Solar Irrigation Pumps (SIPs) in Nepal Update and results from Year 1

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Solar Irrigation for Agricultural Resilience in South Asia (SoLAR-SA) Project
Regional Forum
23-24 Feb, 2021 Virtual

Innovative water solutions for sustainable development
Food · Climate · Growth
## Project plan vs. achievements

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<th>Activities planned</th>
<th>What we did in Y1</th>
<th>What remains to be done in Y2</th>
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<td><strong>Impact evaluation (IE) of SIP:</strong></td>
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<td>1. What are the impacts of SIP on crop production, irrigation hours, and livelihood outcomes?</td>
<td>A. IE design, sample size, site selection, vendor selection, survey questionnaire&lt;br&gt; B. Rapid assessment of AEPC’s SIP program, results shared with AEPC as a report and webinar</td>
<td>Survey of 675 farming households, IE report and a research paper</td>
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<td>2. Who receives government subsidy for SIP? Is subsidy delivery equitable?</td>
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<td><strong>Qualitative Gender and Social Inclusion (GESI) study</strong></td>
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<td>1. How GESI responsive are solar energy related policies and programs in Nepal and Bangladesh?</td>
<td>A. Research methodology design&lt;br&gt; B. Literature based GESI analysis [policies &amp; programs]</td>
<td>GESI case studies in three different SIP models implemented by AEPC, IWMI and ICIMOD</td>
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<td>2. Is SIP beneficial for women and marginal farmers?</td>
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<td><strong>A demonstration pilot</strong>&lt;br&gt;Is Micro-grid connection a solution to full utilization of SIP?</td>
<td>A. Global literature based analysis on institutional modality&lt;br&gt; B. National forum on institutional modality</td>
<td>Techno-institutional modality design and implementation for micro-grid connection</td>
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<td><strong>Capacity development of local technicians on SIP &amp; knowledge forums</strong></td>
<td>A. Curricula design and participants finalization&lt;br&gt; B. National knowledge forums</td>
<td>Deliver the training National knowledge forum</td>
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Who received government subsidy for SIP?
Is subsidy delivery equitable?

*Rapid Assessment results*
SIPs are mostly in Tarai. Average cost is 2.6 lakh rupees

- 1,384 SIPs installed with AEPC’s subsidy; 1,800 total
- Rate of approval of SIP subsidy is 31%, slightly higher in provinces 2 and 5
- Tarai provinces (P1, 2, and 5) account for
  - 75% of applications and 85% of the subsidized SIPs. Same pattern for districts and palikas too.
- Avg. cost of SIP was 2.6 lakh rupees, consistently high for all pump sizes across all provinces.
  - Even with 60% subsidy, small-scale farmers cannot afford SIP.
Who received SIPs? Among applicants, small-holders were prioritized

• From the pool of applicants, AEPC clearly prioritized small-holders (with farm size of less than 3 bigha).

• However, our discussion with farmers and some key informants in province 2 indicated that small holders and tenant farmers were discouraged from applying for SIPs, locally.

• Primary reason cited by the farmers was the mandatory submission of land holding certificate and local palika’s recommendation.

• Another reason was lack of information. Only few large holders with better social connection knew about SIPs.
Who received SIPs? Female-headed households were prioritized

- The pool of applicant consisted 19% female-headed and 81% male-headed households, but 22% of SIPs went to female-headed households.
- AEPC did prioritize female-headed households if they met eligibility criteria.
- Even though AEPC prioritized small-holders and female-headed households in selection process, most beneficiary farmers were relatively well-off farmers. Probably because:
  - In the ground, small-holders, marginal communities, and tenant farmers were excluded in the application stage.
  - More than 80% of applications were received through vendors, thereby marginal farmers with poor social network were unaware of the call.
  - According to local governments, it was very difficult for them to be as inclusive as they wanted to, due to very small number of SIPs available.
How GESI responsive are solar energy related policies and programs in Nepal and Bangladesh?  
*Presenting the case of NEPAL*
What did we set out to do and how?
Methodology and key questions

- How has GESI been considered in the national legal/policy frameworks?
- Has GESI been addressed in energy policies and documents from the chosen policy areas? If yes, what does this conceptualisation look like?
- What is the status of SIPs in the two countries (provision, incentive measures, key actors and beneficiaries)?
- What are GESI gaps and missing considerations in these policies and programs?

SECONDARY REVIEW:
National policies on Agriculture, Irrigation, Energy, Water, Gender. Related projects and scientific literature on the same.
## The characterization of GESI in some major Renewable Energy Policies

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<th>Recognizes gender in some form</th>
<th>GESI is part of the policy explicitly</th>
<th>Women as bearers of traditional energy use burden</th>
<th>Recognizes energy need differentials</th>
<th>Understands barriers to participation in decision-making</th>
<th>Improve access</th>
<th>Inclusion linked to sustainability</th>
<th>Introduces ways to address barriers</th>
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<td>Rural Energy Policy 2006</td>
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<td>National Energy Strategy 2013</td>
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<td>Renewable Energy Subsidy Policy and Delivery Mechanism 2016</td>
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<td>AEPC GESI Policy 2018</td>
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Motivation for gender inclusion in energy policies

- Promoting gender equality and empowerment
- Promoting welfare
- Promoting efficiency

Skutsch (1998)
Major findings:

Assumption 1: Macro energy policies affect men and women equally

Assumption 2: Addressing gender in energy is related to promoting fuel-efficient cooking

Assumption 3: Increasing women professionals in energy sector will solve all problems

Policies are welfare-focused than empowerment focused

Access understood as a blanket monetary problem for all

Lack of women or targeted minority specific approaches to increase RET for irrigation uptake

Discretionary use of criteria – such as requirement of land ownership papers - makes marginalized farmers dependent on the ‘benevolence’ of the implementer

Policy evolution shows greater understanding of gender progressively

Implementing agency stands as GESI aware – implementation?
Is micro-grid (MG) connection a solution to full utilization of SIP?

