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A Study of Pradhan Mantri Surya Ghar Yojna and Its Impact on Household Electricity Costs and Decreasing Dependency on Conventional Energy Sources

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Abstract

According to research, the Pradhan Mantri Surya Ghar Yojna has a significant impact on sustainable energy practices by lowering household electricity costs through rooftop solar installations and reducing India's dependency on foreign energy sources. The Yojna lessens the environmental effect of traditional energy usage by enabling homes to switch to greener options by promoting access to renewable energy. The program's subsidies and incentives increase access to solar energy, promoting its widespread adoption by both urban and rural families. In addition to lowering household power costs, its widespread adoption helps India meet its challenging targets for lowering carbon emissions and fostering environmental sustainability.

Through the creation of chances for local manufacturers, skilled workers, and industries to engage in the solar energy value chain, the project also promotes socioeconomic development. The initiative supports India's larger sustainable energy aims by offering a framework for rooftop solar panel installations, guaranteeing long-term financial gains and promoting energy independence.

There are difficulties, mostly associated with the initial high cost of installing solar panels and the difficulties in obtaining funding or subsidies, but they are gradually being resolved by means of incentives and policy changes from the government. Overall, by making solar energy more accessible, cheap, and appealing to Indian homes, the Pradhan Mantri Surya Ghar Yojna has played a significant role in defining sustainable energy habits and supporting the nation's wider economic and climatic goals.

1. Introduction:

The Pradhan Mantri Surya Ghar Yojna (PMSGY), launched on February 29, 2024, by Prime Minister Narendra Modi, represents a transformative step in India’s journey towards sustainable energy practices. This ambitious initiative aims to install rooftop solar panels on one crore households across the country, significantly reducing household electricity costs and decreasing dependency on conventional energy sources. (pib.gov.in) (moneycontrol.com) [12]

The primary objective of PMSGY is to provide free electricity to households by offering substantial subsidies for rooftop solar installations. The scheme covers up to 40% of the installation cost, making solar energy accessible to a broader segment of the population[1]. By promoting the adoption of renewable energy, the scheme is expected to generate significant savings for the government, estimated at ₹75,000 crores annually in electricity costs[1]. Additionally, households can save between

₹15,000 to ₹18,000 annually on their electricity bills(moneycontrol.com).[3]
The scheme also includes provisions for collateral-free, low-interest loans to further ease the financial burden on households. These loans, available at an interest rate of around 7%, support the installation of residential rooftop solar systems up to 3
1Press Note Details: Press Information Bureau (pib.gov.in) 2
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kW[1]. This financial support is crucial in encouraging widespread adoption of solar energy, thereby reducing the reliance on fossil fuels and contributing to a cleaner environment.
Moreover, the PMSGY aligns with India's broader goals of enhancing renewable energy use and cutting carbon emissions. By transitioning to solar energy, the scheme aims to lower carbon emissions, supporting India's commitment to reducing its carbon footprint[1]. The initiative is a significant step towards achieving the country's renewable energy targets and promoting sustainable development.
The Pradhan Mantri Surya Ghar Yojna is a landmark initiative that not only aims to reduce household electricity costs but also fosters sustainable energy practices in India. By making solar energy more accessible and affordable, the scheme is poised to transform India's energy landscape and contribute to a more sustainable and environmentally friendly future(adda247.com).[1]

2. Background Information:

India, one of the world's fastest-growing economies, has seen a sharp rise in energy demand over the past few decades, creating a need for reliable energy access and a reduction in fossil fuel dependency. To address this, Prime Minister Narendra Modi launched the International Solar Alliance in 2015, promoting solar energy as a sustainable, low-carbon solution on a global scale. Committed to expanding renewable energy, the Indian government set ambitious targets at COP26, aiming for 500 GW of renewable energy by 2030 and reducing the carbon intensity of the economy. Solar energy plays a key role in this strategy due to its abundant availability and decreasing costs. As of February 2023, India's renewable energy capacity reached 168.96 GW, with solar power accounting for 64.38 GW. To encourage further adoption of renewable energy, the government introduced the Pradhanmantri Suryodaya Yojana, now called the PM Surya Ghar Muft Bijli Yojana, promoting rooftop solar systems across households.
PM Narendra Modi introduced the historic PM Surya Ghar: Muft Bijli Yojana on early this year. It seeks to revolutionize India's energy sector by giving families free access to power. This ambitious programme provides a significant financial incentive to homeowners, up to 40% of the cost of putting solar panels on their rooftops, enabling them to harness solar energy. The program is expected to help one crore homes nationwide by facilitating the widespread usage of solar energy. In addition, it is anticipated to save the government a substantial amount of money—roughly Rs. 75,000 crores in power bills every year. The government demonstrates its dedication to advancing sustainable energy and guaranteeing universal access to energy with this program.[2]

