International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 10, October 2026)

From Policy to Adoption: Government Initiatives, Marketing Communication and Consumer Behaviour in Residential Rooftop Solar Adoption in India – A Global Comparative Perspective

Shiamala R K[1], Dr. A. S. Sathish Kumar[2]

[1]*Research Scholar & Assistant Professor, Department of Management Studies, VET Institute of Arts and Science, Erode, Tamil Nadu, India*

[2]*Associate Professor & Head of the Department, Department of Management Studies, VET Institute of Arts and Science, Erode, Tamil Nadu, India*

***Abstract*-- Residential rooftop solar (RTS) has become an important element of the global transition towards low-carbon energy systems. Though India has substantial solar potential, household adoption has remained lower than its potential because of financial constraints, information gaps, complex procedures, trust concerns and lack of complete consumer awareness. A stronger institutional framework for residential rooftop solar adoption has been created by recent policy interventions such as the PM Surya Ghar: Muft Bijli Yojana. Even so, sustained adoption may not be ensured by policy incentives alone unless they are supported by effective marketing communication and an understanding of consumer behaviour. This review paper analyses the relationship between government initiatives, marketing communication and consumer behaviour in residential rooftop solar adoption in India. The paper compares India's emerging approach with a few international experiences, particularly Australia, Germany and the United States. The paper employs a narrative and integrative review methodology using peer-reviewed research, government publications, policy reports and recent industry evidence. The review indicates that while financial incentives reduce economic barriers, household decision-making is influenced by credibility in information, social influence, trust, perception about usefulness and ease of adoption. Recent evidence from India further suggests that awareness does not automatically result in adoption; households may still be at the consideration stage because they lack knowledge about procedures, financing details or trusted support. The comparative analysis suggests that successful residential solar adoption depends on a combination of financial support, simplified procedures, reliable information, consumer protection, market development and community-level engagement. For India, communication strategies that move beyond subsidy promotion towards consumer education, financial literacy, demonstration, peer communication and end-to-end adoption support are required for the transition from policy awareness to actual adoption.**

***Keywords*--Rooftop solar; consumer behaviour; government policy; marketing communication; renewable energy adoption; India**

I. Introduction

The shift towards renewable energy has become more important because of concerns such as climate change, energy security, environmental sustainability and increasing electricity demand. Solar photovoltaic (PV) technology particularly has gained significance because it can be implemented at both utility and household levels. Residential rooftop solar empowers households to become electricity producers while greatly reducing electricity expenses and dependence on conventional energy sources. India is particularly important in this context as it is the most populous nation in the globe. The renewable energy expansion in the country has been pursued through the National Solar Mission, state-level solar policies, rooftop solar programmes and more recently the **PM Surya Ghar: Muft Bijli Yojana**. The PM Surya Ghar scheme was launched in February 2024 with an aim to support rooftop solar installations in one crore households by 2026–27 and it offers financial assistance to residential consumers (MNRE, 2024). As reported by The International Energy Agency, the scheme has an outlay of ₹75,021 crore and provides financial assistance linked to system capacity (IEA, 2025). The solar policy framework has brought a substantial growth in residential rooftop solar installations. As stated by the Government of India, 26,19,879 rooftop solar systems had been installed under PM Surya Ghar by 19 March 2026, and an amount of ₹17,967.53 crore disbursed as financial assistance by the central government. 9,566.89 MW of additional rooftop solar capacity had been contributed by 20 March 2026 by the scheme (PIB, 2026a; PIB, 2026b). The growth in installations does not necessarily indicate that adoption issues are completely addressed. Indian studies point to high costs, poor financing, low awareness, vendor distrust, complex procedures, and inadequate information as major barriers. (Devi, Narayan and Mandal, 2018; Joshi and Yenneti, 2020).

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 10, October 2026)

Evidences state that the challenge has shifted from awareness of solar energy to households' ability to act on that knowledge and install systems. Nationwide survey data from 2026 highlight that though awareness and interest in rooftop solar exist, adoption is hindered by inadequate information on initiation, financing limitations, vendor-related concerns, and procedural complexities (Chaudhary et al., 2026).