*Learning from national forum and scoping visit in demonstration pilot site in Nepal*
Relevance of MG connected SIP in Nepal in 2021

Reflection from National Forum

- Availability of Grid Infrastructure
- Farmers would probably Prefer electric pump due to low tariff of NPR 4.3
- Voltage fluctuation and Capacity of Grid infrastructure
- Economic sense for NEA
- Sustainability of Ground Water
- Increase Capacity Utilization Factor of SIP through Grid connection
- Role of Local Government
MG Connected SIP Pilot in Province 2

- Identifying suitable site for piloting → **Targeting**
- **Detailed Feasibility study**
- Procure a service provider for installing 15 kW Micro-Grid (M. G.) System & Install
- **Develop a framework for impact evaluation & parameters for monitoring**
- Continue **Monitoring** the parameters

**Site Prioritization**
Technical, Social, Economic, Environmental, Institutional

**Parameters to Monitor**
Energy, Income, Perception, GESI, Water output, etc
Site Identification

Sambhawata Village, Ward 2
Chhipaharmai Rural Municipality
Parsa district, Nepal

- Public land available for shifting Solar Panels
- RM willing to invest additional funds
- Female population: 48%
- Number of Ethnicity: 22
- Number of SIP installed: 18
- Solar Panels: 50.18kWp
Grid-connected SIPs

Key Attributes - Institutional models

1. Benefit/Energy Sharing Mechanisms
2. Regulatory Approach
3. Capital Investment
4. Business Model
5. Ownership Model
6. Beneficiaries

Typologies

1. Direct net-metering of solar pump system
2. Solar micro-grid (MG) system
3. Solar-powered Agricultural feeder
4. On-Grid Solar Pump Inverter

Fig.: Schematic of the 15 kW M. G. system
Activities for MG connected SIP

Site Identification
- Reviewed 22 Rural Municipalities data
- Site Periodization Matrix and shortlisted 8 candidate sites
- Field visit covering 5 districts

Institutional Models Review
- Review of Institutional models

Alignment after the Covid19 Lockdown
- Alignment meeting between IWMI, AEPC and NEA
- Rural Municipality Onboarding
Roadmap for MG connected SIP Pilot

- **Mar**
  - Partnership Framework
    - Alignment Meeting
    - Stakeholder Onboarding
    - MOU

- **Apr**
  - Procurement
    - Equipment Procurement
  - Installer Contract
    - Installation Contractor

- **May**
  - Feasibility Study
    - MG Consultant
    - Feasibility Report
    - Installer TOR
  - Monitoring Framework

- **Jun/Jul**
  - Installation
    - MG Installation
    - Grid connection
    - Commissioning
  - Baseline Survey

- **Aug**
  - Reporting
    - Technical Report
    - Net-metering

- **Sep-Dec**
  - Monitoring
    - Report for 2021
    - LFA on board
Capacity development and policy engagement in Nepal
Learning exchange and policy engagement for inclusive SIPs in Nepal

• **42 hr. SIP training for local SIP technicians:** Improved access to SIP technical services timely and locally, and shifting gender roles through promoting women in SIP discourse and technical skills

• **Policy engagement and knowledge forum:** Institutional modality of MG-connection to SIPs [1], and rapid assessment findings sharing [1] and CPMC meeting [2]

• **Knowledge production and exchange:** subsidy mechanisms [2], Covid-19, agriculture and water nexus, [2] micro-grid institutional modality, [1] and GESI policy and program review [1]

SIP Technician Training Modules:

I. Basic concept of Solar PV and SIP, policies and barriers

II. SIP Installation/Maintenance and Load analysis

III. Battery, its sizing and specification

IV. SIP Inverter/Converter (Controller), Installation/ Maintenance and Sizing

V. Pumps types, suitability, causes of breakdown & O/M techniques, markets

VI. Other accessories, installation & post-installation safety

VII. Field trip

VIII. GESI barriers and opportunities for SIP access, adoption and sustainability
Takeaways

1. The AEPC SIP subsidy delivery mechanism is doing well in raising interest and awareness about the technology and is trying to prioritize those with relatively less land in their process; but actual smallholders are still not being tapped into by the project due to farmers’ economic and social capital constraints.

2. Energy policies are progressively intending to benefit women and marginalized groups by ensuring their access to energy technologies, but the conceptualization of GESI is often limited and dissuaded by lack of concrete measures.

3. Micro-grid connection to SIP can be a solution for full utilization of SIPS, but needs piloting to understand which institutional modality would facilitate MG connection and water allocation among farmers.

4. SIP technician training can benefit SIP local technicians and farmers.
Discussion: 20 min
Thank you

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IWMI-Nepal: Out reach, knowledge products


• **OpEd-03**: Vishnu Pandey & Sagar Gyawali. Can grid connected solar irrigation pumps be the future of irrigation in Nepal? (under review with Kathmandu Post)


• **Working paper** [draft ready]: GESI in policies of SIP in Nepal and Bangladesh