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From Gas to Sun: How Solar Energy Can Transform Rural Cooking and Livelihoods

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The rising dependence on LPG in India has created a major economic and energy security problem. In this context, this chapter will examine these issues and identify solar energy as a sustainable and cost-effective solution. It is evident that solar energy helps in saving fuel costs and is not subject to global market risks. It is a climate-resilient solution that helps improve rural livelihoods by reducing household expenditure and promoting value-added agriculture. However, certain challenges are still to be addressed in this context. For instance, high investment costs and a lack of awareness are some of the challenges that need to be addressed through policy support and subsidies to ensure effective adoption of solar energy.

Keywords: LPG, Solar, Livelihood, Demand, Supply

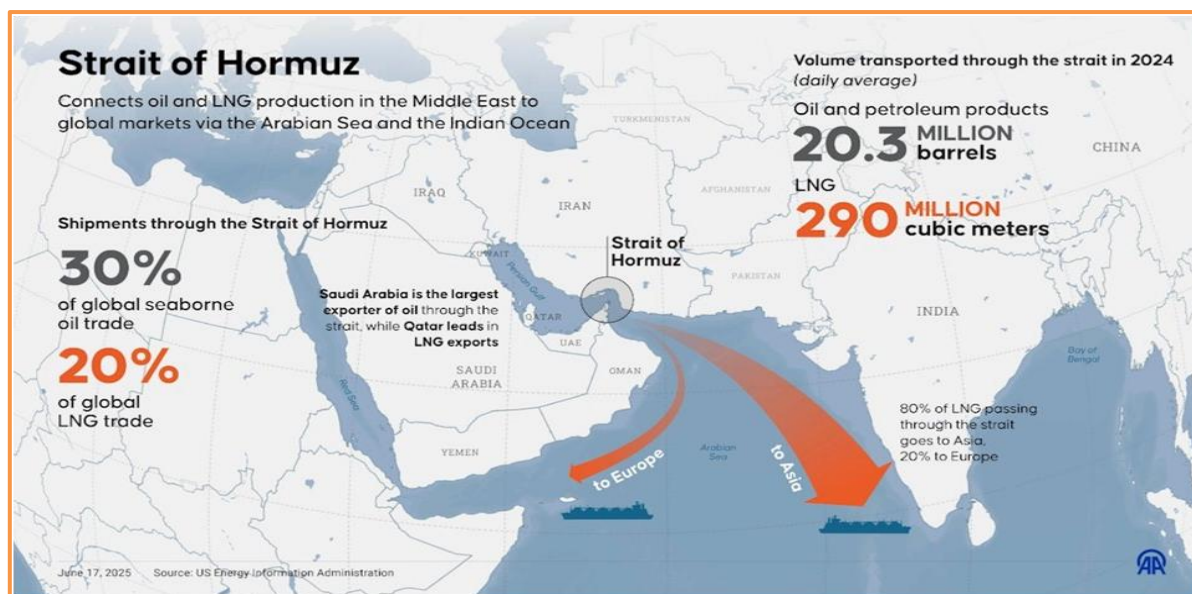
Introduction

The current scenario in India is that the nation is facing a growing challenge in providing affordable and assured access to Liquefied Petroleum Gas (LPG), particularly for rural and poor households. In recent times, the increase in fuel costs has made LPG more expensive and inaccessible. The dependency on LPG in India has also increased with the implementation of the Pradhan Mantri Ujjwala Yojana (PMUY) scheme, which focused on the provision of clean energy to rural Indians. However, the affordability of LPG is also a major factor in this context. The rise in LPG prices has forced Indians to return to the use of conventional energy sources like firewood and cow dung. In addition, India is also dependent on the import of LPG, which makes the country vulnerable to the changing international market scenario. In this scenario, the alternative energy source that can be considered as viable and economically sound is solar energy.