This change points to the importance of viewing residential solar adoption not merely as a technology or policy issue but also as a **consumer behaviour and marketing communication issue**. Economic incentives created by government policy are necessary but not sufficient—households must also recognize the benefits, trust the system and vendors, navigate procedures, evaluate costs, and complete installation. Communication is the key—studies found households often turned to word-of-mouth, vendors, TV, and distribution firms for solar information. (CEEW, 2019). Evidence suggests that communication and incentive policies can drive consumer interest in rooftop solar, yet concerns about expense and inconvenience remain significant barriers to solar adoption (2026). International examples offer useful comparisons. In Australia, rooftop solar is very common. More than 21% of households have adopted rooftop panels, and more than four million systems have been installed under the country's small-scale renewable energy program. (Australian Government, 2026a; Australian Government, 2025). Germany has mainly used feed-in tariffs and still relies on regulated payments for rooftop solar. In contrast, the United States combines federal and state incentives, net-metering or other payment systems, and community-solar programs. This review looks at how government policies, marketing communication, and consumer behavior shape the adoption of residential rooftop solar. The main focus is India, with selected international cases used for comparison.

II. Methodology

The study employs a narrative-integrative review methodology, selected due to the multidisciplinary nature of the topic, which encompasses renewable energy policy, consumer behavior, marketing communication, energy economics, and public policy. The review takes into consideration four broad categories of literature such as:

1. *Peer-reviewed studies* that are based on residential solar adoption and consumer behaviour.
2. *Government and institutional reports* that cover rooftop solar programmes and incentives.
3. *Research reports and consumer surveys* that cover household awareness, adoption barriers, and decision-making.
4. *International evidence* about rooftop solar policies and household adoption.

The focus of the review is mainly on literature published between 2018 and 2026, while also referring to the earlier theoretical studies that provide important base for understanding adoption behaviour. Usefulness, advantage, cost, trust, environmental concern, social influence, control, incentives, communication, and accessibility were the important ideas studied. The analysis was structured around three guiding questions:

- *RQ1:* How have government initiatives shaped residential rooftop solar adoption in India?
- *RQ2:* What consumer behavior and marketing communication factors influence the shift from awareness to actual adoption?
- *RQ3:* What lessons from international rooftop solar markets can inform India's residential adoption strategy?

Rather than employing statistical aggregation, the review integrates findings across studies to identify recurring relationships, divergences, and areas requiring further research.

III. Results And Discussion

Government initiatives – Driver for adoption

Government policy is one of the principal institutional catalysts for adoption of residential rooftop solar. As solar systems require a high upfront investment, the perceived economic risk is reduced by financial support from the government and adoption by households is encouraged. There is a shift in India's rooftop solar policy from broad renewable energy promotion to more direct interventions which are aimed at households. In the case of Grid Connected Rooftop Solar Programme, central financial support is offered to households and incentives are provided to distribution companies. A further move toward a demand-driven household model is done by the PM Surya Ghar programme, with easier applications through a national portal (MNRE, 2026). The importance of policy is evident from the recent hike in installations. The Government of India reported that under the PM Surya Ghar programme nearly 9.57 GW of rooftop solar capacity had been added by March 2026 (PIB, 2026b). This shows that boost market activity can be supported significantly by financial incentives, digital access, and visible policy support.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 10, October 2026)

However, policy design on its own cannot remove all barriers to adoption. Earlier research in Delhi showed that favorable policy conditions did not automatically lead to widespread household adoption. Consumers continued to face barriers such as lack of information, financing difficulties, mistrust, and complex institutional procedures (Joshi and Yenneti, 2020). Therefore, the policy effectiveness should be evaluated at different stages of the consumer journey:

Policy announcement → Awareness → Interest → Information search → Financial evaluation → Application → Vendor selection → Installation → Post-installation experience

A policy may attract attention at first. Later, it may not work well if consumers struggle with paperwork, choosing vendors, arranging finance, or handling net-metering steps.

