SUSTAINABLE MINI-GRID

A MODEL FOR BIHAR

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Energy Access - India

Renewable Energy

- Electricity, 67.25%
- Kerosene, 31.43%
- Other Oils, 0.20%
- Solar, 0.44%
- Biomass, 0.20%
- No Lighting, 0.47%
Energy Access - Bihar

- Kerosene, 82.40%
- Electricity, 16.40%
- Solar, 0.60%
- Other sources, 0.50%
- No Lighting, 0.10%

Renewable Energy
Energy Access – Urban Bihar

- Electricity, 66.70%
- Kerosene, 32.20%
- No Lighting, 0.20%
- Other sources, 0.80%
Energy Access – Rural Bihar

- Kerosene: 88.40%
- Electricity: 16.40%
- Solar: 0.60%
- Other sources: 0.50%
What is Mini-Grid?

- **Grid** – High voltage backbone system of interconnected transmission lines, substations and generating plants.
- **Mini-grid** – Smaller version of a grid
- **But how small it is?**
  - 1.5 kW serving 200 customers?
  - 32 KW serving 400 customers?
Rural household requirement

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Load (W)</th>
<th>Quantity (No)</th>
<th>Hours of consumption</th>
<th>Consumption/day (Wh)</th>
<th>Consumption/month (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CFL lamps</td>
<td>11</td>
<td>2</td>
<td>6</td>
<td>132</td>
<td>3.96</td>
</tr>
<tr>
<td>CFL lamps</td>
<td>8</td>
<td>1</td>
<td>6</td>
<td>48</td>
<td>1.44</td>
</tr>
<tr>
<td>Ceiling fans/table fan</td>
<td>75</td>
<td>1</td>
<td>12</td>
<td>900</td>
<td>27</td>
</tr>
<tr>
<td>Mobile charging</td>
<td>8</td>
<td>1</td>
<td>3</td>
<td>24</td>
<td>0.72</td>
</tr>
<tr>
<td>Television</td>
<td>80</td>
<td>1</td>
<td>5</td>
<td>400</td>
<td>12</td>
</tr>
<tr>
<td>VCD drive/set-top box</td>
<td>30</td>
<td>1</td>
<td>5</td>
<td>150</td>
<td>4.5</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>212</strong></td>
<td><strong>7</strong></td>
<td><strong>37</strong></td>
<td><strong>1654</strong></td>
<td><strong>49.62</strong></td>
</tr>
</tbody>
</table>
## Requirement for 50 households

<table>
<thead>
<tr>
<th>Appliance</th>
<th>Load (W)</th>
<th>Quantity (No)</th>
<th>Hours of operation</th>
<th>Consumption/day (Wh)</th>
<th>Days /month</th>
<th>Consumption/month (kWh)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Residential needs for 50 households</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2481.00</td>
</tr>
<tr>
<td>Pump set</td>
<td>3000</td>
<td>1</td>
<td>4</td>
<td>12000</td>
<td>20</td>
<td>240.00</td>
</tr>
<tr>
<td>Livelihood (marketplace)</td>
<td>11</td>
<td>20</td>
<td>5</td>
<td>1100</td>
<td>30</td>
<td>33.00</td>
</tr>
<tr>
<td>Flour mill</td>
<td>5000</td>
<td>1</td>
<td>2</td>
<td>10000</td>
<td>20</td>
<td>200.00</td>
</tr>
<tr>
<td>Street lighting</td>
<td>11</td>
<td>10</td>
<td>10</td>
<td>1100</td>
<td>30</td>
<td>33.00</td>
</tr>
<tr>
<td>Community centre/ anganwadi/hospital</td>
<td>500</td>
<td>1</td>
<td>4</td>
<td>2000</td>
<td>30</td>
<td>60.00</td>
</tr>
<tr>
<td><strong>Total demand per month</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3047.00</td>
</tr>
<tr>
<td><strong>Technical and commercial losses @ 20 per cent</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>761.75</td>
</tr>
<tr>
<td><strong>Total number of units required to be generated per month</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3808.75 ≈ 3800.00</td>
</tr>
</tbody>
</table>
Definition of mini-grid

- A set of electricity generators, possibly with energy storage system interconnected to a distribution network that is capable of generating at least 3800 units per month in peak power condition to serve 50 households.
  - Technology neutral
  - A minimum size is defined
  - A minimum service parameter is defined
Challenges in the definition

- What will happen to the excess power if demand is less?
  - Interconnected to grid if available
  - If grid is not available – excess power is wasted
    - Proper assessment of demand & its growth
    - Scheduling of power based on demand
    - Economic activities - productive activities
    - Base loads
Amendments in policies

- **Electricity Act – 2003**
  - Define mini-grid
  - Direct NEP to formulate policies for DISCOMs to sell and purchase power from mini-grids
  - Energy equity – equivalent to kerosene replacement cost
  - Electricity supply code for mini-grids
  - Institute MVA for monitoring, verification and rating
  - Follow certain clause of EA part - VI
Amendments in policies

- National Electricity Policy - 2005
  - Redefine REDB
  - Lay down grid interconnectivity with mini-grids
- National Tariff Policy – 2006
  - RPO must include certain % of power from mini-grids
  - Mandate SERCs to decide preferential tariff for mini-grids
- Rural Electrification Policy - 2006
  - Shift the focus from grid extension to mini-grids
Amendments in schemes

- **DDG**
  - Mini-grids in grid connected villages where electricity is less than 12 hours

- **JNNSM**
  - Mini-grids in remote villages only through proposed REAP scheme
  - Off-grid applications like – solar pumps
Tariff Mechanisms

- **Mini-grids in grid connected areas**
  - Feed – in – Tariff from REC directly.
    - Sources – RGGVY, Kerosene subsidy
  - Tariff from served customers

- **Mini-grids in remote areas**
  - Generation based incentives from MNRE directly.
    - Sources – NCEF Fund, Green Climate Fund
  - Tariff from served customers
Capital Expenditure

- **Debt Finance**
  - Bank with soft loans – backed by credit guarantee from government for bankable projects
  - CSR Funds / Multilateral funds for non bankable projects

- **Equity Finance**
  - Mini-grid developer
The Model

Renewable Energy

Bankable Projects
- Credit Guarantee Scheme
- Banks
- CSR Funds
- Multilateral Funds

Monitoring, Verification and Rating
- MVA

DDG Scheme
- DISCOM
- REC

Proposed REAP Scheme
- MNRE

National Fund
- RGGVY
- Kerosene Subsidy
- NCEF Fund

Global Fund
- Green Climate Fund

Flow of Electricity
Flow of Capital
Flow of Tariff
Flow of FIT/GBA
Features of the model

- Source and flow of funds defined
- Bankable and non bankable projects dealt separately
- MVA for monitoring, verification and rating
- Global fund for FIT / GBI
- Cluster approach
- Grid interconnectivity if grid is available
- Energy equity
Cap-ex requirement - Bihar

Renewable Energy

Rs. Crore

- 2014: 9447
- 2015: 10355
- 2016: 15442
- 2017: 16147
- 2018: 16479
- 2019: 12016
- 2020: 11716
- 2021: 11828
- 2022: 7256

Rs. Crore
Renewable Energy

FIT/GBI requirement - Bihar

FIT / GBI support required per year in Rs. Crore
Selection of mini-grid developer

- Bidding
- Bid preparation
- Financial eligibility
- Distribution of electricity – adhere to provisions
- O&M and capacity building