Sustainable Energy and Livelihoods
Poverty Line
Incremental changes prone to externality
Social security line/safety net
Fig. 1: Relationship between Safety Nets, Trajectory of Communities and Vulnerability of Communities across income/poverty levels and time
Shift from beneficiaries and end users to partners, investors and innovators

Safety nets in terms of assets and investments

Benchmarking Solutions and Services for the Poor

Blacksmith blowers
Efficient Looms

Solar Efficient Sewing Machine
Hawker Model

Power Hammer Milling
Milking Machine
Very High Income Group

High Income Group
under market conditions

Middle Income Group

Low Income Group

Very Low Income Group
not under market conditions

Abject Poverty
vulnerable communities like nomads, remote island dwellers, mining communities
Ecosystem for Sustainable Livelihoods

- Financial inclusion with patient and flexible asset based financing
- Human resource development at multiple levels
- Appropriate technology and design
- Need-based social linkages, content development, market linkages etc
- Social, financial and environmental inclusivity in policy making
Efficient huller, polisher, de-stoner etc for remote tribal and rural areas- dependent on diesel (4 more machines ready to scale by quarter 3 2018-2019 - (co-developed by 3 different local entrepreneurs/ manufacturers)
Efficient Roti Rolling Machine
Appropriate technology and design

Financial inclusion with patient and flexible asset based financing

Human resource development at multiple levels

Social, financial and environmental inclusivity in policy making

Need-based social linkages, content development, market linkages etc

Asset-based finance for an entrepreneur to own the machine

Micro-entrepreneur market linkage training for the roti rolling businesses

Accessible market linkages
Demand in local estuaries, hostels, marriages etc

Livelihood entrepreneurship income generation

Schemes and policies that support that system

Example of building the ecosystem for micro entrepreneurs to access appropriate technologies
Panel Discussion

How might we scale an ecosystem driven approach to sustainable energy for livelihoods?

Panelists

1. Bikash Pandey, Director of Clean Energy, Winrock International

2. Garrick Lee, Senior Energy Access Consultant, Efficiency for Access Coalition


4. Gigi Wing-Davies, Program Development Manager – Green Society, HIVOS

Moderator

Huda Jaffer, Lead, Design & Innovations, SELCO Foundation
Sustainable Energy and Livelihoods

A collection of 50 livelihood applications
ECOSYSTEM NEEDS

- Financing solutions: Financing based on perceived cash flows, partnerships with local financial institutions, affordable cost of capital, appropriate repayment mechanisms, appropriate ownership models (individual, operator, rental, community owned).
- Technology innovation: Access to efficient technologies which will build long-term assets/investments, technologies which cater to the actual need and capacity of the entrepreneur/cooperative.
- Training and capacity building: Last mile supply chains and after-sales service.
- Channels/linkages: Access to stable input sources (backward linkages), access to consistent or existing or newer linkages to sell end products.
- Policy: Awareness of informal/micro livelihoods in micro and small enterprise financial schemes, sustainable energy recognition in cross-sector specific schemes (agri, artisan, craftsmen, manufacturing etc), de-risking tools to unlock financing.

User & Livelihood’s Need

COTTON PICKING
- Harvesting of cotton buds
  - **User Group**: Cotton farmers and farm labourers
  - **Energy Intervention**: Hand-held cotton picking machine

GINNING
- Separation of cotton fibres and seeds
  - **User Group**: Mill workers at large scale mills or by weavers at small scale units
  - **Energy Intervention**: Ginning machine for short staple cotton

SPINNING
- Spinning of roved cotton yarn into threads
  - **User Group**: Skilled spinners at decentralized or centralized units
  - **Energy Intervention**: ‘Charkhas’ (Spinning Machines)

WEAVING
- Weaving of threads into cloth
  - **User Group**: Skilled weavers working at decentralized or centralized units
  - **Energy Intervention**: Looms for weavers