The Emerging LPG Crisis in India

The rise in the cost of LPG is having an impact on the financial conditions of people in India. Currently, India imports about 60% of its LPG consumption. This has made India extremely sensitive to any geopolitical tensions that might arise in West Asia (Sanskriti IAS, 2025). Due to supply chain issues that have arisen in recent times, there have been reports of shortages of LPG for commercial use. This has resulted in people opting for electric cooking options instead (Economic Times, 2026). The cost of LPG cylinders has risen significantly in the black market during times of crisis (Upstox, 2026). This shows that the energy crisis is having a major impact on people. The country is spending \$26.4 billion on importing LPG every year. This is to show that the energy crisis is not only having an impact on people but is also a macroeconomic issue (Vajiram & Ravi, 2025). The Indian energy system for cooking is highly vulnerable to changes in the price of imported fuels and geopolitical tensions. It has also become highly sensitive to disruptions in important trade routes like the Strait of Hormuz. Despite the increase in LPG availability to more than 332 million households due to government schemes, the issue of affordability has become a significant constraint. This has

led to the usage of traditional energy resources for cooking. Experts have emphasized that the diversification of energy resources for cooking is important to make the Indian energy system more sustainable and reduce its vulnerability (Down To Earth, 2024). The Strait of Hormuz is one of the most important global energy chokepoints, being a narrow water channel that connects the energy-rich region of the Persian Gulf to the rest of the world via the Arabian Sea and Indian Ocean. As can be seen from the figure, this route is responsible for transporting about 30% of global crude oil and 20% of global LNG trade, estimated at 20.3 million barrels of crude oil and 290 million cubic meters of LNG per day (U.S. Energy Information Administration, 2025). Some of the prominent nations that export crude oil via this route include Saudi Arabia and Qatar. Moreover, 80% of the total LNG transported via this route is for Asian nations including India. Hence, this emphasizes the strategic dependence of nations such as India on this route for meeting their energy requirements. Hence, any geopolitical tensions or conflicts in this region may severely impact global energy trade. For India, which is highly dependent on imports for LPG and other fossil fuels, this may have a direct impact on fuel availability and prices which further reiterates the susceptibility of energy imports and lends support to the case for developing indigenous and alternative forms of energy that are renewable and can be obtained from solar energy.

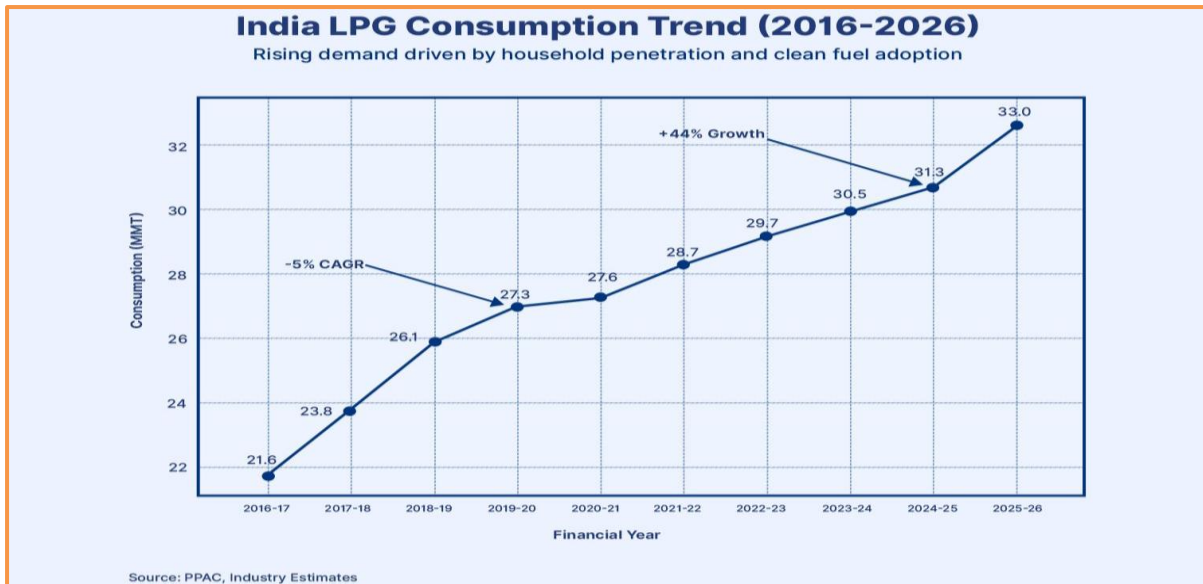


(Source: US Energy Information Administration)

