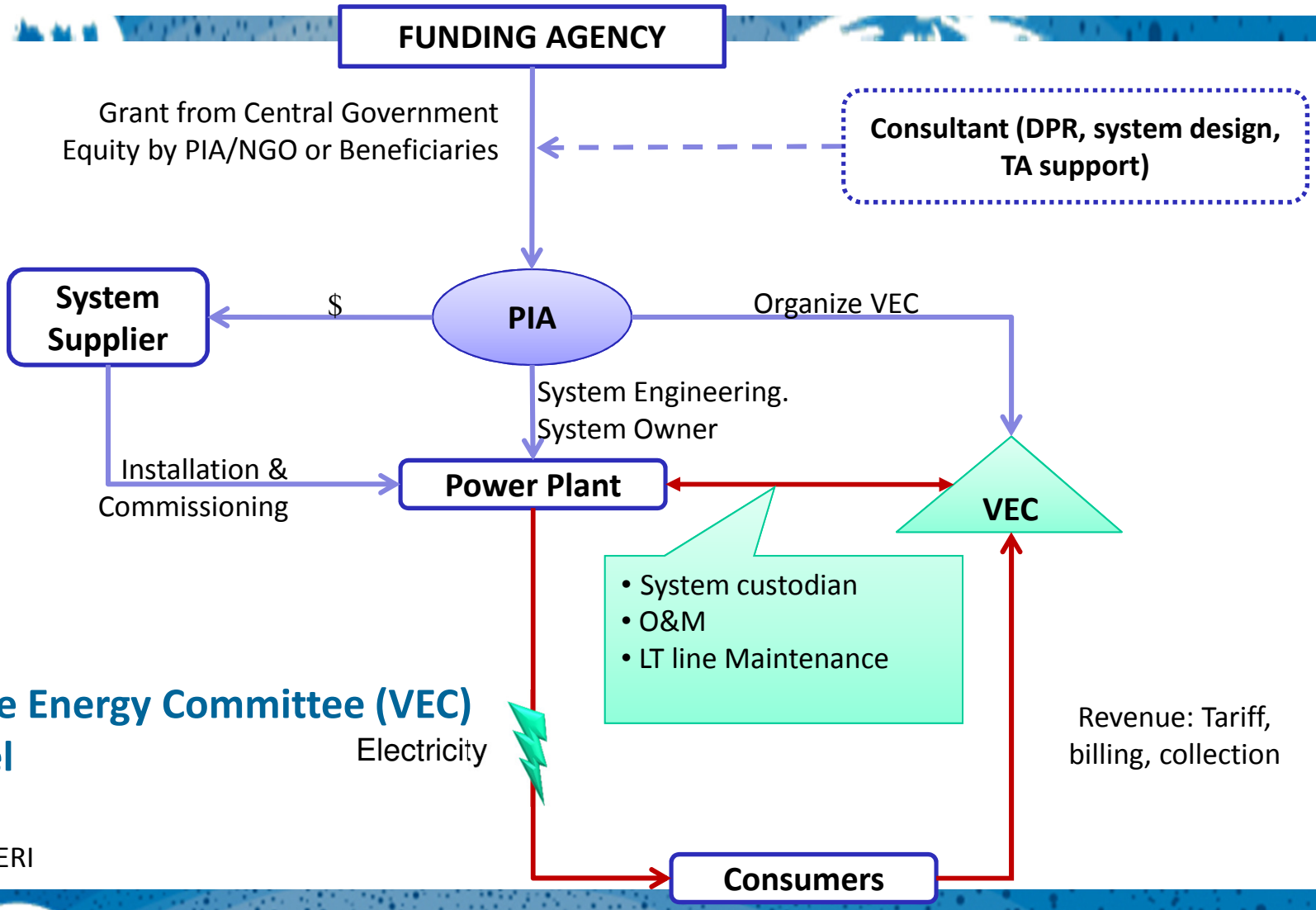
Managing Mini Grids: Earlier Model



Source: TERI

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Single resource - Hybrid System

