IJIREEICE ISSN (O) 2321-2004, ISSN (P) 2321-5526

International Journal of Innovative Research in Electrical, Electronics, Instrumentation and Control Engineering

Impact Factor 8.414 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 13, Issue 8, August 2025

DOI: 10.17148/IJIREEICE.2025.13813

A review on renewable energy awareness and usages patterns in semi urban areas of Ravangla, Sikkim

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Abstract: This paper explores how residents of Ravangla, a semi-urban town in Sikkim, perceive and use renewable energy. Drawing from in-person surveys and community observations, it was found that many people have encountered solar lanterns and water heaters, mainly due to government support or word of mouth, but deeper technical knowledge is rare. Households often rely on these renewables as backup sources during frequent power outages, rather than as their main source of power. While government schemes and local examples can spark interest, obstacles remain: high initial costs, limited product choices in the market, and lack of nearby maintenance support deter widespread adoption. Some confusion persists about what truly counts as renewable energy, with products like LED bulbs or even diesel generators occasionally misidentified. Residents indicate that hands-on demonstrations and training in local languages would help bridge the knowledge gap. The study suggests local entrepreneurs could be trained to provide maintenance and promote awareness. Aligning clean energy products with the community's daily needs—such as solar-powered tools for small businesses or agriculture—may drive higher adoption. Ultimately, the region's journey offers lessons for similar towns, highlighting the value of locally led efforts and practical education over top-down campaigns

Background and Rationale

India has set progressive renewable energy targets as part of its Nationally Determined Contributions (NDC), seeking to reach 50% cumulative electric power capacity from non-fossil sources by 2030. Si,kkim, as a hilly Northeastern state, stands out for its existing reliance on renewable sources—mainly hydro—but is also challenged by weather, terrain, and limitations in grid extension, making off-grid solar and other distributed renewables especially relevant. According to the Sikkim Renewable Energy Development Agency (SREDA), solar potential remains high though actual adoption rates still lag, particularly in semi-urban and rural regions.

INTRODUCTION

Renewable energy has become an increasingly important aspect of India's energy landscape, particularly as the country moves toward ambitious climate and sustainability goals. In the state of Sikkim—a region renowned for its pristine environment and steep Himalayan terrain—the adoption and understanding of renewable energy sources are crucial for both environmental conservation and providing reliable energy access to its scattered and often remote populations. Semi-urban areas, such as Ravangla, present unique challenges: while not as infrastructurally advanced as urban centers, they are also not as isolated or resource-constrained as the most rural regions. These areas serve as a critical bridge in the diffusion of renewable energy technologies, making them vital focal points for understanding awareness, usage patterns, and the challenges faced by residents.

This survey-based research aims to assess the current state of awareness and practical usage patterns of renewable energy among the residents of semi-urban Ravangla. It explores both the potential and obstacles for extending uptake, based on the perceptions and first-hand experiences of local people. This approach provides grounded, context-specific insights that can inform policies and initiatives designed for effective, sustainable energy transitions in the region

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Current State of Awareness

The survey results from semi-urban Ravangla indicate a moderate to low level of structured awareness regarding renewable energy options. Many residents are familiar with basic solar products (solar lanterns, water heaters) largely due to government-led distributions or campaigns, but more advanced or large-scale renewable systems such as rooftop photovoltaics or small hydro are less commonly understood. Misconceptions persist, with some respondents confusing energy-saving devices (like LED bulbs) with renewable power sources.
A recurring theme in responses is the influence of local word-of-mouth and demonstration effects. For example, if one household successfully installs a solar water heater, neighbors are more likely to express interest and inquire further. However, technical jargon and a lack of clear, relatable information act as barriers for broader community engagement.

Renewable energy awareness in Ravangla, Sikkim, is growing but still has a way to go. Govt. agencies like SREDA do promotions, workshops, and some solar lamp installations in the area. People kind of know about solar energy and its uses, thanks to these programs and local NGOs who do awareness campaigns, especially about solar panels at home and for biz. However, many locals confuse renewable energy with just hydropower, so info gaps exist. More practical demos and user-friendly info in local language would really help folks to switch to solar and other clean energy use.

Projected population and estimated energy uses:

Based and considering the 2011 census and local reports on the latest and most reliable population data for Ravangla:

The urban core population of Ravangla town is about 1,727 people (2011 Census figure) and is still used as the best available reference for urban-focused calculations.