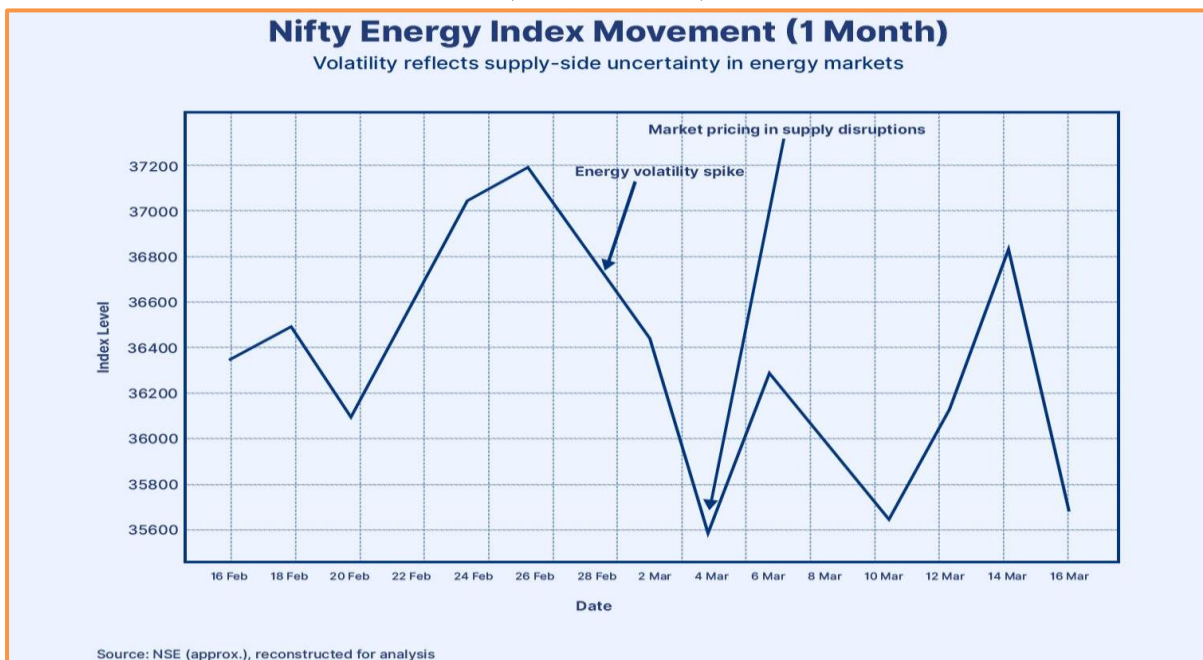
Demand and Supply of LPG

The analysis of the price trends of LPG in India over the period of 2019-2026 indicates that there has been a significant rise in the prices of LPG in India with periodic changes in the prices. According to the Indian Oil Corporation Limited (IOCL), the price of an LPG cylinder in Delhi has risen from ₹701 in 2019 to ₹1103 in 2023. This indicates a rise of around 57% in the price of the LPG cylinder over the past four years. However, the price of the LPG cylinder has reduced in 2024 and has risen again in 2026 to ₹913. Similar trends in the prices of LPG are observed in Kolkata, Mumbai, and Chennai. This indicates a rise in the prices of LPG in India over the past few years. This is primarily attributed to the fact that India imports around 60% of LPG and is highly dependent on the crude oil market. In spite of the increase in prices, the demand for LPG in India has been growing steadily. This shows the inelastic nature of demand for LPG as a fuel. The consumption of LPG in India has been growing steadily to reach approximately 28.7 million tonnes in 2022. This shows the growing demand for LPG in the country. The demand for LPG in India has been growing steadily to reach more than 30 million tonnes in recent years. The demand growth rate for LPG in India has been between 2.9% and 6.4% in recent years due to the increase in availability through welfare schemes like the Pradhan Mantri Ujjwala Yojana (PMUY), urbanization, and growing awareness about clean cooking fuels in the country (Vortexa, 2025).

