Using Solar Energy for improving Livelihood in Rural India - Vigyan Ashram's Experiences

Log of Work In Progress

Work carried out under financial support of Dept of Science and Technology (SEED Division), Govt of India.

www.dsttara.in
Village Pabal.. Approx 300kms from Mumbai (Western Part of India)

Training rural youth to establish technology based enterprises.

Technologies → Improve Productivity → Reduce drudgery : → Energy .. Energy .. Energy
LED light for rural lighting

i) Won ‘Development Marketplace 2013’ award by World Bank and trained 327 rural youth in Madhya Pradesh and Chattisgarh. They sold @ 3000+ light units till 2015.

ii) Formed Bottom of the Pyramid Energy and Environmental Solutions Pvt Ltd. To manufacture LED lights.

Till 2015:
12 Solar Gram in tribal areas of MP -- 100% household having LED lights made by us.
Livelihood Opportunities in Villages

- Food Processing – Heating
- Food processing – Dryer
- Agriculture (Water Pump / Fans for poly house)
- Machines / Rotary Motion

A) Solar Thermal
B) DC to DC Solar appliances
Roasting of groundnut

5 Kg peanuts: Roasted: Time required is 1 hour
Temperature: 160°C.
Cost saving: 35 gm LPG per Kg (Rs.2 (1.5 cents) per kg)

Work remaining to be done:
Central processing facility for roasting? Self Help Group offering Service at cost? Business model to be developed

Roasting of Rava (Semolina)

https://vipul570blog.wordpress.com/solar-drum-roaster/
<table>
<thead>
<tr>
<th>Evaporative Cooking</th>
<th>Making Tomato Sauce / Thickening Milk (Basundi)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Evaporative Cooking" /></td>
<td><img src="image2" alt="Making Tomato Sauce" /></td>
</tr>
<tr>
<td><img src="image3" alt="Evaporative Cooking" /></td>
<td><img src="image4" alt="Making Tomato Sauce" /></td>
</tr>
</tbody>
</table>

### For Sauce making:
- **Quantity:** Max. 30 kg tomatoes
- **Time:** 3 hours
- **Focused temperature:** 200°C

### Advantages:
- Quality / Taste: Better
- Fuel saving: Rs.6 per Kg

### For Khoya making:
- **10 litre milk to made into Khoya to make Gulab-Jamun**
- **Time spent is:** 4 hours
Most of the appliances available are for AC.

Additional cost associated with DC - DC - AC conversion

→ DC motors are 70% more efficient than AC

→ Solar energy is manufactured in decentralized way. DC – DC appliances are useful
## Economics of DC WATER PUMP AT VIGYAN ASHRAM

@ Aquaponics System at Pabal

<table>
<thead>
<tr>
<th>AC Pump on Solar</th>
<th>DC Pump on Solar</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pump required : 1 HP (746 watt)</td>
<td>Equivalent Pump Required : 350 watt</td>
</tr>
<tr>
<td>Pump cost : Rs. 4000/-</td>
<td>Pump cost : Rs. 8131/-</td>
</tr>
<tr>
<td>With Solar Panel : Rs. 55,000/-</td>
<td>With solar panel : Rs. 22,269/-</td>
</tr>
<tr>
<td>Pay back period : 3.5 yrs</td>
<td>Pay back period : 1.3 yrs</td>
</tr>
</tbody>
</table>

Problems:
- Unavailability of DC pumps in the market
- Typically AC pumps are sold with DC systems
- Initial Cost of DC pumps. More HP is not required. Appropriate head and flow.

Immediate Application:

i) Polyhouse air circulation

ii) Blower for dryers

iii) Cooling of homes

iv) Chauffer / fodder cutting machine

v) DC motors for food appliances
Making Ladoo

- Roasting of flour on slow heat
- Continuous stirring to avoiding charring of floor

Installed 1 unit
Work in progress to increase Batch Size from 1 kg to 4 kg per
Automated .. Want to pilot 5 units

Cooler for Vegetable vendor

Problem:
20-25 % weight loss per day – Direct loss
Vegetables do not looks fresh. Gets spoiled.

Piloted a Cooling unit using solar
- 20-25 degree Celsius
- 60% humidity
- Reduce weight loss

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Vegetables</th>
<th>% weight loss</th>
<th>Store period</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Fenugreek</td>
<td>1.48%</td>
<td>3 days</td>
</tr>
<tr>
<td>2.</td>
<td>Cabbage</td>
<td>1.12%</td>
<td>6 days</td>
</tr>
<tr>
<td>3.</td>
<td>Tomato</td>
<td>2.51%</td>
<td>8 days</td>
</tr>
<tr>
<td>4.</td>
<td>Bottle Guard</td>
<td>1.34%</td>
<td>5 days</td>
</tr>
<tr>
<td>5.</td>
<td>Coriander</td>
<td>0.99%</td>
<td>4 days</td>
</tr>
</tbody>
</table>

http://fab.academy.org/2018/labs/fablabvignesharm/students/komal-raut/
<table>
<thead>
<tr>
<th>Conventional Solar Dryer</th>
<th>Dome Dryer</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less batch capacity</td>
<td>High Batch capacity</td>
</tr>
<tr>
<td>Heat capture is limited due position and location</td>
<td>Higher heat capture irrespective to position and location</td>
</tr>
<tr>
<td>High manufacturing cost</td>
<td>Low manufacturing cost</td>
</tr>
<tr>
<td>Process control NO</td>
<td>Process control YES</td>
</tr>
<tr>
<td>Loss of quality of product</td>
<td>High quality of Product</td>
</tr>
<tr>
<td>Easy to operate</td>
<td>Skill required</td>
</tr>
</tbody>
</table>

https://vadic2016shubhamshembade.wordpress.com/
**Solar for Art and Crafts**

<table>
<thead>
<tr>
<th>AC Laser / Router</th>
<th>DC Solar Laser / Router</th>
</tr>
</thead>
<tbody>
<tr>
<td>High cost of CO2 Laser / routers</td>
<td>Only have needed functionality</td>
</tr>
<tr>
<td>Very quality Earthing requirement make it unsuitable for rural areas</td>
<td>DC supply .. No worry about Earthing requirement</td>
</tr>
</tbody>
</table>
Summary:

1) Innovations are needed in AC-grid based appliances to Solar-DC based appliances.

2) Design and technical collaboration to perfect the solution into quality products.

3) Lots of scope in rural areas for use of solar energy
   - Thermal application
   - Rotary motion appliances

3) Create success stories and case studies for propagation.

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