

Role of PM Surya Ghar Yojana in Sustainable Economic Growth in India

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Abstract: The transition toward renewable energy has become a global priority in response to climate change, rising energy demand, and the need for sustainable economic development. As one of the world's fastest-growing economies, India is accelerating its clean energy transition through policy-driven initiatives that promote renewable energy investment and reduce dependence on fossil fuels. Among these initiatives, the PM Surya Ghar Yojana, launched in 2024, represents a significant policy intervention to encourage rooftop solar adoption and strengthen the country's sustainable energy transition. This review paper aims to critically examine the role of the PM Surya Ghar Yojana in promoting rooftop solar adoption, renewable energy investment, and sustainable economic growth in India. The study is based on a comprehensive review of secondary data obtained from the Ministry of New and Renewable Energy (MNRE), Government of India reports, World Bank databases, policy documents, and recent peer-reviewed research articles. A qualitative and thematic review approach has been adopted to analyze existing evidence on the scheme's economic, environmental, and policy implications. The review indicates that the PM Surya Ghar Yojana has emerged as a significant policy initiative for accelerating rooftop solar adoption, mobilizing renewable energy investment, and supporting India's transition towards a low-carbon economy. The evidence further suggests that the scheme can strengthen energy security, reduce dependence on fossil fuels, generate employment opportunities, and contribute to sustainable economic growth. The study concludes that sustained policy support, effective implementation, enhanced public awareness, and increased investment in renewable energy infrastructure are essential for achieving India's long-term clean energy and sustainable development objectives. This study also provides policy recommendations for strengthening rooftop solar adoption and accelerating India's renewable energy transition...

Keywords: PM Surya Ghar Yojana, Rooftop Solar Adoption, Renewable Energy Investment, Sustainable Economic Growth, Energy Transition, Green Economy

INTRODUCTION

The global transition towards renewable energy has become a strategic priority in response to climate change, increasing energy demand, and the urgent need to achieve sustainable development. Countries across the world are accelerating investments in clean energy technologies to reduce greenhouse gas emissions, strengthen energy security, and support long-term economic resilience. As the world's third-largest energy consumer, India faces the dual challenge of meeting rapidly growing energy demand while ensuring environmental sustainability. Consequently, expanding renewable energy investment has become a central component of India's energy transition strategy.

Over the past decade, India has made significant progress in expanding its renewable energy capacity through supportive policy reforms, technological innovation, and increased public and private investment. Solar energy has emerged as the cornerstone of this transition due to its abundant resource potential, declining installation costs, and strong policy support. The Government of India has also committed to achieving ambitious renewable energy targets, recognizing clean energy as a key driver of sustainable economic growth, energy security, and environmental protection...

To accelerate the clean energy transition, the Government of India has introduced several flagship initiatives, including the National Solar Mission, PM-KUSUM, the Green Energy Corridor, and the recently launched PM Surya Ghar Yojana. Among these initiatives, the PM Surya Ghar Yojana represents a major policy intervention aimed at promoting rooftop solar adoption in the residential sector through financial incentives and simplified digital implementation. Beyond expanding household access to clean electricity, the scheme is expected to stimulate renewable energy investment, encourage public participation in decentralized energy generation, reduce dependence on conventional fossil fuels, and contribute to India's broader sustainable development and climate goals.

Despite the growing policy emphasis on renewable energy, limited academic attention has been given to evaluating the broader economic and investment implications of the PM Surya Ghar Yojana. Most existing studies focus on renewable energy policies or solar energy adoption in general, while evidence on how this flagship program may influence renewable energy investment and sustainable economic growth remains limited. Therefore, this review paper critically examines the potential contribution of the PM Surya Ghar Yojana to India's renewable energy transition by synthesising existing evidence and identifying key policy insights and future research directions.