[1] PM Modi launches 'Pradhan Mantri Suryodaya Yojana' for One Crore Households (adda247.com)
[2]https://www.pib.gov.in/PressNoteDetails.aspx?NoteId=152016&ModuleId=3&reg=3&lang=1

1.2 KEY FEATURES;

The PM Surya Ghar: Muft Bijli Yojana offers several significant benefits to participating households:

Free Electricity for Households: The scheme provides households with free electricity by installing subsidised rooftop solar panels, significantly reducing their energy costs. Under this scheme, the beneficiaries will be able to generate and consume 300 units of electricity every month.[3]

Reduced Electricity Costs for the Government: By promoting the widespread use of solar power, the scheme is expected to save the government an estimated ₹75,000 crore annually in electricity costs.

Increased Use of Renewable Energy: The scheme encourages the adoption of renewable energy sources, contributing to a more sustainable and environmentally friendly energy mix in India.

Reduced Carbon Emissions: The transition to solar energy under this scheme will help lower carbon emissions, supporting India's commitment to reducing its carbon footprint.

2.2 IMPLEMENTATION AUTHORITIES

The Pradhan Mantri Surya Ghar: Muft Bijli Yojana will be implemented through a two-tier system. At the national level, the scheme will be overseen by the National Programme Implementation Agency (NPIA), while at the state level, State Implementation Agencies (SIAs) will be responsible for execution. These SIAs will consist of the Distribution Utilities (DISCOMs) or the Power/Energy Departments of the respective states and Union Territories. (DrishtiIAS, 2024).

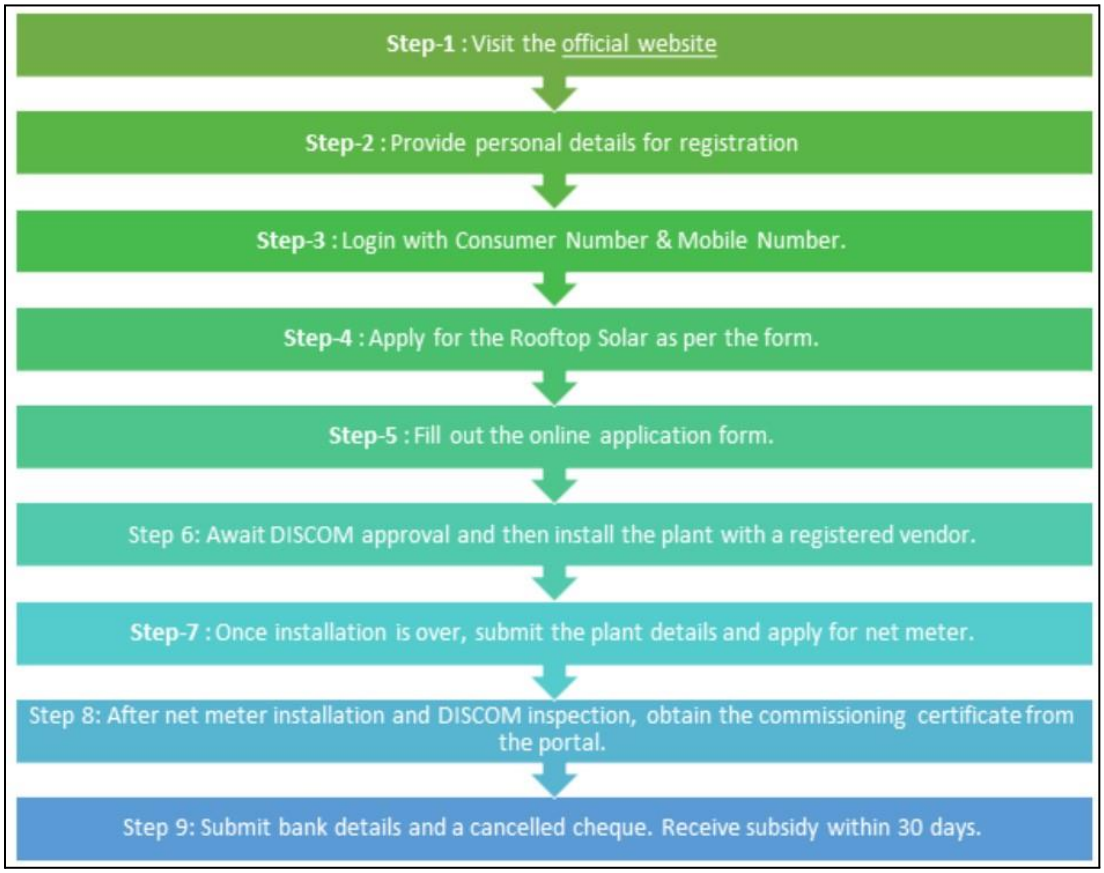
3. Financial structure for the scheme:

