Barriers for Rural Electrification and implementation of clean energy technologies in India

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Schema of Presentation

• Introduction
• Policy Framework and Institutional Structures
  – Clean Energy Technology
  – Rural Electrification
• Barriers
  – Grassroots
  – Financial
  – Policy/ Institutional
• Lessons learnt
  – success stories
  – Failures
• Conclusion
Introduction

- India accounts for
  - a third of the world's population without access to electricity
  - about 40% of those without access to modern energy
- India has about 70% of its population living in rural areas
- One of the first countries to have a department for Non-Conventional energy (Renewable energy) – way back in 1982
- Has had several national programs and projects to introduce clean energy technologies and improve energy access in the rural areas with mixed success
- Some initiatives:
  - National Project for Biogas Development (ongoing from 1980s)
  - National Project for Solar Cookers (1980s to 1993-94)
  - National Programme for Solar PV distribution
  - National Programme for Solar Water Heaters
  - National Solar mission
  - Rural Electrification
Initiatives

• India was one of the first countries to implement a Biogas program for rural households
  – First demonstration in 1960
  – Implemented with a Multi-model, multi-agency approach where NGOs had a very important role
  – Estimated Target potential is 20 million households (INSEDA, 2001)
  – Program described as “Successful”

• Solar Program – Solar Cookers
  – Demonstration in 1970s
  – Subsidies offered 30% to 15%
  – Program status – “Failure”
Initiatives

- Rural Electrification Program
  - Institution – Rural electrification corporation (instituted in 1969)
  - Support SEBs/ Utilities to invest in rural electrification schemes
- RGGVY (Rajiv Gandhi Grameen Vidyutikaran Yojana)
  - Started in 2005
  - Distribution Franchisee model
  - Pilot Franchisee (West Bengal)

- Issues
  - Meters to be installed at the eyelevel, as most of the meter readers were women
  - Problem in Bill format of the invoice they raise to get payment from SEB
  - Telephonic network of these villages appeared to be weak. The private cellular network operation was also not satisfactory. The communication between the members is not proper.
  - The franchisees did not have their office
Issues: Access

- Physical access to energy
- Unmetered access
  - Illegal connections/ Theft
- Connections through a central supply or grid or through distributed generation
- Access to high quality and reliable energy – quality of supply
- Access does not mean availability
  - Most Villages in India have power only for 6 – 8 hours in a day
- Differentiate between:
  - Village connections or household connections
  - Only central grid connections or decentralized distributed generation options

Source: Pachauri & Mueller 2009
### Issues: Affordability

- Economic access to energy
  - Affordability of the fuel or energy type
  - Affordability of a connection and equipment
- Various costs
  - Cost of fuels
  - Upfront costs of connections and equipment
- Cash poor and do not receive a steady reliable income stream, so require access to ready and cheap credit
- Microfinance options have a very high 27 – 30% interest rates

#### Source: Pachauri & Jiang 2008

<table>
<thead>
<tr>
<th>Category of Users</th>
<th>Energy Expenditure (Rs. per year)</th>
<th>Energy expenditure as a percentage of total household expenditure (%)</th>
<th>Price per unit end-use energy (Rs. per Kwh)</th>
<th>Price per unit useful energy (Rs. per Kwh)</th>
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<tbody>
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<td><strong>RURAL</strong></td>
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<td>7.1</td>
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<td>0.33</td>
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</table>
Other issues

• Reliability and Quality
  – Typically solutions for the rural areas are not tested for reliability and are of poor quality (owing to cost vs. quality)

• Safety
  – Lack of standards
  – Education of safety hazards

• Ease of use
  – Electricity in urban areas at a press of the switch
  – But in rural areas solutions are like - Biogas …

• Security
  – Availability of fuels stocks and power over a long term

• Sustainability
  – Technology
  – Market

• Acceptability
Barriers to implementation

• Grass-root level barriers
  - Awareness – Education and empowerment of the people
  - Stakeholder commitment
  - Maintenance and upkeep of the proposed structures and systems
  - Formation of village development institutions
  - Entrepreneurial development for installation, operation and maintenance
  - Infrastructure development for manufacturing and servicing of the energy systems
  - Lack of infrastructure, trained personnel for operation and maintenance and village level institutions
  - Technology demonstration, field performance and high implementation cost

• An example
  - Community based implementation (Panchayat System)
  - SEWA
  - Solar Cookstoves
Barriers to implementation

• Financial mechanisms
  
  • Financing mechanisms for entrepreneurs, NGOs, manufacturers, franchiser and other agencies
  • Provision of venture capital
  • Demonstration of willingness and capacity of rural households to pay for energy services
  • Creation of recovery mechanisms

• An example
  
  – Gujarat’s SEWA model (http://www.sewa.org/)
  – Women as decision makers
Barriers to implementation

• Market Barriers

- Making technologies options attractive and economically viable in the market
- Good R&D for Rural technologies
- Poor market development and lack of confidence for private sector investment
- Working in poor and low population density areas makes it more difficult for private entrepreneurs to sustain a profitable operation.
- Often local public sector and entrepreneurs are not involved
- Many cases of successful pilot projects but poor replicability and scale-up
- Need for “best practices”