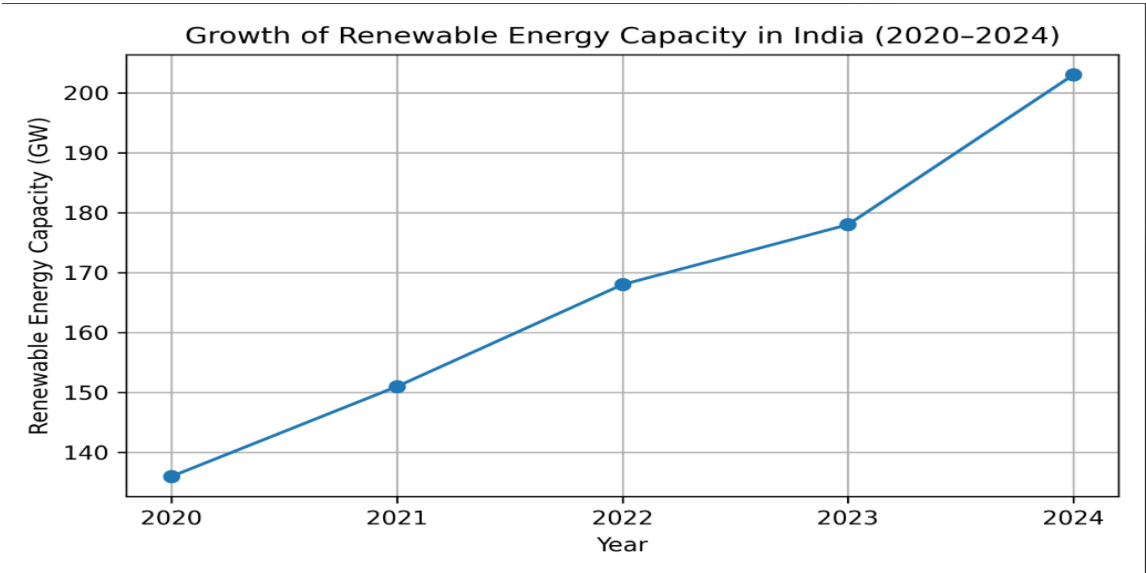


Figure 1: Growth of Renewable Energy Capacity in India (2020-2024)

Source: Ministry of New and Renewable Energy (MNRE), Government of India Reports (2020-2024).

As shown in Figure 1, India's renewable energy capacity increased steadily between 2020 and 2024. The installed capacity rose from 136 GW in 2020 to 203 GW in 2024, indicating continuous progress in the expansion of renewable energy during the study period.

SCHEME OVERVIEW

Objectives

The PM Surya Ghar Yojana, initiated by the Government of India, seeks to promote the adoption of rooftop solar energy systems in residential areas. The primary goal of this initiative is to foster the use of clean and renewable energy sources at the household level. By offering financial assistance and subsidies for the installation of rooftop solar panels, the scheme aims to reduce household electricity costs. Additionally, the program endeavors to enhance the proportion of renewable energy in the national energy mix, thereby supporting sustainable development. This initiative also aims to reduce reliance on fossil fuels and promote a cleaner environment for future generations.

Key features

The PM Surya Ghar Yojana aims to promote the adoption of solar energy systems by offering a range of benefits to consumers. A key component of this scheme is the financial assistance provided by the government in the form of subsidies for the installation of rooftop solar panels. Households that meet the eligibility criteria can receive subsidies of up to 40 percent, thereby alleviating the financial constraints associated with the installation process. Additionally, the scheme offers free electricity benefits up to a specified limit for households that utilize rooftop solar systems. To streamline the process, the government implemented an online application portal designed to facilitate a more efficient,

rapid, and transparent registration and approval process for citizens.

Implementation

The implementation of the PM Surya Ghar Yojana is primarily overseen by the Ministry of New and Renewable Energy (MNRE) in collaboration with state governments and electricity distribution companies. This initiative is implemented at both the central and state levels to ensure extensive reach and effective implementation. Digital monitoring and online tracking systems have been introduced to enhance transparency and efficiency in the implementation process. The government is actively promoting public participation and awareness to bolster the scheme's success nationwide.

Table 2: Key Features of PM Surya Ghar Yojana

Feature	Description
Launch Year	2024
Objective	Rooftop Solar Promotion
Subsidy	Up to 40%
Target Beneficiaries	Residential Households
Nodal Ministry	MNRE
Main Benefit	Free Electricity up to 300 Units per Month

Source: Ministry of New and Renewable Energy (MNRE), PM Surya Ghar Yojana Guidelines, Government of India.

