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EMPOWERING TRIBAL COMMUNITIES IN KALSUBAI HARISHCHANDRAGAD WILDLIFE SANCTUARY THROUGH SOLAR ENERGY: A SUSTAINABLE APPROACH

Manjusha Kothawade

Dr. D. Y. Patil Arts, Commerce & Science College, Akurdi, Pune-44.

Corresponding Author: Manjusha Kothawade

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ABSTRACT:

Tribal communities residing in and around Kalsubai Harishchandragad Wildlife Sanctuary in Maharashtra face numerous socio-economic and environmental challenges, particularly due to energy poverty. Women, as primary energy managers, experience the most significant hardships, relying heavily on traditional fuels. Solar energy offers a sustainable solution that not only improves their livelihoods but also protects the fragile ecosystems these communities depend on. This paper explores the impact of solar energy projects on tribal women and communities within the sanctuary, focusing on income generation, education, health improvements, and environmental conservation. By combining field surveys with statistical analysis, the study provides insights into the successes, challenges, and future directions of solar energy initiatives in these areas.

INTRODUCTION:

Tribal Context in Kalsubai Harishchandragad and Bhimashankar Wildlife Sanctuaries:

Tribal communities in the Kalsubai Harishchandragad sanctuary predominantly rely on subsistence farming and the collection of forest resources for their livelihoods. However, their access to modern energy is limited, resulting in high energy poverty. Women, in particular, bear the brunt of this situation, spending hours collecting firewood, which hinders their ability to engage in other productive activities and jeopardizes local biodiversity.

Potential of Solar Energy:

Solar energy is a clean, decentralized, and eco-friendly solution to address both the socio-economic needs of tribal communities and the conservation goals of these protected areas. The study explores how solar energy can serve as a catalyst for socio-economic empowerment while also preserving the sanctuaries' ecological balance.

REVIEW OF LITERATURE:

Energy Poverty in Wildlife Sanctuary Communities:

Tribal communities living in protected areas often face acute energy poverty, as their access to the grid is limited, forcing them to rely heavily on forest biomass for energy. According to IRENA (2022), this dependency exacerbates the pressure on local ecosystems, making sustainable energy solutions a crucial necessity.

Solar Energy and Conservation:

Research indicates that solar energy helps reduce reliance on traditional biomass sources, thus supporting both socio-economic development and environmental conservation. In areas such as the Sundarbans, similar solar initiatives have led to significant benefits for local communities and wildlife conservation (World Bank, 2021).

Case Studies in Maharashtra:

Previous initiatives in Maharashtra, such as the Barefoot College's Solar Mamas program, have demonstrated the power of solar energy in transforming tribal women into leaders and entrepreneurs, providing them with both income opportunities and technical skills.

MATERIALS AND METHODS:

Study Area:

The study focuses on villages located within and around prominent wildlife sanctuary:

- **Kalsubai Harishchandragad Wildlife Sanctuary**: Known for its biodiversity and dense tribal population relying heavily on forest resources.

Data Collection:

- **Field Surveys**: Surveys were conducted with 100 tribal households across sanctuary, focusing on women's roles and experiences with solar energy.
- **Focus Group Discussions**: Discussions were held with women, community leaders, and local authorities to understand the impacts of solar energy initiatives and the challenges faced in implementation.
- **Secondary Data**: Government reports, NGO publications, and previous studies were analyzed to contextualize the findings.

Metrics Evaluated:

- **Economic Impact**: Changes in household income and employment opportunities.

- **Education**: School attendance rates and study hours among children.
- **Health**: Reductions in respiratory illnesses and associated health expenses.
- **Environmental Benefits**: Decrease in biomass usage and reductions in carbon emissions.

Analytical Tools:

Statistical analysis was performed using SPSS software, employing descriptive statistics, paired t-tests, and regression analysis to assess the impact of solar energy initiatives on these variables.

RESULTS AND ANALYSIS:

Economic Impact:

- Women trained as solar engineers in Kalsubai Harishchandragad earned an additional 5,000 monthly, significantly improving their financial independence.

Education:

- Solar-powered lighting systems enabled 70% of households to extend study hours for children by 2-3 hours daily.
- Schools equipped with solar energy witnessed a 35% increase in attendance, especially among tribal girls.

Health and Time Savings:

- Respiratory illnesses reduced by 42% due to the adoption of solar cook stoves and solar lamps, replacing harmful traditional fuels.
- Women saved an average of 3.5 hours daily, which was previously spent collecting firewood. This time was redirected towards skill development, childcare, and household tasks.

Environmental Benefits:

- Biomass usage decreased by 60%, reducing the strain on forest resources that are vital to the sanctuaries' ecosystems.
- Household carbon emissions dropped by 1.1 tons annually on average, contributing to global climate change mitigation efforts.

Statistical Analysis:

Indicator	Before Intervention	After Intervention	p-value
Average Monthly Income (₹)	2,200	6,800	< 0.001
School Attendance (girls, %)	58%	79%	< 0.001
Time Spent Collecting Fuel (hrs)	4.5	0.9	< 0.001
Respiratory Illness Incidence (%)	38%	22%	< 0.01

CONCLUSION:

Solar energy initiatives have proven transformative for tribal communities in the Kalsubai Harishchandragad Sanctuary. The benefits have extended to increased household incomes, improved education outcomes, better health, and more sustainable environmental practices. These solar projects have also helped reduce the pressure on forest resources, aligning with conservation goals of the sanctuary.

FUTURE SCOPE:

1. **Integration of Solar-Powered Technologies**: Expanding the use of solar energy to include water purification systems, cold storage for agricultural products, and eco-tourism projects could further improve the sustainability of the region.
2. **Community Solar Projects**: Promoting community-managed solar micro grids could enhance energy access and ensure sustainability in remote areas.
3. **Digital Literacy Programs**: Using solar energy to power digital training centers for tribal youth could open doors for modern skills development and economic opportunities.

LIMITATIONS:

1. **Financial Constraints**: The high initial cost of solar installations remains a barrier to adoption among low-income tribal households.
2. **Maintenance Challenges**: Lack of local technical expertise for solar system maintenance can affect the long-term sustainability of these projects.

3. **Cultural Resistance**: In certain communities, traditional gender norms pose barriers to women's participation in solar energy initiatives, limiting their potential benefits.

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