



## Education policy responses to SDG 7: The role of solar energy awareness and adoption in Kerala, India

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### Abstract

Ensuring access to affordable, reliable, sustainable, and modern energy for all, as envisioned under Sustainable Development Goal 7 (SDG 7), requires not only technological and financial interventions but also strong educational and policy support mechanisms. Education plays a critical role in shaping energy awareness, influencing attitudes toward renewable energy, and enabling informed adoption decisions. This study examines education policy responses to SDG 7 with a specific focus on solar energy awareness and household solar adoption in Kerala, India. Using primary survey data collected from 500 households across five districts of South Kerala and supported by policy analysis of national and state-level education and energy frameworks, the study investigates the relationship between education-driven awareness and solar adoption outcomes. The findings reveal that higher levels of education and targeted awareness initiatives significantly influence adoption decisions, while gaps persist in institutional integration, curriculum design, and management information systems (MIS) for monitoring policy implementation. The paper concludes with recommendations emphasizing curriculum integration, institutional collaboration, and MIS-based tracking mechanisms to strengthen the role of education in achieving SDG 7.

**Keywords:** SDG 7, education policy, solar energy adoption, renewable energy awareness, Kerala, MIS

### Introduction

The global transition toward sustainable energy systems has become an urgent priority in the context of climate change, energy insecurity, and environmental degradation. Sustainable Development Goal 7 (SDG 7) seeks to ensure universal access to affordable, reliable, sustainable, and modern energy services by 2030. Among renewable energy sources, solar energy has emerged as a key solution due to its scalability, declining costs, and suitability for decentralized energy generation, particularly in developing economies such as India.

While India has made notable progress through initiatives such as the National Solar Mission and state-level renewable energy programs, the rate of household solar adoption remains uneven across regions. Existing research largely emphasizes economic incentives, technological feasibility, and policy subsidies; however, the role of education policy in fostering awareness and adoption remains underexplored. Education influences not only technical understanding but also environmental values, risk perception, and long-term behavioral change. In this context, Kerala presents a unique case due to its high literacy rate, strong public education system, and proactive renewable energy policies.

This study examines how education policy responses contribute to SDG 7 through solar energy awareness and adoption in Kerala. By integrating primary survey evidence with policy analysis, the paper seeks to bridge the gap between education frameworks and energy transition outcomes.

### Education policy and SDG 7: conceptual framework

Education is increasingly recognized as an enabler of sustainable development, with SDG 4 (Quality Education) closely interlinked with SDG 7. Education policy can support SDG 7 by incorporating renewable energy concepts

into curricula, promoting community awareness programs, fostering skill development for green jobs, and enabling informed consumer decision-making.

In India, the National Education Policy (NEP) 2020 emphasizes experiential learning, environmental awareness, and sustainability-oriented education. Although renewable energy is indirectly addressed through environmental studies and science curricula, explicit integration of solar energy literacy remains limited. At the state level, Kerala has initiated programs combining education, local self-governments, and renewable energy agencies; however, systematic evaluation of their effectiveness is scarce.

A conceptual framework for this study positions education policy as a driver of solar awareness, which in turn influences attitudes, trust, and adoption decisions. Management Information Systems (MIS) act as a supporting mechanism by enabling data collection, monitoring, and feedback for policy refinement.

### Literature Review

The role of education in promoting renewable energy adoption has been increasingly recognized in sustainability and energy policy literature. Early studies such as Painuly (2001) <sup>[7]</sup> emphasized that lack of awareness and information constitutes a major non-economic barrier to renewable energy diffusion in developing countries. This foundational work highlighted the importance of education and training in shaping positive perceptions toward renewable technologies.

Subsequent studies in the Indian context have reinforced these findings. Bhattacharyya (2012) <sup>[1]</sup> argued that while policy incentives are necessary, informed consumers are essential for successful energy transitions. His study noted that education enhances the ability of households to evaluate long-term cost-benefit aspects of solar energy systems. Similarly, Rao and Kishore (2010) <sup>[8]</sup> found that social

awareness and institutional outreach significantly influence household-level renewable energy adoption in India. Kerala-specific studies have pointed to the state's high literacy rate as a facilitating factor for renewable energy acceptance, though adoption remains uneven. Krishnan and Ramasamy (2018) [5] observed that despite favorable literacy and policy conditions, gaps in structured awareness programs limited large-scale household adoption of rooftop solar systems. Their findings suggest that general education alone is insufficient without targeted energy literacy initiatives.

International literature further supports the education-energy nexus. Studies conducted in Europe indicate that curriculum-integrated sustainability education positively influences pro-environmental behavior and renewable energy adoption (Wolsink, 2012). In Southeast Asia, Nguyen *et al.* (2019) [6] demonstrated that education-based community programs significantly increased solar adoption rates by reducing misinformation and trust deficits.