OBJECTIVES OF THE STUDY

To examine the role of the PM Surya Ghar Yojana in promoting rooftop solar adoption and renewable energy investment in India.

To analyze the contribution of renewable energy investment to sustainable economic growth, energy security, and environmental sustainability in India.

To evaluate the effectiveness of the PM Surya Ghar Yojana in accelerating India's clean energy transition.

To identify the key policy challenges and implementation barriers affecting the successful implementation of the PM Surya Ghar Yojana.

To propose policy recommendations for strengthening renewable energy investment and achieving long-term sustainable development in India.

LITERATURE REVIEW

Song, Huang, and Wang (2025), in their study titled *“Green Economy Development, Renewable Energy Investment, and Economic Growth,”* used secondary data analysis and econometric methods to examine the relationship between renewable energy investment and economic growth. The study found that investment in renewable energy positively supports green economic development and improves long-term economic growth by reducing environmental risks and increasing sustainable energy usage.

Das and Mishra (2024), in the research titled *“Rooftop Solar Adoption and Energy Security in India,”* used survey and analytical methods to evaluate rooftop solar schemes. The study concluded that rooftop solar adoption improves household energy access and reduces electricity expenses.

Sharma et al. (2024), in the study *“Solar Energy Adoption and Sustainable Development in India,”* used descriptive and analytical methods to evaluate the impact of solar energy policies in India. The study concluded that rooftop solar schemes increase clean energy usage and support sustainable development goals.

Zhang et al. (2024), in the study titled *“Renewable Energy Transition and Economic Sustainability,”*

used panel data analysis to examine the relationship between renewable energy transition and sustainable economic growth. The study found that renewable energy investment positively contributes to environmental sustainability and long-term economic performance.

Mehta and Sharma (2024), in the study “Sustainable Energy Policies and Economic Growth in India,” used secondary data and trend analysis methods to evaluate the role of renewable energy policies in India. The findings revealed that renewable energy policies improve sustainable economic growth and environmental protection.

Verma et al. (2024), in the study “Government Renewable Energy Policies and Economic Growth,” used secondary data analysis to evaluate renewable energy schemes in India. The study concluded that government incentives increase renewable energy adoption and attract private investment.

Patel and Singh (2023), in the study “Green Finance and Renewable Energy Growth in India,” applied comparative analysis techniques to investigate the role of green finance in renewable energy development. The findings indicated that government support and green investment policies improve renewable energy capacity.

Gupta and Kumar (2023), in the study “Renewable Energy and Sustainable Economic Development in India,” used descriptive and statistical methods to analyze renewable energy trends in India. The study found that renewable energy expansion supports sustainable industrial and economic growth.

Khan and Rehman (2023), in their research titled “Green Energy Investment and Economic Development,” applied regression analysis using secondary data from developing countries. The findings revealed that green energy investment significantly improves economic growth and reduces environmental degradation.

Yadav et al. (2023), in the study “Renewable Energy Policies and Economic Performance,” used comparative analysis to examine renewable energy policies in developing economies. The findings indicated that renewable energy investment positively influences economic performance and sustainability.

Iqbal et al. (2023), in their research titled “Renewable Energy Investment and Carbon Emission Reduction,” used econometric analysis to examine the impact of renewable energy investment on environmental quality. The study concluded that renewable energy investment significantly reduces carbon emissions.

Ahmed et al. (2022), in the research titled “Renewable Energy and Environmental Sustainability,” used correlation analysis to examine the impact of renewable energy investment on environmental quality. The study found a positive relationship between renewable energy adoption and carbon emission reduction.

Bhatia and Roy (2022), in the study titled “Clean Energy Transition and Green Growth,” used statistical techniques to analyze the relationship between clean energy investment and economic growth. The study found that green energy policies support sustainable development and employment generation.

Chen et al. (2022), in their research titled “Solar Energy Investment and Green Economic Growth,” used regression analysis to analyze the impact of solar investment on sustainable growth. The findings revealed that solar energy investment improves energy security and environmental quality.

Srivastava et al. (2022) conducted a study titled “*Green Finance and Sustainable Economic Growth in India*” using secondary data collected from government reports and international databases. The researchers applied correlational and comparative analyses in the study. The findings revealed that green finance and renewable energy investment play an important role in promoting sustainable economic growth and environmental stability in India.