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

Wind Diesel Hybrid system

Source: TERI

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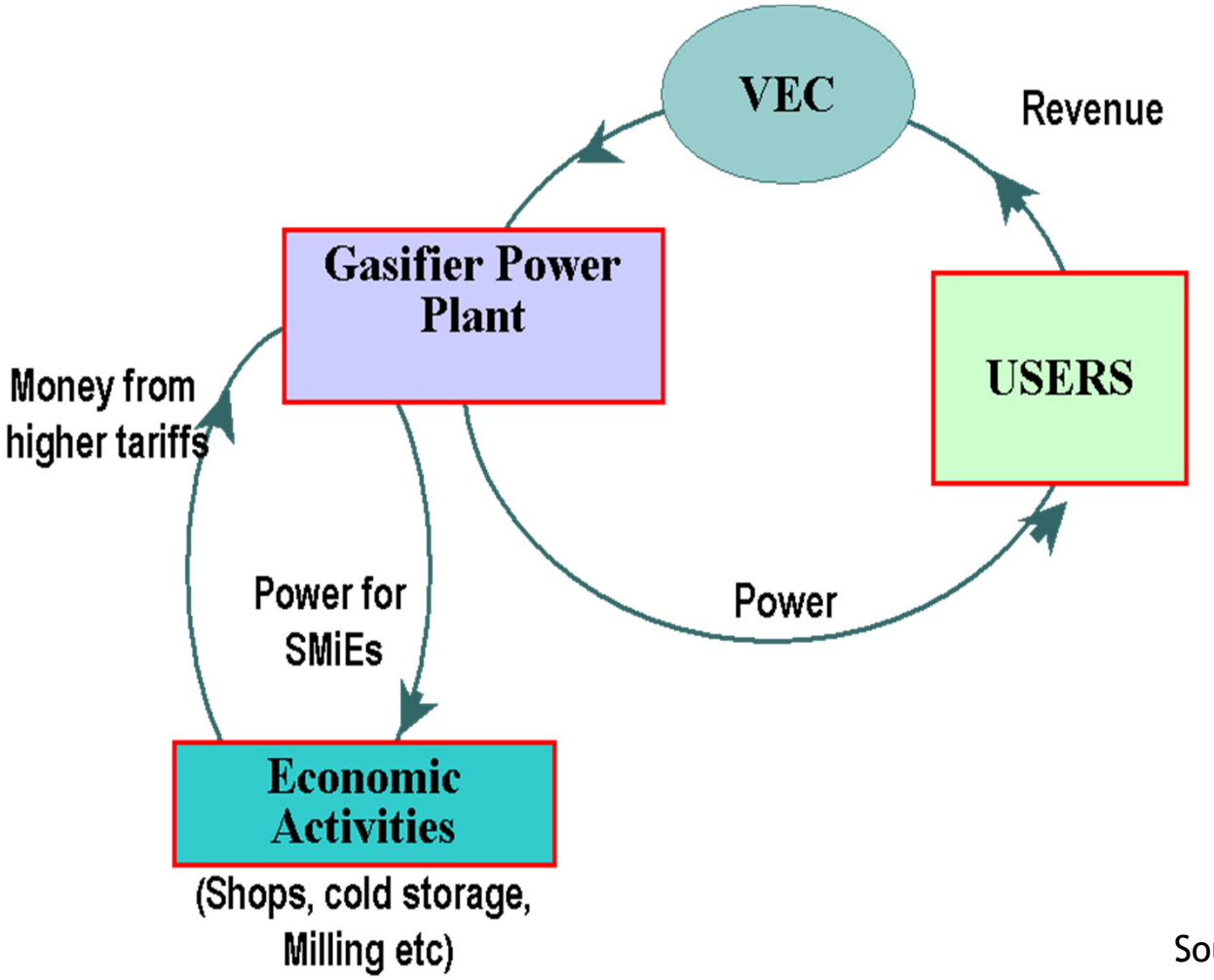
Mini Grids: Addressing low load



