Rural Electrification using Biomass

Husk Power Systems (HPS)

More than 125000 villages in India after sunset
Conventional Solutions Can’t Deliver

Over 550,000,000 rural Indians without reliable power

The Solution-

Decentralized Generation & Distribution

Non-conventional Technology

Renewable Resource
The Solution -

We explored the options …

The Solution - Biomass

PRACTICALLY A WASTE IN THE LIVES OF RURAL POPULATION
An Interesting Co-incidence -

Plenty of rice husk to serve 125K un-electrified villages in India

**Rural Power Market**
- 125,000 villages starving for power
  - 18,000 to stay off-grid forever
- $102B rural power mkt.
  - Replacing diesel and kerosene

**Rice Production**
- ~132MT rice produced
- ~40MT husk
- ~27,000,000 MW

Source: World Energy Outlook 2006, World Resources Institute

The Technology – Biomass Gasification

**What is Gasification?**

- Solid Fuel
- Air or oxygen, steam

**GASIFIER**
(Partial oxidation process)

- Gaseous Fuel
- Ash or slag
HPS Revenue Sources (Revenue per Plant)

<table>
<thead>
<tr>
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<th>2010</th>
<th>2014</th>
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<tbody>
<tr>
<td>Revenue</td>
<td></td>
<td></td>
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<tr>
<td>Electricity Gen.</td>
<td>95%</td>
<td>50%</td>
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<tr>
<td>CER Sales</td>
<td>0%</td>
<td>4%</td>
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<tr>
<td>RHC</td>
<td>5%</td>
<td>25%</td>
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<tr>
<td>Corp Partners</td>
<td>0%</td>
<td>21%</td>
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Husk Power Systems — Targeting a new paradigm in Social Impact

Villages  HPS
Up to Rs 60,000 per plant per month (Electricity and products)

Villages  HPS
> Rs 1 lakh per plant per month (Wages & Raw Material)  
Extra Income Generation to 100’s of households

Husk Power Systems

✓ Inception in Aug’ 2007
✓ More than 60 operational plants
  ✓ Catering over 300 villages and hamlets
✓ Capex less than $1 / Watt for Generation and distribution
  ✓ Cheaper than the conventional thermal
✓ World class team (IITs, ISB, Oxford, UT Austin, Darden, RPI)
✓ Over 40 months of operational experience
✓ A comprehensive training program
  ✓ HPS university curriculum to train operators, mechanics, managers and entrepreneurs
✓ A series of Technical Innovations
  ✓ Pre-paid meters, smart monitoring / smart grid, dry exhaust gasifier, absorption chiller
✓ A motivated team of more than 300 on-ground employees
✓ Excellent Investing partners
  ✓ IFC, Acumen Fund, Oasis Funds, LGT VP, DFJ, CISCO, Shell Foundation, MNRE
✓ Very strong commitment to HSSE
Husk Power Systems – Growth Models

- **BOOM – Build Own Operate Maintain**
  - Company’s ownership, operation, maintenance

- **BOM – Build Own Maintain** (only for individuals willing to either to be operators or tariff collectors)
  - For locations in existing clusters
  - Operations (raw material procurement, electricity sale and Tariff collection) by local entrepreneur
    - Entrepreneur’s share of capital cost < Rs 2.0 lakh
    - HPS share of the capital - rest
      - HPS owns the plant machinery and cables for a period of six years

- **BM – Build Maintain**
  - Agencies own and operate the plant (for large orders i.e > 50)
    - Cost per plant (including training and knowledge transfer) ~ Rs 15 lakh
    - MNRE Subsidy ~ Rs 7.5 lakh (after one month of operation)
      - 3-4 month’s gap between inception of project and release of subsidy
    - Franchisee fee to cover plant repair and non-regular maintenance
    - HPS to share revenue from monetization of addition streams

Husk Power Systems – Pricing

- **Cheaper than the alternative**
  - Kerosene costs more than Rs 150 per month
  - One charge of a 7 plate battery costs > Rs 10

- **Pricing the power rather than energy**
  - Per W rather than per kWh

- **The higher you consume the lesser you pay**
  - Two CFL and mobile charging @ ~Rs 12 / kWh
  - 1000 W @ ~ Rs 8 / kWh

- **Deliver the smallest package possible**
  - Average consumption ~ 50 W

- **Removing the tie to feedstock**
Husk Power Systems – Collection

• Use of circuit breakers
  – From the simple 6W bulbs to smart fuses and smart meters
• Pre-paid power
• Door to door collection
  – Very important
• Accounting discipline
  – Use of technology such as hand held devices
• Product fulfillment
• Proper incentive to the collector

Husk Power Systems – Pre-paid Meters
“Smart Grid”

Regional Operations

- Regional Manager (approx 30 plants)
  - Accountant
  - Regional Engineer
    - Cluster Manager (6 plants)
      - Operator
      - Collector
      - Cluster Engineer
      - Husk Loader
      - Electrician
      - Husk Acquisition team
      - Mechanics
HPS Sends over 250 kids to school