Rahman et al. (2021), in the study titled “Green Investment and Environmental Sustainability,” used panel regression models to examine the impact of green investment on environmental protection. The findings showed that green investment significantly reduces environmental risks.

Li and Zhou (2021), in the study titled “Economic Effects of Renewable Energy Investment,” used econometric analysis to examine the impact of renewable energy investment on GDP growth. The study found that renewable energy investment contributes positively to employment generation and economic development.

Pavlyk (2020), in the research titled “*Assessment of Green Investment Impact on Economic Development*,” used statistical and analytical methods to evaluate the effect of green investment on economic performance. The study concluded that green investment contributes significantly to economic efficiency, employment

generation, and sustainable development while also supporting environmental protection.

Bhattacharya et al. (2016), in their study titled *"The Role of Renewable Energy Investment in Economic Growth,"* used cross-country secondary data and regression analysis to examine the relationship between renewable energy consumption and economic development. The study found that renewable energy investment increases economic growth, improves energy security, and supports sustainable development in developing economies.

RESEARCH GAP

Previous research has primarily examined renewable energy investment, green finance, and sustainable economic growth at national and international levels. Various scholars have investigated the connection between renewable energy and economic development using diverse methodologies and data sources. Nonetheless, there is a significant gap in the literature on recent government initiatives to promote rooftop solar energy adoption in India. The PM Surya Ghar Yojana, introduced in 2024, remains under-researched regarding its impact on renewable energy investment and economic growth. Current studies tend to focus on general renewable energy policies, often neglecting the PM Surya Ghar Yojana's specific economic contributions and effectiveness. This study addresses this gap by evaluating the influence of the PM Surya Ghar Yojana on renewable energy investment and economic growth in India.

DATA AND METHODOLOGY

The present study is based on secondary data collected from various government reports; the Ministry of New and Renewable Energy (MNRE), World Bank databases, the Reserve Bank of India (RBI), the International Energy Agency (IEA), research journals, and policy reports related to renewable energy and economic growth. The study uses descriptive and analytical research methods to examine the relationship between rooftop solar adoption, renewable energy investment, and sustainable economic growth in India.

The study mainly focuses on the period from 2020 to 2025 to analyze recent developments in renewable energy investment and the implementation of PM Surya Ghar Yojana. Statistical tools such as trend analysis, percentage analysis, and comparative analysis have been used to interpret the collected data. The study also applies descriptive analysis to examine the relationship between renewable energy investment and economic growth indicators in India.

Research Design

This study adopts a qualitative review research design based on secondary data. The study systematically reviews published literature, government reports, policy documents, and international databases to examine the role of the PM Surya Ghar Yojana in promoting rooftop solar adoption, renewable energy investment, and sustainable economic growth in India.

Data Sources

The study is based entirely on secondary data collected from authentic and reliable sources. Data have been obtained from the Ministry of New and Renewable Energy (MNRE), National Institute of Solar Energy (NISE), Reserve Bank of India (RBI), NITI Aayog, Ministry of Statistics and Programme Implementation (MoSPI), Central Electricity Authority (CEA), Economic Survey of India, World Bank, International Energy Agency (IEA), and relevant peer-reviewed research articles.

Study Period

The study covers the period from 2014 to 2025. This period has been selected to capture India's renewable energy transition, major policy developments, and the launch of the PM Surya Ghar Yojana in 2024.

Variables of the Study

The study examines the relationship between the PM Surya Ghar Yojana, rooftop solar adoption, renewable energy investment, and sustainable economic growth in India. The PM Surya Ghar Yojana is considered the primary policy intervention, while rooftop solar adoption serves as an intermediate factor influencing renewable energy investment. Sustainable economic growth is assessed using indicators such as GDP growth, employment generation, energy security, and environmental sustainability.

Data Analysis Techniques

The collected secondary information was analyzed using thematic analysis, descriptive interpretation, comparative review, and trend analysis based on published government reports, policy documents, and peer-reviewed literature. The findings were interpreted to understand the role of the PM Surya Ghar Yojana in promoting rooftop solar adoption, renewable energy investment, and sustainable economic growth in India.