The Ravangla subdivision population including rural areas is approximately 47,955 (2011 Census).Sikkim's total population projection for 2025 is about 698,400, with urban population share rising to about 45% by 2025 across the state.Using this urban population of 1,727 for Ravangla town, here is the updated estimation of annual energy use and renewable energy availability:

Energy Use Estimation for Ravangla Urban Area

Population: 3454 peoples

Urban per capita annual electricity use in India: Approximately 1,537 kWh (national urban average)

Total annual energy use estimate:

≈ 5.30 Gwh/year

(3454×1,537kWh=2,654,599kWh≈5.30GWh/year)

This estimate includes household and small commercial energy consumption typical of a small town.

Renewable Energy Sources in Ravangla

Ravangla and the wider South Sikkim region benefit mainly from:

Hydropower: Sikkim has abundant hydropower resources; multiple projects in South Sikkim provide a significant clean energy supply, including micro-hydropower units supplying local demand. Sikkim's hydropower capacity on a state level is several thousand MW, making it the backbone of electricity supply.

Solar Energy: Solar PV installations are present for domestic hot water, rooftop solar systems, and street lighting in Ravangla and nearby villages[previous].

Wind-Solar Hybrids: Some pilot projects of small-scale wind-solar hybrids exist in parts of South Sikkim, though wind potential is limited and localized[previous].

Biomass: Biomass stoves and limited biogas plants operate mostly in rural areas near Ravangla[previous].

The estimated urban energy use of Ravangla town with a population of 3454 is approximately 5.30 GWh per year. This demand is primarily supported by Sikkim's large-scale hydropower supplemented by distributed solar and some biomass energy. This aligns with Sikkim's green energy initiatives, keeping Ravangla's energy footprint low-carbon and sustainable.

This calculation uses the most recent relevant data for population and energy benchmarks available as of 2025.

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Usage patterns:

Most reported usage revolves around entry-level solar products: streetlights supplied through government schemes; lanterns and home-lighting kits used during outages; and, in a few cases, solar water heating systems for household use. Biomass stoves, although promoted, see limited adoption due to perceptions of inconvenience or uncertainty regarding performance.

One interesting pattern is that renewable energy use often supplements rather than replaces grid electricity. Residents rely on renewable products mainly during frequent power outages or in situations where grid supply is unreliable—such as during monsoon-induced faults in the transmission network. There is reluctance to fully transition to non-grid sources, mainly due to concerns about reliability, maintenance, and cost.

Perceived Barriers

Based on survey responses and literature, notable barriers include:

- **Product Availability:** Many residents cited difficulty finding renewable energy products locally. Most products are provided through government schemes rather than through local shops or private distributors, resulting in limited choice and after-sales support.
- **Affordability:** Cost remains a significant concern, especially for larger systems, despite subsidies. Residents often perceive that the initial investment is not justified by the savings, partly because of unclear communication around payback periods and long-term benefits.
- **Technical Reliability:** Several respondents expressed doubts regarding product durability and ease of repair. Products distributed for free or at discount occasionally underperform or fail, reinforcing skepticism.
- **Lack of Variety:** Survey participants noted limited product choices—both in size/capacity and application—which hampers customization and broader usage.

Influencing Factors

- **Government Schemes and Subsidies:** Adoption is heavily dependent on government promotion; whenever products are distributed free or highly subsidized, local uptake spikes.
- **Community Engagement:** Peer influence is significant; neighbors and community leaders who vouch for or demonstrate successful renewable energy usage contribute to higher adoption rates.
- **Awareness Campaigns:** Respondents suggested that practical demonstrations—rather than pamphlets or posters—are most effective in encouraging interest and confidence.

Demographic Insights

Survey analysis found that:

- Younger, more educated respondents were more open to experimenting with renewable energy and had higher awareness, but lacked financial independence for major purchases.
- Older residents prioritized product reliability, and many were content with traditional energy sources unless prompted by severe grid outages.
- Occupation and household income correlated with willingness (but not always the ability) to invest in larger systems.

Human Experience and Error

While compiling responses, a few participants misunderstood questions regarding "renewable" resources, classifying diesel generators or energy conservation products as renewables. Some also conflated government provisioning of any new electrical appliance with a renewable energy scheme, highlighting the gap between technical terms and practical understanding. A handful noted frustration with malfunctioning solar streetlights but admitted not reporting issues due to unclear maintenance channels.