• Tirupati Solar Cooking initiative
  – 30000 meals per day
Barriers to implementation

- Policy impact and policy level barriers
  - Political rhetoric resulting in setting unrealistic targets and in poor implementation of programs
  - Bureaucracy and red tapism
  - Low follow up and poor monitoring mechanisms
  - Pricing of fuels often decided on considerations of winning the populist vote
  - Policy analysis for rational pricing of energy – Subsidies often mistargeted and have other unintended consequences

- An example
  - India’s Biogas policy of the 80s
  - India’s current RES policies
  - The field demonstration is likely to have an impact on policy barriers such as subsidy to conventional energy and absence of level playing field to bio energy options
Barriers to implementation and possible alternatives

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Possible Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Willingness and capacity of rural households to pay for energy services</td>
<td>• Field demonstration of the different energy options</td>
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<tr>
<td>• Market barriers to new, rural energy options</td>
<td>• Sound policy analysis for rational pricing of energy</td>
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<tr>
<td>– subsidies (open and hidden) to conventional rural energy options</td>
<td>• Vital to have an entire hardware plus “software” implementation package consisting of the technology, economics, financing, management, training, institutions, etc. necessary for the dissemination of the suggested system</td>
</tr>
<tr>
<td>– limited access to information</td>
<td>• Enable and ensure people's participation (in particular for the supply of resources and payment for services) as households and/or as a community</td>
</tr>
<tr>
<td>– first-cost sensitivity (where household decisions are based on initial, rather than life-cycle costs)</td>
<td>• Promote local capacity building at the rural level with special attention given to operation and maintenance know-how</td>
</tr>
<tr>
<td>• Barrier of indifference to energy costs particularly when these costs are not in terms of money but in terms of the labour of women leading to limited attention to alternative energy options</td>
<td>• Have policies for immediate-term, medium-term and long-term time horizons for technology development and dissemination</td>
</tr>
<tr>
<td>• Other barriers – Supply-biased paradigm, vested interests (in the private and public sector) and institutional obstacles</td>
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</tbody>
</table>
Value Analysis - The Value Spiral of Socio-technical Phenomenon

The Value Spiral

- Change/Death
- Normalization
- Transformation
- Birth/Justification

Net Potential Value (NPV) = \( f(T \times H \times S \times E \times N) \)

Technology Output (T) = \( f(\text{Resource usage, efficiency, reliability, accessibility, affordability}) \)
Human Capital (H) = \( f(\text{Human Capabilities, Education/Training, Applications, Innovation and R&D}) \)
Social Capital (S) = \( f(\text{Relational capabilities, standardization and universalization, employment, livelihood pattern}) \)
Economic Capital (E) = \( f(\text{GDP, FDI, GNP,...}) \)
Natural Capital (N) = \( f(\text{resource indicators related to usage and consumption...}) \)

• All the factors have a multiplier effect on the net value.

\[ \text{NPV} = k (T \times H \times S \times E \times N) \]
Lessons Learnt from successes and failures

• Good Technology is not the key to successful implementation
• Consider socio-cultural aspects
  – There exists a Socio-cultural diversity in different regions
  – One solution does not always fit all
  – Technology new & alien to rural people
  – Specially if developed outside the rural environment
  – First viewed with skepticism
  – Information spreads by word of mouth
  – Important to understand lifestyle related issues
• Long gestation period
  – Long Birth/Justification phase
  – Need for acceptance and internalization
  – Long Hand holding period
Lessons Learnt from successes and failures

• “Trust Building”
  – Important to first demonstrate technologies using local field agencies or NGOs who have implemented other programs successfully and have established “trust”
  – Stakeholders should be involved from “Day 1” of the implementation
  – Approach should be stakeholder based rather than marketing oriented

• “Technology Maturity”
  – Technology selected for promotion should be fully matured before it is transferred, demonstration, and promoted for rural applications
  – In the initial stages of demonstration, failure of even one unit could create negative impact in villages
  – Preferably develop technology with inputs from users rather than Technology push
Lessons Learnt from successes and failures

• Initial acceptance does not imply long term usage
  – Need for Champions
  – Monitoring and maintenance mechanisms

• Subsidies ≠ Sustainability
  – Long term subsidies defeat the purpose
  – Initiatives not sustainable
  – Need Incentives

• Policy Instruments
  – Mere policy push does not ensure success
  – Political decoupling is important
  – Increased accountability
  – Transparency to ensure coordinated stakeholder effort
  – Programs should be targeted correctly (One size and solution does not fit all)
Conclusion

• There is a need to
  – Integrate energy into overall development where energy technology is used as a means of empowering local community rather than an end in itself
  – Recognize the diversity of approaches in service delivery

• On the institutional front
  – Demand more institutional leadership and critical roles for the public sector also in public-private partnerships
  – Widen the policy “spectrum” and put more emphasis on learning-by-doing capacity development

• Instead of treating rural areas solely as market place for technologies, the programmes should be used for ‘creating employment’ for villagers and for ‘capacity building’
THANK YOU
References (representative sample)

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