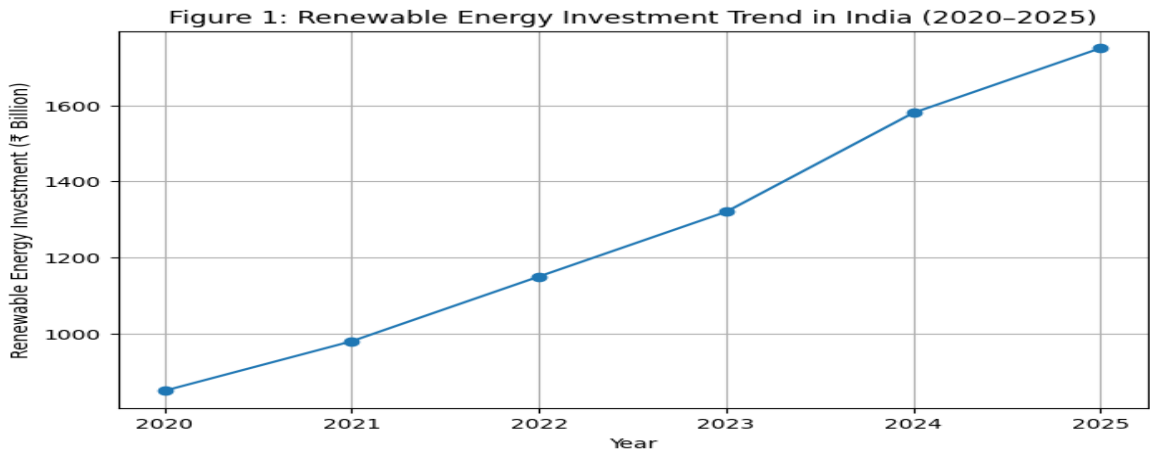


Figure 1: Renewable Energy Investment Trend in India (2020–2025)

Source: Compiled from Ministry of New and Renewable Energy (MNRE), International Energy Agency (IEA), and Government of India Renewable Energy Statistics.

RESULTS AND DISCUSSION

Trend Analysis of Renewable Energy Investment

The trend analysis indicates a continuous increase in renewable energy investment in India during the period 2020–2025. As illustrated in Figure 1, renewable energy investment has shown a steady upward trajectory, reflecting the government's growing commitment to clean energy development. The implementation of the PM Surya Ghar Yojana in 2024 further accelerated rooftop solar adoption by providing financial incentives and simplified installation procedures. The increasing investment trend demonstrates India's transition towards a sustainable and low-carbon economy while strengthening energy security and reducing dependence on fossil fuels.

Table 3: Impact of Renewable Energy Investment on Economic Growth Indicators

Economic Indicator	Impact of Renewable Energy Investment
Employment Generation	Positive Increase
Energy Security	Improved
Carbon Emissions	Reduced
GDP Growth	Positive Contribution
Sustainable Development	Strengthened
Fossil Fuel Dependence	Decreased

Source: Compiled from MNRE Reports, World Bank Data, and Secondary Research Studies.

Impact of PM Surya Ghar Yojana on Renewable Energy Investment

The findings of the study suggest that renewable energy investment positively contributes to sustainable economic growth by improving energy security, creating employment opportunities, and reducing environmental pollution. The increasing adoption of rooftop solar systems has also reduced dependence on conventional energy sources such as coal and petroleum.

Significance of the Study

This review makes several important contributions to the existing literature on renewable energy investment and sustainable economic development in India. First, it provides one of the earliest comprehensive reviews of the PM Surya Ghar Yojana and examines its potential role in promoting rooftop solar adoption and renewable energy investment. Second, the study integrates evidence from recent literature to explain the relationship between renewable energy investment, energy transition, and sustainable economic growth within the Indian context. Third, it identifies key research gaps and highlights policy measures that can strengthen the implementation of the scheme and support India's long-term clean energy transition.

