Solar powered irrigation pumps (SPIP) in South Asia

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Kathmandu, Nepal

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## Country wise adoption of SPIP

<table>
<thead>
<tr>
<th>Country</th>
<th>Estimate of total Units Installed*</th>
<th>Official Targets for SPIP**</th>
<th>Qualified Companies for solar pumping systems***</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bangladesh</td>
<td>391</td>
<td>50,000</td>
<td>13</td>
</tr>
<tr>
<td>India</td>
<td>13964</td>
<td>1,000,000</td>
<td>19</td>
</tr>
<tr>
<td>Nepal</td>
<td>85</td>
<td>No Target Yet</td>
<td>43</td>
</tr>
<tr>
<td>Pakistan</td>
<td>NA</td>
<td>30000</td>
<td>139</td>
</tr>
</tbody>
</table>

*Bangladesh – Pumps installed by IDCOL and Hossain et al (2015); India - NABARD, 2014; Nepal - 81 pumps for drinking water purpose have been installed in the mid-hills and 4 pumps installed by ICIMOD

**Bangladesh - Target for 2025; India - Target for 2020-21, Pakistan - Proposed by Pakistan Solar Association

***Official Government websites
India has subsidy led models for uptake of SPIP


• MNRE target is to install 1,00,000 SPV water pumps with a financial support of INR 400 crores during 2014-15 (target was not met, money remained unspent).

• Government of India has supported adoption of SPIP through subsidies and loan arrangements.

• NABARD has 40 (grant):40 (loan): 20 (equity) model
## State level Subsidies in India

<table>
<thead>
<tr>
<th>State</th>
<th>Central Government Subsidy</th>
<th>Current State Level Subsidy</th>
<th>Total Subsidy</th>
<th>SPV pumps installed till 2014-15</th>
</tr>
</thead>
<tbody>
<tr>
<td>Andhra Pradesh</td>
<td>30%</td>
<td>59%</td>
<td>89%</td>
<td>-</td>
</tr>
<tr>
<td>Bihar</td>
<td>30%</td>
<td>60%</td>
<td>90%</td>
<td>139</td>
</tr>
<tr>
<td>Gujarat</td>
<td>30%</td>
<td>65%</td>
<td>95%</td>
<td>85</td>
</tr>
<tr>
<td>Haryana</td>
<td>30%</td>
<td>30%</td>
<td>60%</td>
<td>469</td>
</tr>
<tr>
<td>Karnataka</td>
<td>30%</td>
<td>60%</td>
<td>90%</td>
<td>551</td>
</tr>
<tr>
<td>Punjab</td>
<td>30%</td>
<td>40%</td>
<td>70%</td>
<td>1857</td>
</tr>
<tr>
<td>Rajasthan</td>
<td>30%</td>
<td>56%</td>
<td>86%</td>
<td>4501</td>
</tr>
<tr>
<td>Tamil Nadu</td>
<td>30%</td>
<td>50%</td>
<td>80%</td>
<td>829</td>
</tr>
</tbody>
</table>

*Various sources*
India: Current financial models exacerbate inequities

• Adoption is limited to medium and large farmers.
• Demand of NABARD loan cum grant model is depressed due to high subsidies.
• More adoption in groundwater scarce regions (west and south), than in groundwater abundant eastern part.
• Likely to increase inequity in terms of access and exacerbate gw over-exploitation in already over-exploited area
Commercial model in Pakistan: Only large farmers benefit

• Very less subsidy. Large farmers adopt due to lack of electricity and high cost of diesel.

• Large commercial farmers, who can afford SPIP by paying full cost invest in these systems.

• Government of Pakistan is proposing to install 30,000 SPIP in the next three years through loan financing for small farmers.

• Loan amount to not exceed 1,000,000 Pakistani Rupees and repayment period is within one year to be done in equal half-yearly instalments.

• Falling ground water level is a concern in Pakistan.
Fee for service models in Bangladesh

• Fee for service model: Farmers buy water from private companies/NGOs
• Private companies/NGOs/Farmers can buy pumps using 50 (grant): 35 (loan): 15 (equity) model. They sell water farmers
• This model is successful in providing SPIP accessibility to small and marginal farmers.
• Currently 445 SPIP have been approved for installation under this model. Of them, 196 are in operation.
• Water distribution and payment collection are some of the major challenges for the success of this model.
• SPIPs used intensively in boro (summer) season. Rest of the year, panels lie idle
SPIP in Nepal

• AEPC administers a subsidy (75%) to promote community solar pumps for drinking water, but there is not yet an official government policy for SPIP.

• Several international development organizations are piloting demonstration projects to showcase the technology (e.g. ICIMOD, IDE, Winrock).