Source: TERI, 2009

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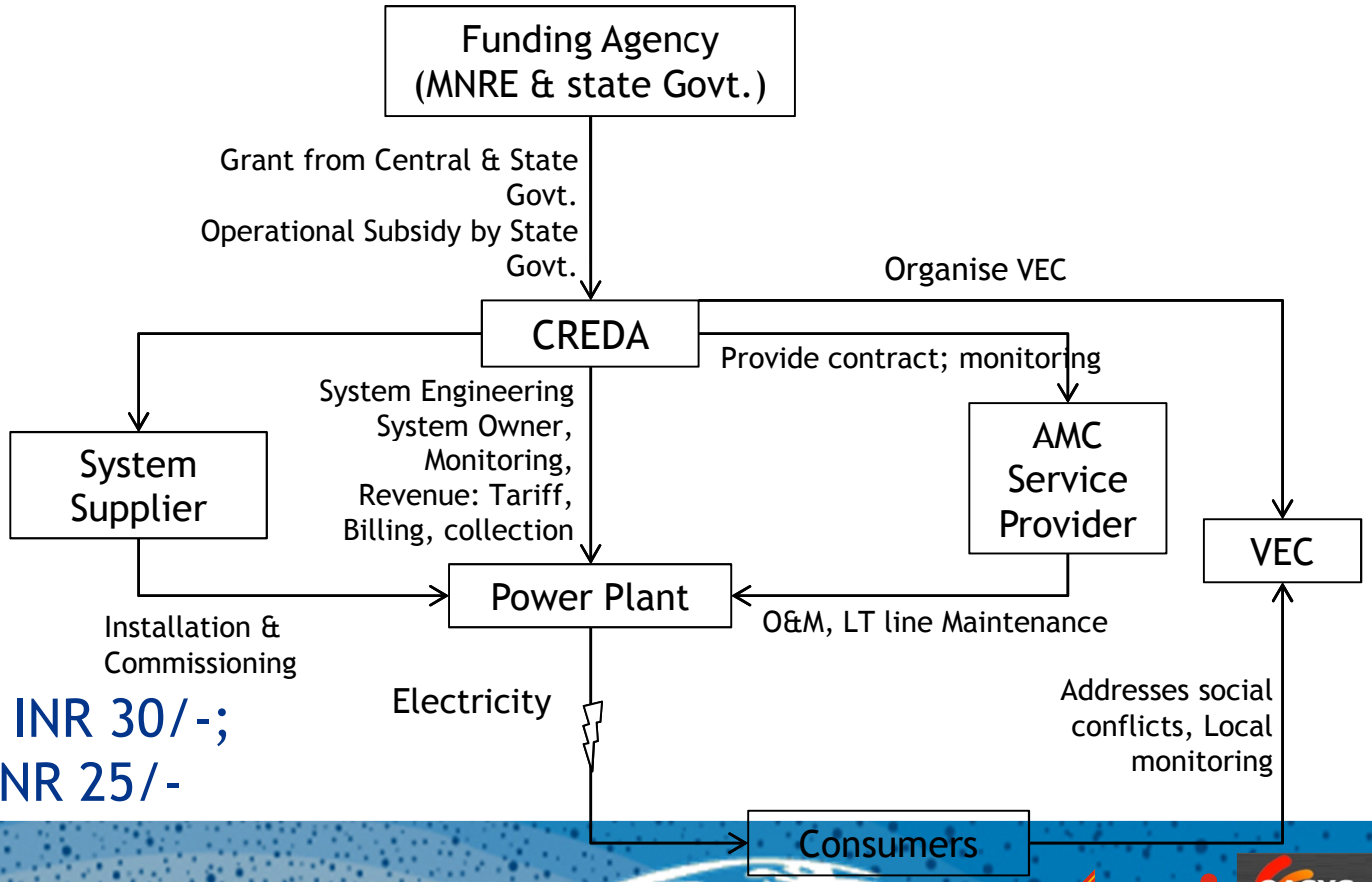
Mini grid Model in Chhattisgarh State

- CREDA follows a top-down approach with installation and O&M responsibility - three-tier maintenance framework