This shows a demand-price paradox in the market. However, the rise in prices has started to exert economic pressure on households. A study has shown that a rise in prices has resulted in a decrease in the intensity and frequency of using LPG. In some cases, households are even forced to switch to conventional energy sources. However, India’s dependence on imports makes LPG susceptible to geopolitical tensions in West Asian countries. These tensions have resulted in supply chain disruptions and price hikes (Khalmetov, 2026). All these factors pose a threat to the sustainability and affordability of LPG. In this context, solar energy has emerged as a promising and strategic solution to replace LPG for cooking and household energy requirements. With solar-based cooking systems and electric cooking systems using renewable energy sources, households can benefit from cost advantages and sustainability. With prices of LPG nearing ₹900 to ₹1100 per cylinder, the cost advantage of solar energy systems is evident (Vaishnav, 2020). In addition, solar energy can be a solution for rural areas and can be a step towards making India self-reliant and self-dependent in energy sources. Thus, the evidence provided by the escalation in the prices of LPG and the increase in the demand for it further emphasizes the need for a shift towards sustainable sources of energy, such as solar power, which not only helps in reducing the financial burden on the public but also ensures the sustainability of the country in the long run.



(Source: PPAC)



(Source: NSE India)

Table 1: Price of LPG Cylinder in India

| Month | Delhi | Kolkata | Mumbai | Chennai |
|-------|-------|---------|---------|---------|
| 2019 | 701 | 727.50 | 673.50 | 717 |
| 2020 | 805 | 839.50 | 776.50 | 826 |
| 2021 | 819 | 845.50 | 819 | 835 |
| 2022 | 949 | 976 | 949.50 | 965.50 |
| 2023 | 1103 | 1129 | 1102.50 | 1068.50 |
| 2024 | 803 | 829.50 | 802.50 | 818.50 |
| 2025 | 853 | 879 | 852 | 868 |
| 2026 | 913 | 939 | 852.50 | 928.50 |

(Source: IOCL)

Uses of Solar in replace of LPG

Cost Advantage of Solar/Electric Cooking

The increasing cost of LPG in India has prompted more and more households to look for alternative and cost-effective methods for cooking. Recent studies and analyses have suggested that electric cooking, especially when combined with solar power, is not only cost-effective but also 37% cheaper than LPG. An assessment of policies related to electric cooking has suggested that this form of cooking is not only cost-effective but also 37% cheaper than LPG when all costs, including fuel, efficiency, and maintenance, are taken into consideration (PwOnlyIAS, 2025). Moreover, observations based on recent price increases in LPG suggest that electric cooking is already 15-20% cheaper than LPG in many urban and semi-urban households (Down To Earth, 2024). The cost advantage is even more prominent in rural areas, especially when combined with solar PV systems, which help households save on electricity costs. Solar energy is one form of energy that provides households with near-free energy once installed, and this is one form of energy security that is long-lasting and cost-effective for households. In addition, LPG prices continue to remain volatile due to fluctuations in crude oil prices and subsidy rationalization policies (Upstox, 2026).

Energy Security and Import Dependence

The Indian LPG-based system is inherently dependent on imports, as 60% of the total LPG requirements are met through imports, making the system susceptible to geopolitical risks and price volatility (Sanskriti IAS, 2025). The country faces a substantial outflow of 26.4 billion dollars annually on the import of LPG, creating a drain on the country's foreign exchange (Vajiram & Ravi, 2025). Solar energy offers a decentralized and homegrown form of energy, which can be utilized by the people to reduce dependence on the centralized supply of fuels. The shift to solar energy increases the energy security of the people as well as the country as a whole. In addition, solar-based energy solutions, like solar cookers, can be especially useful in the rural areas of the country, as the supply of LPG is inconsistent.

Environmental Sustainability

Though LPG is considered to be more environment-friendly than the conventional use of biomass, it is still a fossil fuel and contributes to greenhouse gas emissions. The continued use of LPG is not in line with India's long-term commitments to environmental sustainability and the Paris Agreement. In contrast, the use of solar energy is considered to be a renewable and pollution-free energy source with zero greenhouse gas emissions. Studies have also pointed out the need to increase the use of solar energy in cooking, which can help in reducing carbon footprints and arresting the process of deforestation, especially in rural India, where biomass is used as an alternate fuel when LPG prices are beyond affordability (Down To Earth, 2024). In addition, the use of solar energy in cooking is in line with India's renewable energy and sustainable development goals (SDG).