From awareness to actionable awareness

Recent Indian studies show an important point: knowing about solar energy is not the same as knowing how to use it. A household may know about rooftop solar and even about government subsidies. But to actually adopt it, they need more details such as Who can apply, How much subsidy is given, What size of system is suitable, How much will the household pay, What financing choices are available, Which vendors can be trusted, How is the installation approved, How does net-metering operate, What upkeep is needed, What happens if the system does not perform as expected. The 2026 CEEW survey shows this gap clearly. Many households knew about rooftop solar and were interested, but they did not start adoption. A key reason was that they did not know how to begin. The study found that many households did not know about solar financing options. As a result, they often thought solar was too costly. This shows that high-cost concerns may come from poor financial information, not just the real price of systems. (Chaudhary et al., 2026). This indicates that communication strategies should extend beyond promotional slogans such as 'Install solar and receive subsidy.' Instead, they must provide detailed, practical guidance, including expected household costs, available financial support, application procedures, vendor selection processes, and realistic estimates of potential savings.

Consumer Behaviour and Residential Solar Adoption

Residential rooftop solar represents a high-involvement purchase. Unlike conventional consumer goods, the decision involves significant financial investment, technical uncertainties, and long-term consequences. Different theories explain why people adopt solar.

The Theory of Planned Behaviour (TPB) says that attitudes, social pressure, and a person's sense of control shape their intention to act. (Ajzen, 1991). The Technology Acceptance Model (TAM) says people adopt technology if they find it useful and easy to use. (Davis, 1989). The Diffusion of Innovation Theory explains adoption by looking at certain features: relative advantage, compatibility, complexity, observability, and trialability. (Rogers, 2003). Indian studies support these theories. One study with 863 people used structural equation modelling. It found that relative advantage, compatibility, complexity, innovation features, and observability strongly influenced household purchase decisions. Trialability, however, did not have the expected effect (Journal of Social Marketing, 2022). Recent Indian studies using an extended TPB model show that trust, perceived benefits, concern for the environment, and government support are important. The research found that benefits, trust, and policies shaped attitudes. In turn, attitudes, social norms, and perceived control influenced intention to adopt solar (Sahu et al., 2026). These results show that adoption is shaped by many factors. People do not only think about financial returns. They also ask if the technology is reliable, socially accepted, easy to understand, and in line with their values and situation.

The role of economic benefits and perceived cost

Money is a key factor when households think about solar. They usually look at Lower electricity bills, Initial investment, How long it takes to recover costs (payback period), Subsidy support, Financing options, Maintenance expenses, How long the system will last, Future electricity prices, Effect on resale or property value. Indian studies show that high upfront cost and lack of financing are big barriers to solar adoption. (Devi, Narayan and Mandal, 2018; Joshi and Yenneti, 2020). Recent studies show that cost cannot be seen on its own. People may misperceive that solar is more expensive than it is in reality if people do not fully understand subsidies, loans, savings, or payback periods. The 2026 CEEW study shows that 23% of households paid for solar installation using loans and that people who were not aware of financing options were more likely to think solar was too expensive (Chaudhary et al., 2026). This implies that the financial policy and communication must be synchronized.

Marketing communication and information sources

Marketing communication helps in reducing the information gaps between consumers, government and installers.

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 10, October 2026)

The network of rooftop solar communication includes Government websites and portals, TV and radio, Newspapers, Social media, Digital ads, Solar vendors, Electricity distribution companies, Community programs, Demonstrations, Neighbours and friends, Customer testimonials and Financial institutions. In India, interpersonal communication is highly important in finance context. A CEEW survey found that people learnt about rooftop solar mostly through word-of-mouth, followed by solar vendors, television, and distribution companies (CEEW, 2019). Recent studies confirm earlier findings, with greater emphasis on quality of communication. The 2026 national survey showed:

- 71% of the households surveyed considered government departments and officials as credible sources of information for new government schemes.
- Solar adopters showed higher exposure to targeted, experiential communication forms, such as solar events, radio advertisements and print advertisements.
- Solar non-adopters showed comparatively lower exposure to such communication channels (Chaudhary et al., 2026).

Effectiveness of communication should be judged not only by the number of people it reaches but also its depth, credibility, and relevance in turning interest into real action.