- Tariff rate is flat, INR 30/-;
- Govt. subsidizes INR 25/-

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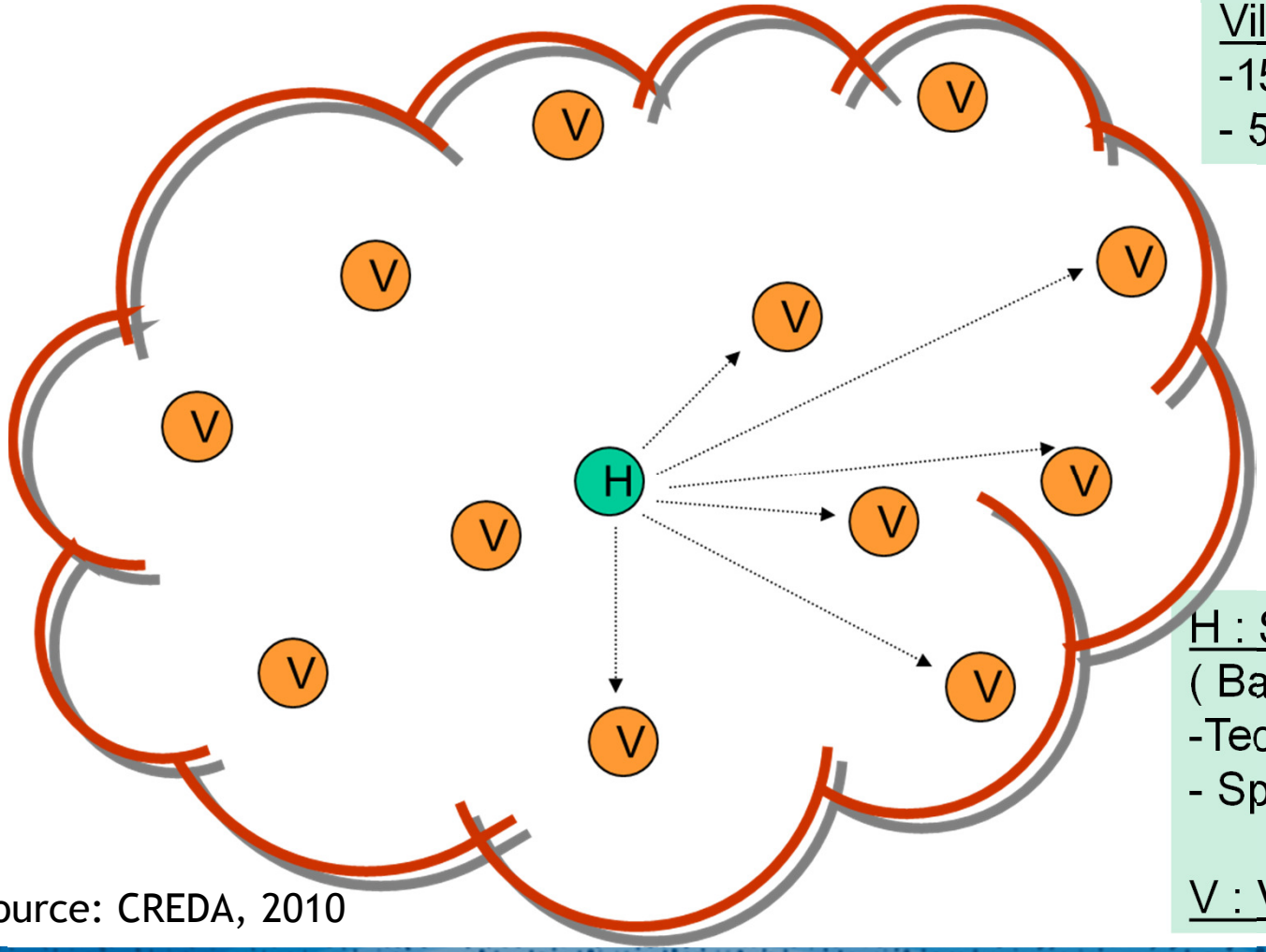
Cluster Based Service Delivery



Village Cluster
-15 Villages
- 50 Customers / Village

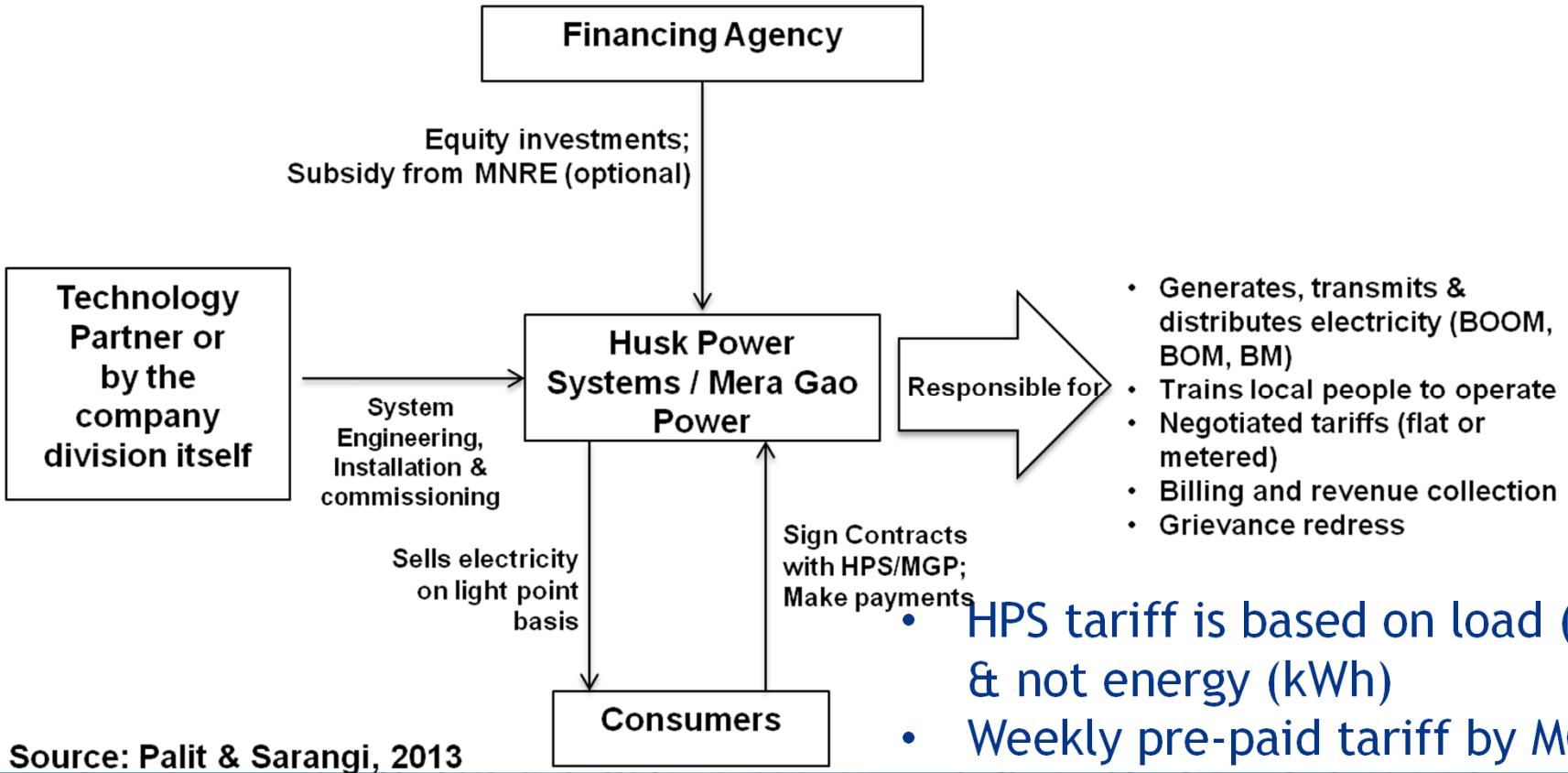
H : Service Hub
(Base station)
-Technician / Helper
- Spares / Consumables