Health Benefits

One of the unintended effects of the rise of prices of LPG is the increased tendency to resort to the use of biomass fuels, especially among the poor segment of the population. The solar and electric cooking solutions help to avoid the use of combustion, thereby eliminating the

problem of indoor air pollution altogether. According to the energy policy debates, the promotion of clean energy like solar cooking can help to improve health results for the people, especially in the rural areas of India, as a result of the economic crisis (Sanskriti IAS, 2025).

Emerging transition: LPG to Solar

During the recent shortage of LPG in India, there is an increase in the use of induction stoves and electric cooking methods in households as well as in commercial institutions such as restaurants as an alternative solution (Economic Times, 2026). The government is actively supporting electric cooking as an integral part of the energy transition in India, as it is considered an alternative solution to fossil fuels (Sanskriti IAS, 2025). As indicated by long-term projections, there is likely to be an increase in electric cooking methods in India in the future; as a result, there is likely to be a reduction of up to 50% in the demand for LPG by 2050, thereby easing the import of LPG in India and making it more sustainable in nature (Down To Earth, 2024).

Challenges in Solar Adoption

Despite the obvious economic and environmental advantages of solar-based cooking systems in India, there exist various structural as well as behavioral factors that act as limitations to the large-scale adoption of these systems. Some of these factors include high initial investment costs of solar photovoltaic systems, solar cookers, as well as battery storage devices, despite solar-based cooking systems having lower lifecycle costs compared to LPG-based systems (PwOnlyIAS, 2025). In addition, there is limited awareness as well as technical knowledge of solar-based cooking systems, particularly in rural areas of India, where individuals are not accustomed to solar-based cooking methods as well as their technical advantages (Sanskriti IAS, 2025). Another major limitation of solar-based cooking systems is their intermittent nature, as cooking is often required in the early morning hours as well as in the evenings when solar radiation is limited. Behavioral factors also act as major limitations to solar-based cooking systems in India. This is because cooking in India is often considered an integral part of tradition, and individuals might find it difficult to shift from conventional LPG-based cooking methods to solar-based methods (Down To Earth, 2024). However, the challenges are not insurmountable, and the problems can be addressed by specific policy and institutional interventions.

Ways to look forward

The government can play a crucial role by offering subsidies to reduce the high cost of solar cooking technologies. The solar energy solutions can be integrated with the existing rural development programs and clean energy initiatives to enhance the adoption of solar cooking technologies. Capacity-building programs, training, and awareness programs are also essential to improve the technical knowledge of the users of solar cooking technologies. A viable and efficient method of promoting solar cooking technologies is to adopt a hybrid approach, wherein solar energy can be utilized for daytime and bulk cooking, and the secondary energy source like LPG or electricity can be utilized as a backup for greater flexibility and reliability of the solar cooking technologies. The policy discussions highlight the potential of solar-powered electric cooking, including induction stoves, which can be powered by rooftop solar, as a bridge between conventional and innovative energy solutions (Vajiram & Ravi, 2025). Furthermore, Self-Help Groups (SHGs) and agripreneurs can be considered major agents of change through enabling the dissemination and maintenance of solar technologies and promoting entrepreneurship for rural areas. This integrated and decentralized method is in line with the energy transition vision for India and can greatly reduce dependence on LPG in the country in the future because estimates show that alternative cooking solutions such as solar and electric cooking can reduce LPG consumption by up to 50% by 2050 (Down To Earth, 2024).

Conclusion

The increasing dependence of India on LPG, in addition to the rise in prices and dependence on imports, has put the country in a state of economic stress. In such a case, solar energy has emerged as a viable option that not only ensures the environment but also provides a cost advantage in the form of no fuel cost as opposed to LPG. In addition, solar energy also provides the advantage of avoiding the impact of international politics on the availability of fuel. Moreover, the introduction of solar-based cooking and energy technologies has the potential to enhance the livelihoods of the people in the rural areas by not only reducing the cost of living in the country but also by promoting the development of value-added products in the agricultural sector. However, it has to be ensured that the policy interventions are robust in nature so that the introduction of solar-based cooking and energy technologies in the country not only ensures the environment but also provides a strategic advantage in the form of achieving the goal of energy security in the country.

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