Trust as a behavioural factor

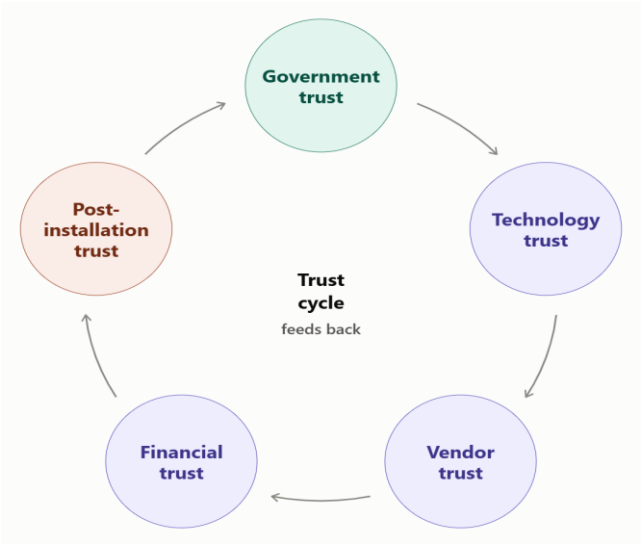


Figure 1: Trust Cycle of Residential Rooftop Solar Adoption

Figure 1 shows that there are several levels at which trust operates. A consumer who supports renewable energy may still hesitate to invest if they are not confident about things like panel quality, installer reliability, subsidy payments, net-metering procedures, or after-sales service. Earlier studies in India showed that the major reason for households not adopting rooftop solar was lack of trust in solar companies (CEEW, 2019). The Delhi study also found that mistrust was one of the key reasons slowing down rooftop solar adoption (Joshi and Yenneti, 2020). This makes a strong case for government support through quality checks, clear vendor information, standard consumer disclosures, and good grievance-handling systems. Consumers should be able to compare solar vendors using clear indicators. Communication should not only promote solar but also protect consumers. Key indicators include Installation quality, Warranty terms, Service record, Expected generation, Customer experience.

IV. Global Comparative Perspective

Global experience shows that no single policy drives rooftop solar adoption. Countries rely on a mix of financial incentives, market rules, consumer information, grid policies, and institutional support.

Table 1: Global Comparative Perspective for Residential Rooftop Solar Adoption

Dimension	India	Australia	Germany	United States
Major policy approach	Subsidies/CFA and demand-driven PM Surya Ghar	SRES, rebates and household guidance	Feed-in remuneration and self-consumption	Federal/state incentives and state-level compensation mechanisms
Consumer emphasis	Subsidy access and national portal	Consumer information and financial support	Self-consumption and grid remuneration	Financial incentives, state programmes and community solar
Key communication feature	Government portal and awareness programmes	Government-backed independent consumer guidance	Regulatory and market information	Federal/state and utility-level communication
Major behavioural issue	Information, finance, trust and procedural complexity	Economics, system selection and batteries	Economics, self-consumption and regulatory conditions	Economics, incentives and local compensation rules
Emerging challenge	Converting interest into installation	Integrating batteries and multi-unit housing	Managing changing remuneration and grid integration	Policy variation across states

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 10, October 2026)

Australia

Australia data shows extensive household rooftop solar adoption. Official data indicate that by late 2024, over 21% of households had installed solar PV, with cumulative rooftop installations exceeding four million systems. (Australian Government, 2026a; Australian Government, 2025). Australia's strategy mixes financial help with clear consumer information. The Small-scale Renewable Energy Scheme lowers the cost of rooftop solar, while tools like the Solar Consumer Guide and SunSPOT calculator help households estimate system size, cost, and payback. (Australian Government, 2026b). Australia has also been moving towards battery adoption. Starting in July 2025, the Cheaper Home Batteries Program offered households about a 30% discount on eligible small-scale batteries. (Australian Government, 2025). Australia's experience shows that success comes from combining financial incentives with clear, independent information for consumers.

Germany

Germany is a leading example of policy-driven solar growth. The country first relied on feed-in tariffs under its renewable energy laws. Today, it still offers regulated payments for electricity exported from rooftop systems, with published rates for small systems that distinguish between partial and full feed-in options. (BMWK, 2024). Germany shows why clear, long-term policy signals matter. At the same time, changes in electricity markets have made self-consumption and system optimisation more important for households.