V : Villages in the Cluster

Source: CREDA, 2010

Mini Grid – Private Sector

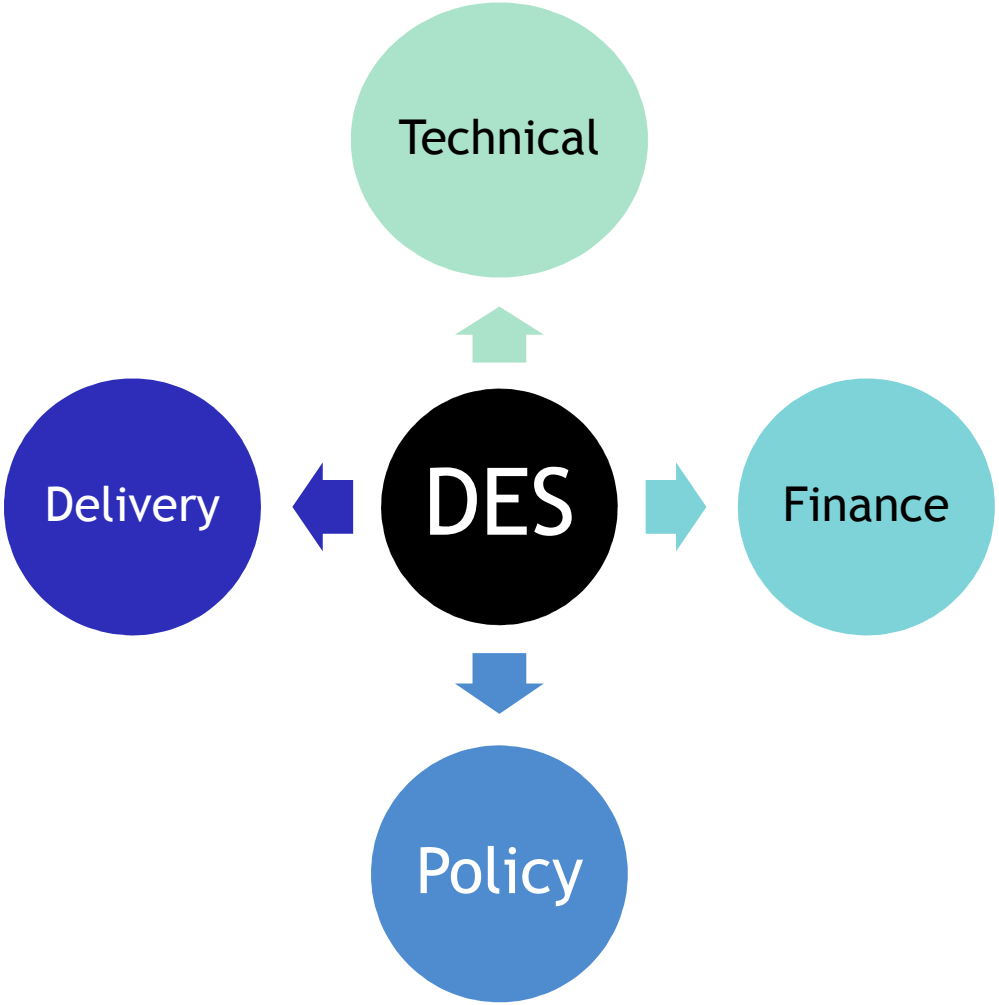
- Private sector follow a commercial approach and are purely demand driven