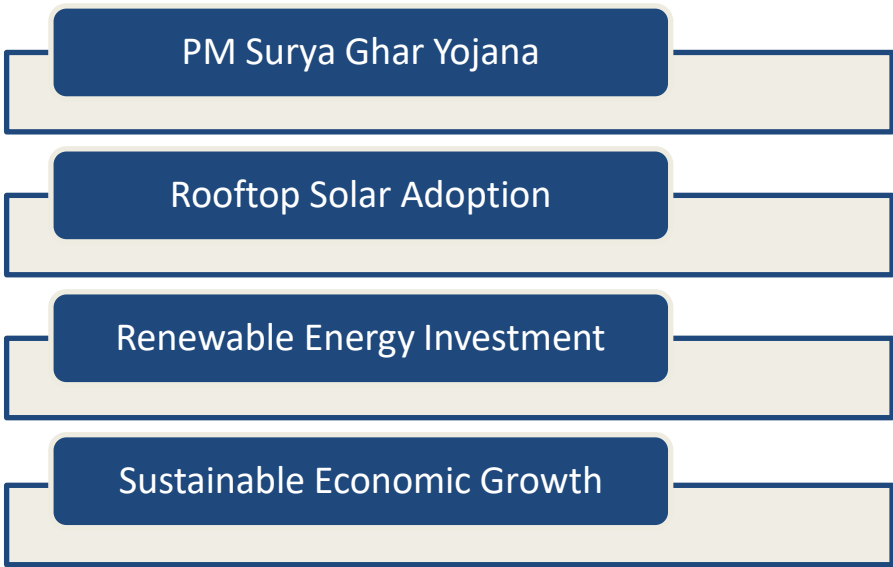
Research problem

In recent years, India has achieved remarkable development in the renewable energy sector. However, the current level of investment remains inadequate to satisfy escalating energy demand and sustainability objectives. Many renewable energy initiatives require substantial initial capital, posing financial challenges for both investors and consumers. Consequently, the pace of investment in renewable energy has lagged behind the country's increasing energy demand. A critical issue is the heavy reliance on conventional energy sources such as coal and petroleum. These energy sources significantly contribute to environmental pollution, climate change, and increased carbon emissions. Despite the government's introduction of numerous renewable energy policies and programs, the uptake of clean energy solutions at the household level remains insufficient in several regions.

In recent years, numerous government initiatives have been introduced to advance renewable energy development. Despite these efforts, there is a significant deficiency in comprehensive assessments of their actual economic and investment impacts. Given that the PM Surya Ghar Yojana is a newly implemented scheme, there is a paucity of research evaluating its effectiveness and potential to stimulate investment in renewable energy and foster economic growth. Thus, it is crucial to explore and evaluate the effects of the PM Surya Ghar Yojana on renewable energy investments and the economic growth trajectory of India. This study aims to bridge this gap by analyzing the scheme's contribution to advancing sustainable and environmentally friendly economic progress.

Conceptual Framework

The study's conceptual framework illustrates the relationships among the PM Surya Ghar Yojana, rooftop solar adoption, renewable energy investment, and sustainable economic growth in India. The framework assumes that the PM Surya Ghar Yojana promotes rooftop solar adoption through financial incentives and policy support. Increased rooftop solar adoption is expected to stimulate renewable energy investment, thereby contributing to sustainable economic growth by improving energy security, generating employment opportunities, reducing dependence on fossil fuels, and enhancing environmental sustainability.