Note: Some participants expressed awareness fatigue—having attended multiple awareness drives but still feeling underinformed due to the technical nature and lack of practical demonstrations in previous campaigns.

This assessment underscores that while there is latent interest and isolated success stories in renewable energy use in Ravangla, genuine wide-scale adoption will hinge on a mix of education, product diversification, affordable financing, and robust after-sales support (including community-level maintenance)—rather than information campaigns alone.

Way Forward

Ravangla, as a semi-urban town at the intersection of rural needs and evolving infrastructure, holds considerable potential

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in shaping the success of decentralized renewable energy transitions in Sikkim. Building upon the survey findings and current challenges, there are several key actionable areas that can support more equitable, practical, and sustained uptake of renewable energy solutions in the region.

1. Enhanced Community-Centric Awareness Programs

While general awareness of solar energy exists among many residents, a deeper technical and functional understanding remains limited. Future campaigns should go beyond pamphlets and poster-based outreach. More interactive formats—such as working demonstrations, mobile renewable energy exhibitions, and hands-on workshops—must be prioritized. Conducting sessions in local languages and involving local champions (teachers, panchayat leaders, or NGO workers) can greatly improve message retention. A 'Seeing is Believing' approach, where community members observe solar water heaters or home lighting kits in action, can boost social acceptance.

2. Improving Product Availability and Local Access

One of the consistent challenges residents face is the limited presence of renewable energy products in the local market. To bridge this access gap, efforts should be made to establish dedicated renewable energy corners in local shops or through seasonal community fairs. Partnering with private vendors to create "pop-up" stores during awareness events could introduce a variety of systems for household and commercial needs. This also opens the door for comparative evaluation of products, allowing people to make more informed choices.

3. Expanding the Role of Local Entrepreneurs

Capacity-building programs aimed at creating a fleet of trained local technicians, service providers, and clean energy entrepreneurs can address the trust deficit around maintenance and reduce post-installation issues. Incentivizing local youth—especially those with ITI or diploma training in electrical work—to become certified solar professionals would create livelihood opportunities while keeping after-sales support community-based and efficient.

4. Tailored Financing Models and Micro-Credit Access

Although subsidies help make renewable products more accessible, the upfront cost of solar rooftops or bio-digesters continues to deter many families. To overcome this, schemes need to focus on staggered payment systems, interest-free or low-interest loans, and tie-ups with rural banks or cooperative societies who have an existing rapport with the community. Financial education, especially around long-term cost savings and return on investment, should accompany these interventions.

5. Strengthened Monitoring and Maintenance Ecosystem

Reliability concerns related to solar lamps and streetlights often stem from inadequate maintenance rather than inherent design flaws. A decentralized grievance redressal system—such as a toll-free number or WhatsApp-based reporting—can ensure regular servicing. Involving local bodies or SHGs (Self Help Groups) in managing this system will instill community ownership and speed up response times. Periodic maintenance drives should also be institutionalized in collaboration with SREDA.

6. Diversification of Renewable Applications

Residents need access to a broader product ecosystem that goes beyond basic lanterns and solar water heaters. For example, solar-powered weaving machines, e-rickshaws, cold storage facilities for perishables, or solar pumps for horticulture can open up new economic avenues, especially for women and small entrepreneurs. A tailored approach that Aligns renewable energy technology with existing livelihood patterns can increase long-term relevance and adoption.

7. Data-Driven Planning and Feedback Loops

Establishing a mechanism for regular feedback from users will help policymakers and suppliers fine-tune strategies. This includes gathering insights on product performance, satisfaction levels, and emerging needs. Establishing local energy clubs where students and youth collect insights, supported by district-level officials or NGOs, could serve both as a monitoring tool and an educational opportunity.

CONCLUSION

Ravangla is at a critical juncture in its renewable energy journey. The region has shown promise through its early adoption of small-scale solar products and hydropower usage, but persistent obstacles—including affordability, lack of information, and product accessibility—are slowing further progress. To enable a lasting transition, policy efforts must blend human-centered design with infrastructure support. A more collaborative, grassroots-led approach—backed by strong local institutions and financial innovations—has the potential to accelerate adoption, bolster trust, and deliver on

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the promise of reliable, clean energy for all.

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