Source: Palit & Sarangi, 2013

- HPS tariff is based on load (kW) & not energy (kWh)
- Weekly pre-paid tariff by MGP

Challenges



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Overcoming challenges ……

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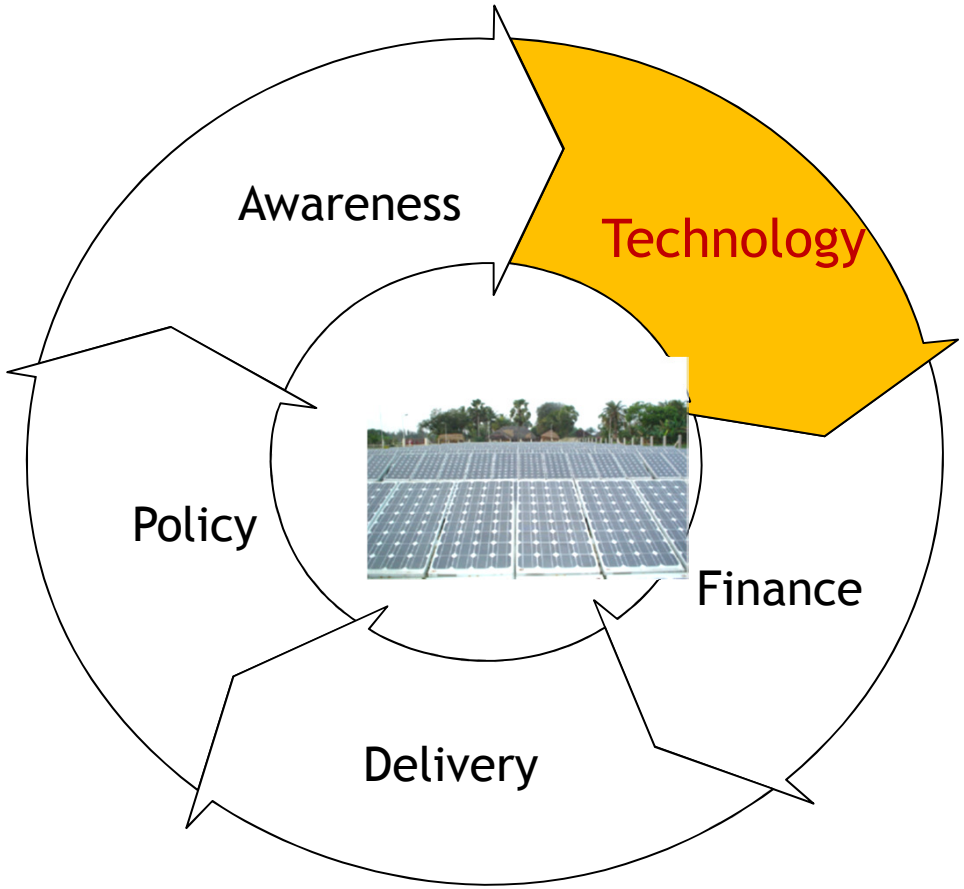
Technology ……



- Untested products/ Absence of benchmarks/standards
- Quality of service
- Limited local technical capacity
- Battery technology still vulnerable (over drawl by most consumers)
- Suite of technology designs/ models; E.g. hybrid models
- New research & pilots by Private sector with enabling policies & mandate by Govt