1. **CFA to Residential Consumers:** ₹65,700 crore
2. **Incentives for Distribution Companies (Discoms):** ₹4,950 crore
3. **Development of Model Solar Villages:** ₹800 crore, to establish a model solar village in each district.
4. **Incentives for Local Bodies:** ₹1,000 crore
5. **Payment Security Mechanism:** ₹100 crore to ensure financial stability and support for the program.
6. **Innovative Projects:** ₹500 crore to foster new and creative solar energy initiatives.
7. **Capacity Building:** ₹657 crore to enhance skills and capabilities related to the program's implementation.
8. **Awareness & Outreach:** ₹657 crore to promote public understanding and engagement with the scheme.
9. **Service Charges:** ₹657 crore to cover operational and administrative costs.[4]

Through the National Portal, the PM Surya Ghar Muft Bijli Yojana makes it easier for homeowners to install rooftop solar systems. Under the capex option, customers can finance the installation directly from registered vendors or through a bank loan, paying them ahead. The site is used to submit all Central Financial Assistance (CFA) requests. DISCOMs will set up helpdesks at field offices to aid with the application and installation. Instead than requiring state agencies to hold bids or choose suppliers, residential customers can directly negotiate pricing with vendors.

[3] https://www.drishtiias.com/daily-updates/daily-news-analysis/pm-surya-ghar-muft-bijli-yojana
[4] https://www.impriindia.com/insights/solar-power/

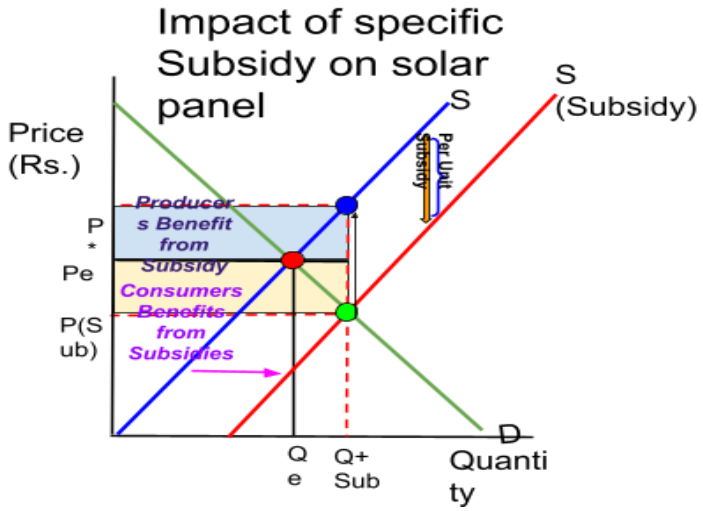
4. Application process:



5. Benefits of the scheme:

5.1 SUBSIDY

The PM Surya Ghar Muft Bijli Yojana offers a structured subsidy to lower the cost of installing rooftop solar systems, with a maximum cap set at 3kW capacity. For solar systems with a capacity of up to 2kW, consumers can receive a subsidy of 60%, making the installation significantly more affordable. For systems ranging between 2kW and 3kW capacity, the subsidy is set at 40%. This tiered approach ensures greater financial assistance for smaller installations, encouraging widespread adoption of solar energy while promoting sustainability and reducing electricity costs for households across the country.



In the diagram the initial equilibrium price as Pe and equilibrium quantity was Qe where demand curve and supply curve intersect. Due to subsidy the supply curve shifts to the right from S to S-subsidy, as a result, the equilibrium price decreases from P to P+subsidy and the equilibrium quantity increases from Qe to Q+subsidy.