United States

U.S.A. has a more decentralised policy setup. Federal incentives work alongside state programmes, utility schemes, and community-solar projects. The Department of Energy has promoted community solar to extend benefits to households that cannot install panels on their own roofs (U.S. Department of Energy, 2021). This is especially important for India, since apartment residents, renters, and households with unsuitable roofs are a large underserved group. Community and shared-solar models can help overcome the physical limits of individual rooftop ownership.

V. Comparative Lessons For India

The global comparison shows that successful rooftop solar markets usually rely on a mix of policies and consumer behaviours working together.

Financial incentives are necessary but insufficient

Subsidies can lower financial barriers, but they do not solve problems of limited information, lack of trust, or complex procedures. India therefore needs to link subsidy messages with financial literacy and practical installation support.

Independent consumer information is important

Australia's consumer guides show that independent information can reduce reliance on sellers. India could improve similar tools by offering easy calculators for system size, subsidy, household share, loan EMI, annual generation, bill savings, payback time, and maintenance costs.

Social influence should be systematically used

Solar adoption is visible in communities. When households see panels on nearby homes, it creates chances for social learning. Demonstration houses, resident welfare groups, local champions, and adopter stories can add to mass advertising.

Policy implementation must be consumer-centric

The consumer journey should be made easier, from applying to installing and getting service afterward. Recent CEEW findings show that information and procedural hurdles are concentrated at certain stages of the adoption process. (Chaudhary et al., 2026).

Communication should address different consumer segments

A single communication strategy may not be effective for all households. Campaigns could segment consumers according to- high versus low electricity consumption; independent houses versus apartments; urban versus semi-urban households; homeowners versus renters; high versus low financial capacity; environmentally motivated versus economically motivated consumers; and digitally confident versus digitally dependent consumers. This approach helps communication move beyond general awareness and towards targeted behaviour change.

VI. An Integrated Framework For Residential Rooftop Solar Adoption

The literature reviewed suggests that residential rooftop solar adoption can be understood through an integrated framework:

International Journal of Recent Development in Engineering and Technology
Website: www.ijrdet.com (ISSN 2347-6435 (Online) Volume 15, Issue 10, October 2026)



Figure 2: Integrated Framework for Residential Rooftop Solar Adoption

The framework shows a circular process. Adoption itself creates new communication, as satisfied consumers share their experiences and influence neighbours. It also shows that policy, communication, and consumer behaviour are linked: policy sets the rules, communication builds trust and understanding, and behaviour decides whether benefits turn into real installations.

VII. Research Gap

The literature identifies several opportunities for future research. First, much of the Indian literature has focused on **adoption intention** rather than actual installation behaviour. Future studies should distinguish between awareness, willingness, application, installation and continued usage. Second, there is only relatively limited research which combines government policy, marketing communication and consumer behaviour in a single investigative model. These dimensions are examined separately in existing studies. Third, more attention has to be paid to state-level differences. Across different states of India, there are significant differences in electricity tariffs, DISCOM performance, net-metering arrangements, solar irradiation, household income and awareness. Fourth, there is a relative underrepresentation of apartment owners and tenants. In urban India, the concepts of shared solar and community solar may become increasingly important. Fifth, more research is required on the role of digital communication.

The way the households search for information and make investment decisions may be influenced by the increasing use of government portals, social media, online calculators and digital vendor platforms. Finally, post-adoption behaviour should be analysed in future research. Word-of-mouth communication and the adoption decisions of other households can be influenced by customer satisfaction, solar system performance, maintenance experience and savings in electricity bill.