SEWING
- Stitching of cloth or other materials for various purposes
  - **User Group**: Individual home based entrepreneurs/tailoring units
  - **Energy Intervention**: Sewing machines of various capacities
DAIRY

MILKING
System of harvesting milk quickly and gently
- Energy Intervention
  Milking Machine

COLLECTION
Harvested milk collected at collection centres
- Energy Intervention
  Weighing and Testing

VALUE ADD
Shaking up the milk/cream to make butter
- Energy Intervention
  Butter Churners

POULTRY

LIGHTING
Keeps the chicks warm
- Energy Intervention
  Lights

BROODING
Nurturing chicks for 2-3 weeks before selling
- Energy Intervention
  Brooders

INCUBATION
Hatching of eggs
- Energy Intervention
  Egg Incubators
# Typologies of Technical Solutions

## Home Based
- **Type of Stitching:** Normal tailoring with straight stitching
- **Type of Materials:** Cotton, silk, synthetic, nylon, polyester
- **Products Manufactured:** Household tools, small hardware products, small agri tools
- **Market Linkage:** Individual orders and orders from shops

## Shop Based
- **Type of Stitching:** Normal tailoring with straight stitching
- **Type of Materials:** Plastic, cloth
- **Products Manufactured:** Bags (plastic fertilizer bags)
- **Market Linkage:** Individual orders and bulk orders from centres which are passed on to home-based tailors. Takes market linkage risk

## Cottage Industry
- **Type of Stitching:** Industrial tailoring with high speed, straight stitching
- **Type of Materials:** Leather, denim, plastic, cloth, jute
- **Products Manufactured:** Bags, uniforms, denims, gunny bags
- **Market Linkage:** Direct bulk orders from retailers which is given to the tailors employed at the centre

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## 60 W PMDC Motor

## 80 W PMDC Motor

## High Speed Universal AC Motor

<table>
<thead>
<tr>
<th>Component</th>
<th>PMDC Motor</th>
<th>High Speed PMDC Motor</th>
<th>High Speed Universal AC Motor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Power Consumption (W)</td>
<td>60</td>
<td>80</td>
<td>250</td>
</tr>
<tr>
<td>Operating Voltage (DC)</td>
<td>12V</td>
<td>12V</td>
<td>230V</td>
</tr>
<tr>
<td>Energy Requirement kWh (H)</td>
<td>240 (4 hours)</td>
<td>320 (4 hours)</td>
<td>1000 (4 hours)</td>
</tr>
<tr>
<td>Solar Module Wp</td>
<td>60</td>
<td>60</td>
<td>250</td>
</tr>
<tr>
<td>Battery Ah, V</td>
<td>30 Ah, 12V</td>
<td>110 Ah, 12V x 1</td>
<td>80 Ah, 12V x 2</td>
</tr>
<tr>
<td>Inverter VA</td>
<td>NA</td>
<td>800 VA</td>
<td>800 VA</td>
</tr>
<tr>
<td>Stitches/Minute</td>
<td>1</td>
<td>300</td>
<td>2000-2500</td>
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</tbody>
</table>
## Types of Blacksmiths

### 1. Nomadic
- **Products Manufactured:** Household tools, small hardware products, small agri tools, cultural products
- **User Group:** Nomadic - travelling constantly on predefined routes, making metal products and selling them in villages on the way and returning to their home village once a year.
- **Monthly Income:** INR 10,000 - 15,000
- **Labour Requirements:** Family members engage in the task with occasional assistance from customers.
- **Tools Used:** Manual blowers, hand cranked wheels, manual angle grinders and hammers

### 2. Small Scale
- **Products Manufactured:** Household tools, small hardware products, small agri tools, cultural products
- **User Group:** Small workshops, usually adjacent to the home or near a market place; livelihood seasonal; dependent primarily on agri session
- **Labour Requirements:** Basic blacksmith tools, power hammers, angle grinders
- **Tools Used:** Manual blowers, hand cranked wheels, manual angle grinders and hammers