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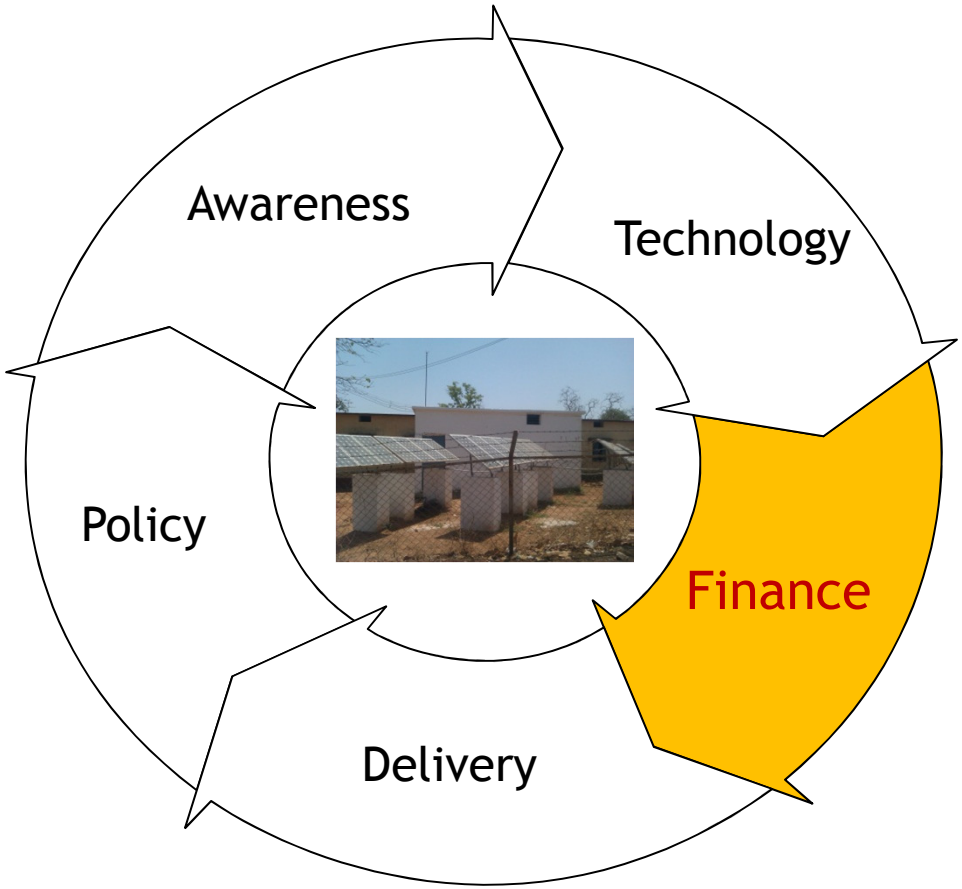
Financing ……



- 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
- Improved & affordable access to capital with flexibility along entire value chain/Priority sector lending
- Viability gap funding / Risk guarantee fund
- Low cost fund and Mix of Grant: Debt: Equity

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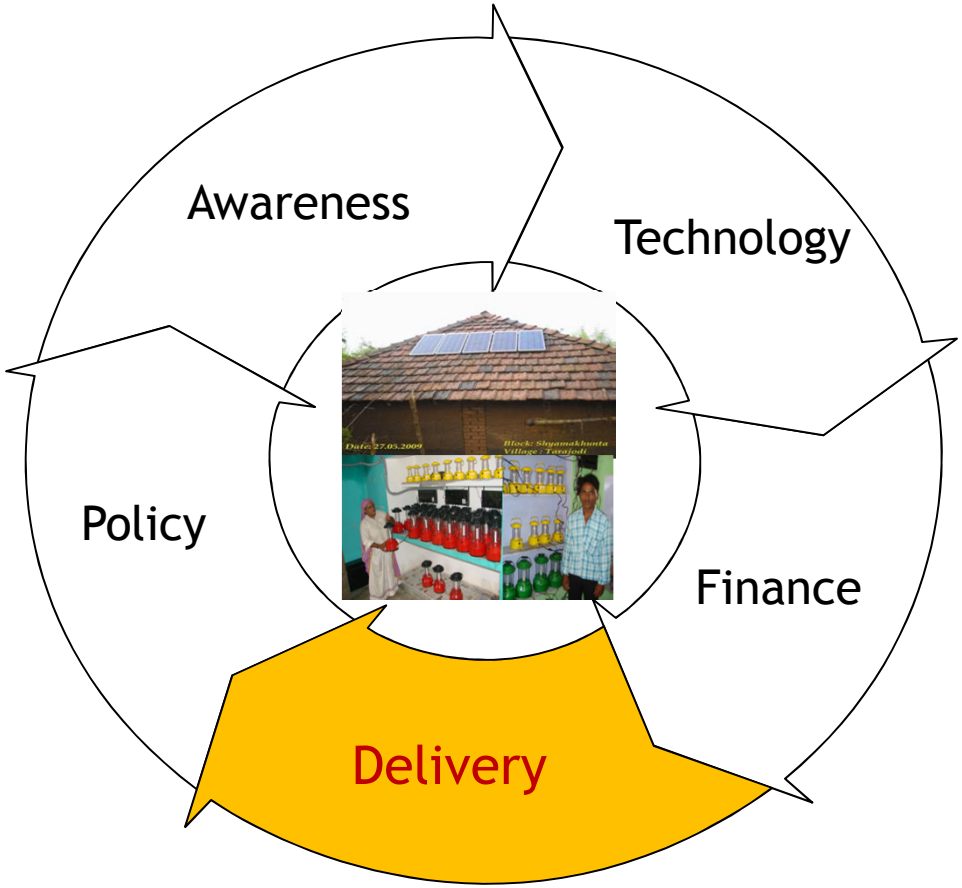
Institutions/delivery ……