VIII. Conclusion

In India, residential rooftop solar is changing from a niche renewable-energy activity to a mainstream activity in households. Government has played a significant role, especially through PM Surya Ghar- a combination of financial aid, digital applications, and a huge target for residential adoption. Since the programme began, a strong growth is seen and recent data shows the same. Still, policies alone cannot not promise adoption. The important step is moving from awareness stage to action. Customers must have knowledge not only that subsidies exist but also the extent of savings, finance and application, vendor selection and maintenance after installation. Studies show that customer decisions depend on usefulness, advantage, trust, social influence, control, environmental concern, and ease of use. Marketing communication can reduce uncertainty and build confidence. Important lessons can be learnt from international experiences. In Australia, subsidies are combined with independent customer information, For a longer timer, Germany has supported solar generation widely through strong policies, and the United States uses a combination of federal, state, and community-based mechanisms. These practices show how households can be encouraged in different ways to adopt solar. In India's case, the next level of rooftop solar growth needs integrated approach. There is a need for Government incentives along with clear customer communication, transparency in financing, reliable vendors, simple procedures, quality control, community programmes, and after-sales service. Making solar financially attractive not the only challenge, but making the adoption process simple, credible, and convenient is also an additional challenge. Thus, the conversion from policy to adoption depends on three important forces: government can create the environment, communication can build trust and understanding, and customer has to change these into adoption. All these provide a strong base for future research and improved programmes in India.

REFERENCES

[1] Ajzen, I. (1991). The theory of planned behavior. Organizational Behavior and Human Decision Processes, 50(2), 179–211. https://doi.org/10.1016/0749-5978(91)90020-T

[2] Australian Government, Department of Climate Change, Energy, the Environment and Water. (2025). Australians can now access support for small-scale batteries. https://www.energy.gov.au/news/australians-can-now-access-support-small-scale-batteries

[3] Australian Government, Department of Climate Change, Energy, the Environment and Water. (2026a). Households. https://www.energy.gov.au/households

[4] Australian Government, Department of Climate Change, Energy, the Environment and Water. (2026b). Solar for households. https://www.energy.gov.au/solar/switch-solar-power/solar-households

[5] Council on Energy, Environment and Water. (2019). Scaling rooftop solar technology in India: Consumer survey. https://www.ceew.in/publications/scaling-rooftop-solar-technology-in-india

[6] Chaudhary, M., Purohit, S., Vijayan, M., & Tyagi, B. (2026). What drives rooftop solar installation decisions in Indian homes? Understanding household decision-making through a pan-India survey. Council on Energy, Environment and Water. https://www.ceew.in/publications/what-shapes-rooftop-solar-decisions-in-indian-households

[7] Davis, F. D. (1989). Perceived usefulness, perceived ease of use, and user acceptance of information technology. MIS Quarterly, 13(3), 319–340. https://doi.org/10.2307/249008

[8] Devi, A., Narayan, U., & Mandal, T. (2018). Here comes the sun: Residential consumers' experience with rooftop solar PV in five Indian cities. World Resources Institute. https://www.wri.org/research/here-comes-sun-residential-consumers-experience-rooftop-solar-pv-five-indian-cities

[9] International Energy Agency. (2025). Solar panels scheme – Policies. https://www.iea.org/policies/26510-solar-panels-scheme

[10] Joshi, L., & Yenneti, K. (2020). Understanding the barriers to the diffusion of rooftop solar: A case study of Delhi (India). Energy Policy, 144, 111674. https://doi.org/10.1016/j.enpol.2020.111674

[11] Ministry of New and Renewable Energy. (2024). Guidelines for PM-Surya Ghar: Muft Bijli Yojana. Government of India. https://mnre.gov.in/en/notice/guidelines-for-pm-surya-ghar-muft-bijli-yojana/

[12] Ministry of New and Renewable Energy. (2026). Grid connected rooftop solar programme. Government of India. https://mnre.gov.in/en/grid-connected-solar-rooftop-programme/

[13] Rogers, E. M. (2003). Diffusion of innovations (5th ed.). Free Press.

[14] Sahu, K. K., Sahoo, T. R., Santosh, I., Guru, S., & Chaudhary, R. K. (2026). Behavioral determinants of solar energy adoption in India: Insights for policy from an extended TPB framework. Energy Policy, 210, 115079. https://doi.org/10.1016/j.enpol.2026.115079

[15] Sahu, K. K., et al. (2026). Role of media use, incentives policy, and perceived inconveniences in transforming consumers' intention to purchase residential rooftop solar panel systems in India. International Journal of Energy Sector Management, 20(3), 936–959. https://doi.org/10.1108/IJESM-06-2025-0067

[16] U.S. Department of Energy. (2021). National Community Solar Partnership targets. https://www.energy.gov/cmei/systems/national-community-solar-partnership-targets