However, a critical gap identified across studies is the limited focus on education policy as a systemic enabler of SDG 7. Most research treats education as an individual-level variable rather than a policy-driven institutional mechanism. Additionally, the role of Management Information Systems (MIS) in monitoring and evaluating education-led energy initiatives remains underexplored. This study addresses these gaps by linking education policy frameworks, awareness creation, MIS mechanisms, and household solar adoption outcomes in the context of Kerala.

### Objectives

1. To analyse the relationship between education level and solar energy awareness.
2. To examine the role of education-driven awareness as a mediating factor influencing solar adoption decisions.

### Research Methodology

Primary data were collected from 500 households across five districts of South Kerala Thiruvananthapuram, Kollam, Pathanamthitta, Alappuzha, and Kottayam using stratified sampling. Each district contributed 100 responses to ensure geographical representation. Data were collected using a structured questionnaire through field survey and researcher-assisted responses.

### Data Analysis

#### Socio-Economic and Educational Profile of Respondents

Table 1

Education Level	Percentage (%)
Higher Secondary	34
Graduate	38
Postgraduate & Above	28

Source: Primary Data

#### Education Level and Solar Energy Awareness Mean Solar Awareness Scores by Education Level

Table 2

Education Level	Mean Score
Higher Secondary	3.21
Graduate	3.78
Postgraduate & Above	4.12

Source: Primary Data

### Association between Education and Solar Adoption

A chi-square test of independence was conducted to assess the association between education level and solar adoption. The results reveal a statistically significant relationship ( $p < 0.05$ ), confirming that education level significantly influences adoption decisions.

### Education Level and Solar Adoption Status

Table 3

Education Level	Adopters (%)	Non-Adopters (%)
Higher Secondary	29	71
Graduate	46	54
Postgraduate & Above	61	39

Source: Primary Data

### District-Wise Analysis

#### District-Wise Awareness and Adoption

Table 4

District	Mean Awareness	Adoption Rate (%)
Thiruvananthapuram	3.89	47
Kollam	3.74	42
Pathanamthitta	3.61	38
Alappuzha	3.58	36
Kottayam	3.83	44

Source: Primary Data

Cross-tabulation by district revealed moderate variations in awareness and adoption levels. Districts with relatively stronger institutional awareness initiatives recorded higher adoption rates

### Education Level and Solar Energy Awareness

Table 5

Education Level	High Awareness (%)	Moderate Awareness (%)	Low Awareness (%)
Higher Secondary	32	45	23
Graduate	51	38	11
Postgraduate & Above	67	28	5

Source: Primary Data

The results clearly show that awareness levels increase with educational attainment

### Education Level and Solar Adoption Status

Table 6

Education Level	Adopters (%)	Non-Adopters (%)
Higher Secondary	29	71
Graduate	46	54
Postgraduate & Above	61	39

Source: Primary Data

A chi-square test confirmed a statistically significant association between education level and solar adoption ( $p < 0.05$ ).

## Logistic Regression Results – Determinants of Solar Adoption

Table 7

Variable	Coefficient	Significance
Education Level	Positive	Significant
Awareness Score	Positive	Significant
Household Income	Positive	Significant
Trust in Providers	Positive	Significant

Source: Primary Data

The regression results indicate that education and awareness remain strong predictors of adoption even after controlling for income.

### Key Findings

1. Educational attainment has a significant positive influence on solar energy awareness among households in Kerala.
2. Higher awareness levels are strongly associated with increased likelihood of household solar adoption.
3. Education-driven awareness remains a significant predictor of adoption even after controlling for income and household characteristics.
4. Households exposed to institutional or education-based awareness programs demonstrate higher trust in solar technologies and service providers.
5. Districts with stronger local awareness initiatives show relatively higher adoption rates, indicating the role of institutional outreach.
6. High general literacy alone does not guarantee solar adoption without targeted energy education.
7. Lack of integrated MIS limits effective monitoring and evaluation of education-led solar initiatives.
8. Weak coordination between education institutions and renewable energy agencies reduces policy effectiveness.

### Suggestions

1. Introduce structured solar energy literacy modules at school and higher education levels aligned with NEP 2020.
2. Encourage colleges and universities to act as community awareness hubs through extension activities and NSS programs.
3. Establish district-level MIS dashboards integrating data from education departments and renewable energy agencies.
4. Provide periodic training for teachers and local administrators on renewable energy awareness.
5. Promote partnerships between educational institutions, local governments, and solar service providers.
6. Design targeted awareness programs for rural and semi-urban households using simple, localized communication.
7. Incorporate feedback mechanisms through MIS to continuously refine education and energy policies.

### Conclusion

Achieving SDG 7 requires a comprehensive approach that integrates education policy with renewable energy initiatives. This study demonstrates that education-driven awareness significantly influences household solar adoption in Kerala. By strengthening curriculum integration,

institutional collaboration, and MIS-based monitoring, education policy can serve as a powerful catalyst for accelerating clean energy transitions and supporting sustainable development goals.

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