Discussion of Findings

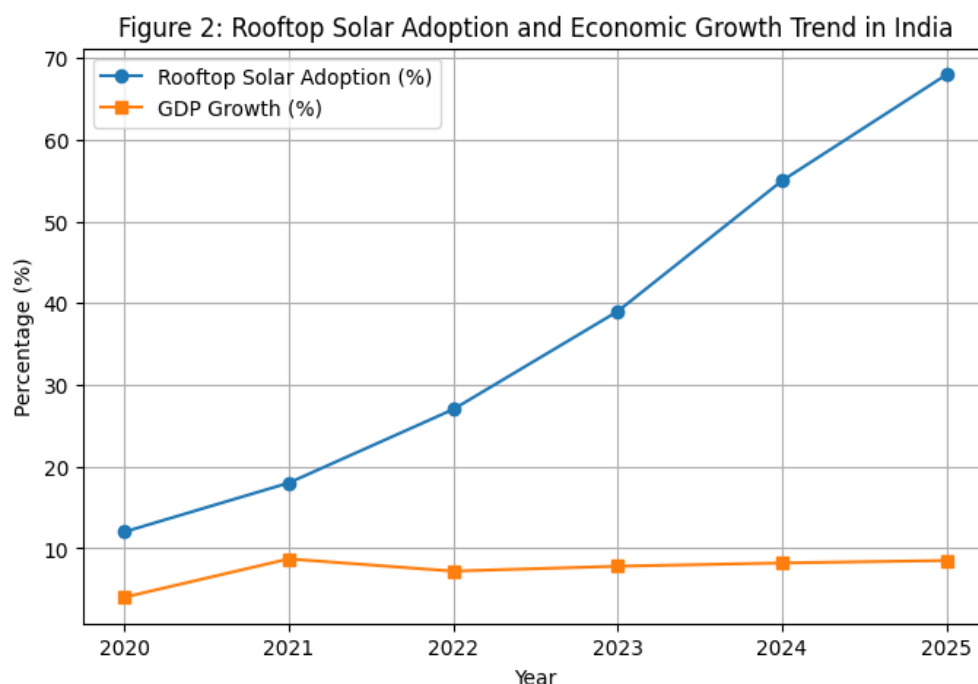
The study further reveals that government subsidies, policy support, and financial incentives under the PM Surya Ghar Yojana play an important role in promoting renewable energy investment in India. The scheme has the potential to increase green investment and support India’s transition toward a sustainable and low-carbon economy.

In addition, renewable energy investment contributes to long-term environmental sustainability by reducing carbon emissions and promoting clean energy development. Therefore, the PM Surya Ghar Yojana can be considered an important initiative for achieving sustainable economic and environmental goals in India.

Graph data

Year	Rooftop Solar Adoption (%)	GDP Growth (%)
2020	12	4.0
2021	18	8.7
2022	27	7.2
2023	39	7.8
2024	55	8.2
2025	68	8.5

Figure 2: Rooftop Solar Adoption and Economic Growth Trend in India



Source: Compiled from Ministry of New and Renewable Energy (MNRE), World Bank Database, and Government of India Economic Survey Reports.

Comparison with Previous Studies

The findings of the present study are consistent with earlier studies on renewable energy investment and sustainable economic growth. Previous studies by Song et al. (2025), Zhang et al. (2024), Bhattacharya et al. (2016), and Pavlyk (2020) also reported that renewable energy investment positively contributes to economic growth, employment generation, and environmental sustainability. However, unlike these studies, the present review specifically examines the PM Surya Ghar Yojana, which was launched in 2024 to promote rooftop solar adoption in India. Therefore, this study extends the existing literature by highlighting the potential role of this scheme in accelerating renewable energy investment and supporting India's clean energy transition.

POLICY IMPLICATIONS

The findings of the study suggest that government support and policy incentives play an important role in promoting renewable energy adoption in India. The PM Surya Ghar Yojana can significantly improve household participation in rooftop solar systems and increase investment in renewable energy infrastructure. The government should strengthen financial support, awareness programs, and technological accessibility to ensure the successful implementation of the scheme. Increased investment in renewable energy can contribute to employment generation, environmental sustainability, and long-term economic growth in India.

Conclusion

The present study concludes that the PM Surya Ghar Yojana plays an important role in promoting rooftop solar adoption and renewable energy investment in India. The scheme encourages the use of clean and sustainable energy sources at the household level and supports the country's transition toward a green economy. The study found that renewable energy investment positively contributes to sustainable economic growth by improving energy security, generating employment opportunities, and reducing environmental pollution. Government initiatives, financial incentives, and policy support under the PM Surya Ghar Yojana have increased public awareness and participation in renewable energy development.

In addition, the expansion of rooftop solar systems can help reduce dependence on conventional fossil fuels and support India's long-term environmental and economic goals. The study highlights that effective implementation, technological advancement, and continuous policy support are essential for achieving sustainable development and strengthening renewable energy investment in India. Therefore, the PM Surya

Ghar Yojana can be considered a significant step toward promoting clean energy adoption, environmental sustainability, and sustainable economic growth in the country..

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