Per unit subsidy is the vertical difference between the two supply curves [P* - (P-subsidy)]

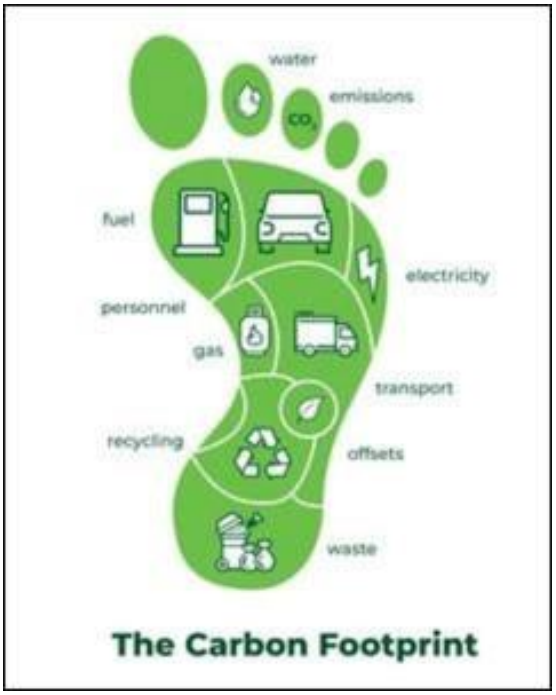
The PM Surya Ghar Yojana program provides consumers the chance to make an income from the sale of excess power in addition to considerable savings on electricity costs. Moreover, by generating about 17 lakh (1.7 million) direct employment in various industries, including manufacturing, logistics, supply chain, sales, installation, and operations and maintenance, the program is expected to boost economic growth significantly. The scheme's contribution to increasing the use of renewable energy, improving household financial stability, and promoting environmental sustainability is highlighted by these combined outcomes.

6. Carbon Footprint and Pradhan Mantri Surya Ghar Yojna :

The entire amount of methane and carbon dioxide produced by human activity is known as a carbon footprint. Although the global average is 4 tons, the average carbon footprint in the United States is 16 tons per person. Just 3% of global emissions have come from India since 1850 (15 Gt C). India's per-person emissions rose to 2 tons in 2022, which is half the world average, by 5.1%. The average yearly carbon footprint must fall to less than 2 tons by 2050 in order to stop a 2°C increase in global temperatures. In order to mitigate the impacts of climate change, this decrease is imperative.

Average Monthly Electricity Consumption (units)	**Suitable Rooftop Solar Plant Capacity**	**Subsidy Support** (IMPRI India, 2024)
0-150	1-2 kW	₹ 30,000/- to ₹ 60,000/-
150-300	2-3 kW	₹ 60,000/- to ₹ 78,000/-
> 300	Above 3 kW	₹ 78,000/-

Subsidy Application and Vendor Selection	**Collateral-Free Loans**
Households can apply for the subsidy and select a suitable vendor through the National Portal. The portal provides information on system sizes, a benefits calculator, vendor ratings, and other relevant details. (IMPRI India, 2024)	Collateral-free, low-interest loans at around 7% interest are available for installing residential rooftop solar (RTS) systems up to 3 kW. (IMPRI India, 2024)



The PM Surya Ghar Muft Bijli Yojna will help reduce carbon footprints in several ways:

Direct Reduction in CO2 Emissions: Each kilowatt-hour (kWh) of solar electricity generated cuts greenhouse gas emissions by approximately 0.4 to 1 kg of CO2, compared to fossil fuel sources. By enabling households to generate solar power, the scheme can substantially lower CO2 emissions based on the amount of solar energy produced and used.

Grid Stability and Lower TransmissionLosses: Distributedsolar energy generation improves grid stability and reduces transmission and distribution losses, which account for 8-10% of electricity generated in India. By producing electricity closer to where it's consumed, solar panels minimize grid stress and reduce
long-distance transmission losses.

Energy Savings and Efficiency: Solar panels have a conversion efficiency of 15-20%, with modern systems reducing electricity loss during distribution.

Long-term Sustainability: Solar panels have a lifespan of 25-30 years, offering a sustainable energy source with consistent carbon reduction, unlike fossil fuels which generate emissions with every use.

Market Transformation: Financial incentives for solar installations increase demand, lowering costs through economies of scale. This price reduction accelerates solar adoption, further boosting installed capacity and reducing carbon emissions.[5]

7. Performance of the scheme so far:

The PM-Surya Ghar Muft Bijli Yojana is set to revolutionize the residential energy sector by enabling households to save significantly on their electricity bills while generating additional income from selling surplus power to DISCOMs. Households that install a 3 kW rooftop solar system under this scheme can produce over 300 units of electricity per month, covering the provision of up to 300 free units. The program aims to add 30 GW of solar capacity through residential installations, which is expected to

[5] https://www.nextias.com/beyond-classroom/pm-surya-ghar-yojana

generate 1000 billion units of electricity over a 25-year period, reducing CO2 emissions by approximately 720 million tonnes.