### 3. Mid-Scale
- **Products Manufactured:** Agri tools or machinery, gates, railings, hardware products, automotive garages
- **User Group:** Small workshops - usually near a market place; primarily dependent on the agri season
- **Labour Requirements:** Hire 2-3 labourers depending on the workload expenditure INR 250 - 400 per day for hand cranked blowers + hammering

### 4. Large Scale
- **Products Manufactured:** Agri tools or machinery, gates, railings, automotive components, customised products, lifestyle products
- **User Group:** Fabrication workshops - usually near the marketplace; caters to wide variety of customers
- **Labour Requirements:** Highly skilled tradesperson employed, expenditure INR 400 - 500 per day for hand cranked blowers + hammering

### Solar Powered Portable or Fixed Blowers

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<th>2. Small Scale</th>
<th>3. Mid-Scale</th>
<th>4. Large Scale</th>
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<td><strong>Monthly Income</strong></td>
<td>INR 10,000 - 15,000</td>
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<td>INR 15,000 - 25,000</td>
<td>INR 25,000 - 60,000</td>
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<tr>
<td><strong>Labour Requirements</strong></td>
<td>Family members engage in the task with occasional assistance from customers.</td>
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<td>Hire 2-3 labourers depending on the workload expenditure INR 250 - 400 per day for hand cranked blowers + hammering</td>
<td>Highly skilled tradesperson employed, expenditure INR 400 - 500 per day for hand cranked blowers + hammering</td>
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<td>Basic blacksmith tools, power hammers, angle grinders</td>
<td>Power hammers, Heavy duty bending Jig, Quick change conversion dies, Lathe machines, Oxy - Acetylene and arc welding</td>
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OWNERSHIP MODELS

HOME BASED ENTREPRENEURS (Individual ownership)

CONSUMER
Smaller shops, Temples, Rural and urban hotels

AVG. PROFIT PER MONTH
INR 12,000-15,000 (INR 4 per roti)

LABOUR
Family members support in preparation, market linkage and delivery

FINANCIAL MODEL
Selling 200 rotis a day at an average, and with existing financial products
20% of the profit per month, would pay back the loan in 2 years

ENTERPRISE MODEL (employing multiple members with clear task division)

CONSUMER
Smaller shops, Canteen, temple, weddings, restaurants

INCOME (AVG)
INR 30,000 (INR 4 per roti)

LABOUR
The Self Help Group (SHG) and shared ownership model for the enterprise results
in profit being shared between its different members equally. The tasks in the
enterprise are divided, and no extra labour costs are incurred.

FINANCIAL MODEL
Selling 400 rotis a day at an average, and with existing financial products
10% of the profit per month, would pay back the loan in 2 years

CANTEEN, RESTAURANTS

CONSUMER
students, families, neighbours, local community

INCOME (AVG)
INR 40,000 - 50,000 (INR 10 per roti)

LABOUR
Women and young boys from the local community are employed to handle
various tasks related to meal preparation, cooking and cleaning.

FINANCIAL MODEL
Selling 400 rotis a day at an average, and with existing financial products
15% of the profit per month, would pay back the loan in 1 years
**IMPACTS**

**IMPROVED HEALTH & WELLBEING**
All the blacksmiths where interventions were carried out, reported a reduction in impact of injuries related to physiological and upper limb musculoskeletal disorders (MSD). This has improved the health and wellbeing of not only blacksmiths, but of children and women engaged in the livelihood.

**INCREASED PRODUCTIVITY**
With the additional provision of lighting, the workshop operational hours gets extended by 2-3 hours per day thereby improving their productivity during peak season.

- Percentage increase in productivity of the blacksmith: $+20 - 30\%$

**INCOME INCREASE**
Without the additional requirement of a typically difficult to find and expensive labourer, the expense component for the blacksmith has come down drastically.

- Percentage decrease in operational expenses of the blacksmith: $-45\%$
Video Link