• IDE and Winrock are promoting very small pumps for kitchen garden and specifically targeting small and marginal farmers

• ICIMOD has piloted 1HP (1200w) and 2HP (2400w) pumps

• Objective is to find Sustainable Financial Solutions for Upscaling
Low Subsidy

Large farmers benefiting

Small Farmers benefiting

Pakistan

India

Bangladesh

Nepal??

High Subsidy

Large farmers benefiting

Small Farmers benefiting
WLE pilot of SPIP in Saptari

• In August 2015, ICIMOD installed four SPIP systems in Saptari district of Nepal. These systems have been provided for demonstration purposes for a year.

• Starting April 2016, we will run a Randomized Control Trial to test the impact of three financial models on demand for SPIP
  • Subsidy model: 40% subsidy: 60% equity
  • Loan model: 40% subsidy: 40% loan:20% equity
  • Rental model: Pay monthly rent

• Special rates for women and very small/marginal farmers who apply as a group (subsidy up to 60%)
## Description of sites

<table>
<thead>
<tr>
<th>Site location (VDC)</th>
<th>Type of pump</th>
<th>Beneficiary</th>
<th>Number of farmers utilizing</th>
<th>Total command area (hectares)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Haripur</td>
<td>1 HP</td>
<td>Farmers’ association</td>
<td>4</td>
<td>2.3</td>
</tr>
<tr>
<td>Boriya</td>
<td>1 HP</td>
<td>Male farmer</td>
<td>1</td>
<td>2.7</td>
</tr>
<tr>
<td>Rayapur</td>
<td>1 HP</td>
<td>Female farmer</td>
<td>6</td>
<td>2.4</td>
</tr>
<tr>
<td>Hardiya</td>
<td>2 HP</td>
<td>Water seller</td>
<td>11</td>
<td>3.8</td>
</tr>
</tbody>
</table>
1 HP pump for farmers’ association in Haripur

Training on basic do’s and don’ts

Training on collecting data from flow meter
Women farmers with 1 HP pump in Rayapur

Flow meter installed to measure discharge

Women farmers operating the system
2HP system in Hardiya

Panels need to be cleaned regularly to increase flow

Wife of the water seller can also operate the system
Total Hours of utilization of SPIP (Aug-Feb)

- Haripur (1 HP): 405
- Hardiya (2 HP): 150
- Rayapur (1 HP): 212

Total discharge (‘000 liters) (Aug-Feb)

- Haripur (1 HP): 4368
- Hardiya (2 HP): 3649
- Rayapur (1 HP): 2161
Hours of Utilization of SPIP by crop type

- Paddy: 343 hours
- Vegetables: 353 hours
- Wheat: 39 hours
- Mustard: 8 hours

Crop Area (in kathas) vs Hours of Solar
## Impact on SPIP on cropped area

<table>
<thead>
<tr>
<th>Cropped area (kathas)</th>
<th>Treatment (farmers with access to SPIP) N=22</th>
<th>Control (farmers without access to SPIP) N=13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1 (before SPIP)</td>
<td>454</td>
<td>97</td>
</tr>
<tr>
<td>Year 2 (after SPIP)</td>
<td>499</td>
<td>89</td>
</tr>
<tr>
<td>Difference</td>
<td>45</td>
<td>-8</td>
</tr>
<tr>
<td>Difference in difference (Addition in area cropped attributable to SPIP)</td>
<td>+ 53 kathas</td>
<td></td>
</tr>
</tbody>
</table>
## Impact of SPIP on diesel savings

<table>
<thead>
<tr>
<th>Diesel cost/katha</th>
<th>Treatment (farmers with access to SPIP) N=22</th>
<th>Control (farmers without access to SPIP) N=13</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year 1 (before SPIP)</td>
<td>248</td>
<td>240</td>
</tr>
<tr>
<td>Year 2 (after SPIP)</td>
<td>28</td>
<td>141</td>
</tr>
<tr>
<td>Difference</td>
<td>-220</td>
<td>-99</td>
</tr>
<tr>
<td>Difference in difference</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Savings in diesel attributable to SPIP, Rs/katha)</td>
<td></td>
<td>-121</td>
</tr>
</tbody>
</table>
Diesel utilization has fallen drastically

Diesel Cost for irrigation in all sites

- Paddy
- Vegetables
- Wheat

Some Quotes...

• Amrica Devi Yadav – from Rayapur
  ➢ “SPIP has made irrigation less physically intensive, allowing me to operate it comfortably”.

• Ramakant Choudhary – from Haripur
  ➢ “SPIP water is enough to irrigate about 3 Bighas of land. It helped to save our diesel cost from the earlier year and we are hoping to earn much this year. If we got a bigger system then the existing one, we are planning to increase our command area and the production too.”

• Jiten Yadav – from Hardiya
  ➢ “Post-SPIP command area has been increased from earlier by around 8 Kattha, 2 new customer has been using water from SPIP to irrigate crops.”
Thank you