On July 17, 2024, the Asian Development Bank (ADB) approved a loan of $240.5 million to boost the expansion of rooftop solar systems in India, supporting the Solar

Rooftop Investment Program. The financing, channeled through the State Bank of India (SBI) and the National Bank for Agriculture and Rural Development (NABARD), focuses on residential solar installations. By generating electricity close to consumption points, rooftop solar systems reduce the strain on the power distribution network, cut down on long-distance power transmission losses, and contribute to energy independence, thus ensuring fewer power disruptions.

8. Challenges of the scheme so far:

Household reluctance to adopt rooftop solar systems is a key issue, largely driven by the availability of free electricity in many states and union territories. Additionally, restricted terrace space, uneven terrain, shading, and concerns like vandalism or theft complicate the installation of solar panels, particularly for the 1-2 kW segment.

DISCOMs also face operational challenges due to the net metering system, which increases their financial strain, as they act as unpaid storage for households generating solar energy during the day but drawing from the grid at night. Furthermore, the lack of mandatory storage systems with rooftop installations can cause grid management issues, such as the "duck curve." Lastly, ensuring the quality of solar systems is difficult for consumers, making them vulnerable to substandard installations and performance.

The main challenges are ;

1. **Household Reluctance**: Many households hesitate to adopt rooftop solar systems due to the availability of free electricity provided by several states and union territories.
2. **Restricted Space Use**: Limited terrace space, uneven terrain, shading, low property ownership, and concerns about vandalism or theft make it difficult to serve the 1-2 kW solar segment.
3. **Operational Strain on DISCOMs**: The current net metering system places a financial burden on DISCOMs, who are already facing significant losses.
4. **Unpaid Storage by DISCOMs**: DISCOMs serve as unpaid storage facilities for homeowners, who generate energy during the day but draw from the grid at night.
5. **Storage Integration**: The absence of a mandate for storage systems with rooftop solar installations could lead to grid management issues like the "duck curve."
6. **Quality Assurance Challenges**: Consumers often struggle to assess the quality of installed solar systems, making them susceptible to substandard service and system performance.

Sinha emphasized that while climate-friendly alternatives are often capital-intensive, solar energy presents a less costly installation option, with significant global advancements (Sinha). Arokar noted the industry's progress, with 6.94 lakh residential homes adopting solar, aiming for one crore within three years, despite challenges (Arokar).

9. CONCLUSION:

According to research, the Pradhan Mantri Surya Ghar Yojna has a significant impact on sustainable energy practices by lowering household electricity costs through rooftop solar installations and reducing India's dependency on foreign energy sources. The Yojna lessens the environmental effect of traditional

energy usage by enabling homes to switch to greener options by promoting access to renewable energy. The program's subsidies and incentives increase access to solar energy, promoting its widespread adoption by both urban and rural families. In addition to lowering household power costs, its widespread adoption helps India meet its challenging targets for lowering carbon emissions and fostering environmental sustainability.

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10. BIBLIOGRAPHY

1. Press Information Bureau. "Press Note Details." Press Information Bureau, Press Information Bureau, www.pib.gov.in/PressNoteDetails.aspx?NoteId=152016&ModuleId= 3&reg=3&lang =1. Accessed 9 Oct. 2024.
2. "How PM Surya Ghar Muft Bijli Yojana Is Different from the Previous Rooftop Solar Scheme." Moneycontrol, www.moneycontrol.com. Accessed 9 Oct. 2024.
3. "PM Modi Launches 'Pradhan Mantri Suryodaya Yojana' for One Crore Households." Adda247, Adda247, www.adda247.com. Accessed 9 Oct. 2024.
4. "PM SuryaGhar Muft Bijli Yojana." Drishti IAS, www.drishtiias.com/daily-updates/daily-news-analysis/pm-suryaghar-muft-bijli-yojana. Accessed 9 Oct. 2024.
5. "Solar Power." IMPRI India, www.impriindia.com/insights/solar-power/. Accessed 9 Oct. 2024.
6. Sinha, Abhijeet, and Amit Arokar. Next IAS. Next IAS, www.nextias.com. Accessed 9 Oct. 2024.