- Absence of organized/ structured delivery model in most cases (e.g. involving Utility etc.)
- Lack of standard process and metrics for scaling up
- Last mile access for products and (spares)
- Single Window model vis-à-vis Two Window model
- Reducing costs…New operating models
- Build scale/bundling to cut costs & ensure bankability

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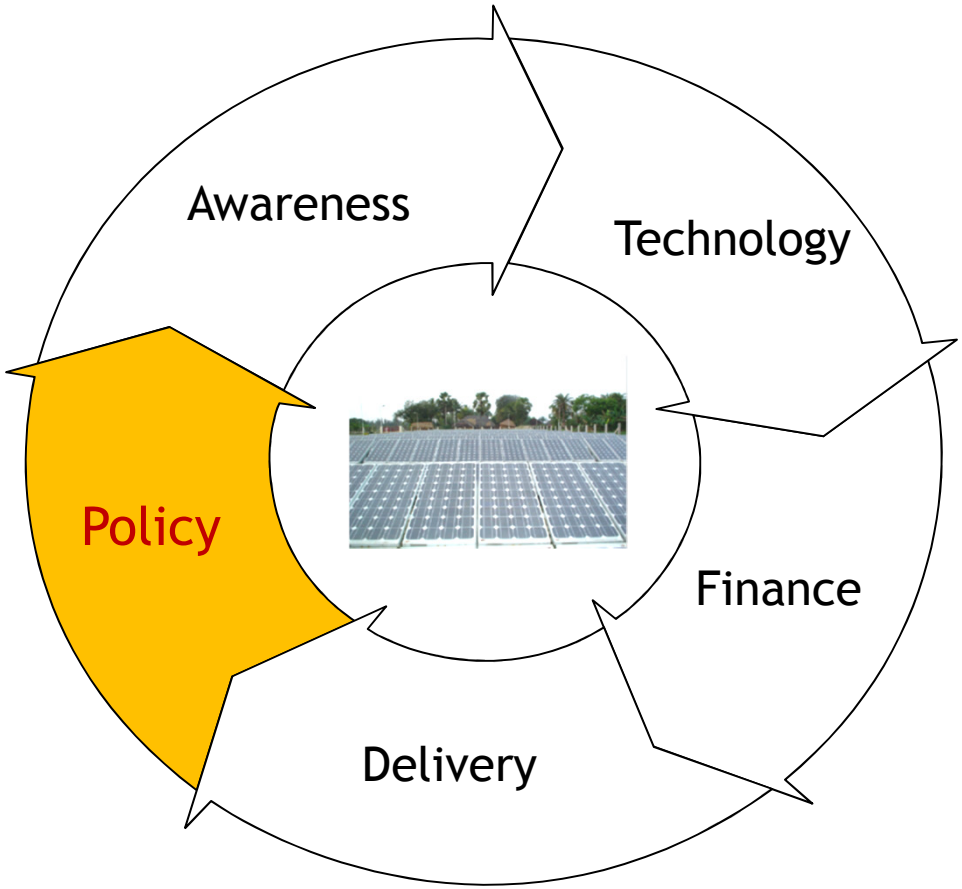
Policy……



- Dissemination suffers from uncertainty in political framework conditions
- Cross- subsidy in grid electrified villages/ Regulatory uncertainty
- No clarity on LT grid connection, rules out grid as an anchor load
- **Strong political will**

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Takeaways

- Defining success – not just financial but should also consider operational and outcome – benefits to community
- Service delivery models to be structured considering the uniqueness of the region within which the plant is to be installed -*Today off-grid, grid-connected tomorrow*
- Contrary to prescribed models of off-grid electrification, *top-down approach/organized structure* seems to be working better than community model - *Scaling up may need differentiated responsibility*
- Anchor load may be useful for meeting the fixed costs – not necessarily energy costs – to reduce overall cost of supply from small capacity systems

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Takeaways

- Cost of supply may be considered as the metric for comparison and not cost of generation , while designing projects
- Designing variable tariff structures considering both *ability to pay as well as operational expenses*
- Strong regulatory & policy regime supports development of projects – *Viability gap funding/Results based aid*
- Low cost/Patient capital required for scale up
- Need to *build local capacity and adopt clustering* for effective maintenance & viability of operation
- *Most importantly – recognition by country political set up*

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Any Questions ?

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