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ANALYSIS AND MONITORING OF SOLAR ROOF TOP SYSTEM IN USERS OF NCR

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ABSTRACT

The degree of consumer satisfaction is crucial for the widespread adoption of a new technology, such as solar energy in general and solar rooftop panels in particular. in order to address the unsatisfactory variables before devoting additional time and resources to it. Such prompt inspections guarantee a rapid and lively overall development. Only until end users are satisfied will the government's very ambitious goals be met. The degree of satisfaction with solar rooftop panels in the city of Gurugram is the subject of this article. The city is a center for multi-national corporations in northern India and is a part of the NCR-Delhi. The demand for housing is rising along with work prospects. Power demands obviously rise as a result. Installing solar rooftop panels can support and depend on this power source. Based on economic, technological, and environmental factors, a survey of the families where they are installed was conducted to determine the degree of satisfaction. In the relevant study area, the solar panels' performance has been deemed good.

KEYWORDS: Gurugram, Haryana, solar energy, multinational enterprises

INTRODUCTION

The global industrial revolution was brought about by non-renewable energy sources. This led to a fast-paced culture with unending demands. Power or electricity was the most common of these requests. Thermal power plants powered by coal emerged as a significant source of electricity. Although several methods of producing electricity have been developed over the past 200 years, thermal and hydro power remain the most common.

The growing population and rising energy consumption are putting more strain on non-renewable resources. The world is already running out of fuel, yet no one has access to electricity yet. It became essential to concentrate on the other choices in order to close this energy gap and decentralize power. Nowadays, a variety of renewable energy sources are available, including solar, wind, tidal, and wave. Solar energy is the most popular and, so, the most promising of these.

Energy is vitally needed in nations like India, where a large portion of the population still lacks access to this essential service. Not only is there a total lack of power, but frequent power outages, fluctuations, and other problems are also noted. These findings can be found even in the nation's most developed areas. This indicates that power quality and power ability are unrelated. It interferes with daily family tasks, such as children's study hours, cooking in the dark, unpredictable sleep schedules, charging different appliances, and more.

Decentralization of power can be anticipated with the arrival of solar energy. In this case, a home can generate the power and experience self-sufficiency. This can be made a reality with the availability of on-grid, off-grid, and hybrid technologies. India has already placed a high value on solar energy due to its strong commitment to a greener future. India declared at the most recent climate summit that it would use non-fossil energy to cover 50% of its energy needs. India must install 42 GW of energy annually in order to reach this goal. However, India is falling behind mostly because it is having difficulty meeting its targets for solar rooftop installation.

This is due to the fact that adopting new technology requires a great deal of serious work from government, corporate entities, and individuals. There won't be a significant shift unless the adoption is trouble-free.

The IEA reports that in 2020, 74% of electricity was produced from coal, while only 1.7% came from solar power. It is necessary to close this disparity and increase excitement for solar energy adoption.

Haryana Situation

By 2022, Haryana wants to have 4.2 GW, of which 1.6 GW will come from rooftops. For residential constructions greater than 500 square yards, the state offers perks such as a loan of up to 10 lacs to property owners. Additionally, there is a requirement to install three to five

percent solar capacity. Additionally, the government waives power duties and taxes, among other things. However, the state has only reached 1 GW of its 4.2 GW target thus far. Even though the remaining goals cannot be met in a single year, growth will still occur in the future. Not only Haryana, though; every state has performed differently, and it now appears impossible to reach 100 GW by 2022.

Gurugram Situation

The city is located in the state's southeast. Its northeastern boundary is with Delhi. This region has a hot, semi-arid climate. Summertime temperatures average 40 °C. Rainfall averages 28.1 inches per year. It is also a significant satellite city of the nation's capital. It is the third-largest banking hub and the second-largest IT cluster in India. In terms of overall wealth, it is the eighth largest city in India and is home to thousands of start-up businesses.

All of this indicates that immigration is a significant factor in the city's growth, but it also results in population expansion due to favorable financial circumstances. In these places, there is a strong demand for energy in general and electric energy in particular. According to the HAREDA data, Gurugram has seen the most increase in solar rooftop panels in Haryana. Gurugram accounted for 18.5 percent of all installations over the 2016–2019 period, while Rohtak had the second-highest percentage at 7.01 percent.

Given its close proximity to the nation's capital and energy needs, it is evident that Gurugram district has adopted the technology with greater zeal than the rest of the state.

Since the government is currently cutting back on subsidies, users sharing their experiences will help spread this technology. The more satisfied people are with it, the more optimistic the community will be. Additionally, the areas where authorities need to do more to raise people's levels of satisfaction might be divided.

The study's objective

To determine each household user's contribution to the satisfaction metrics in Gurugram, Haryana.

Methdology

A sample of one hundred homes with solar rooftop panels was gathered from the Gurugram district. From a total of 816 residences with solar panels installed between 2016 and 2019, these families were chosen. The initial poll that served as the basis for the research report

asked "yes" and "no" questions. To find out how satisfied household users were, the following variables were selected:

- High Cost
- Investment Returns
- Consistency
- Easy Maintenance
- Easy Maintenance
- Bill Savings
- High Safety Concerns
- Self-Sufficiency

Following that, these variables were divided into three categories: economic, technical, and environmental. High cost, investment returns, and bill savings are examples of economic factors. High safety concern, ease of maintenance, and equipment quality are examples of technical factors. Self-sufficiency and consistency are environmental factors.

Findings and Discussion

Users' comments on how satisfied they were with the solar rooftop panels' economic factor are shown in the accompanying image.

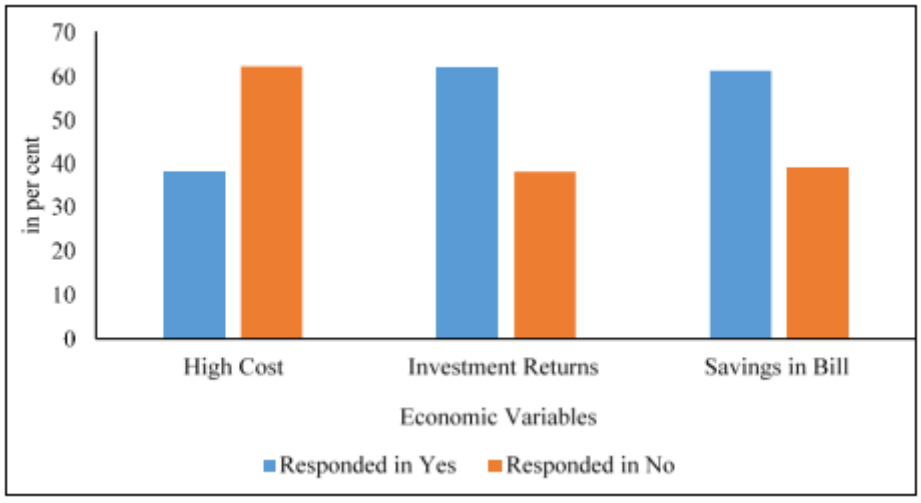

Figure 1: Percentage of Economic Factor.

Sixty-two percent of users responded negatively when asked if the price was too high. This indicates that the cost was not a major worry for Gurugram, a city with a greater income level than many other cities in the nation. Once more, 62% of homeowners expressed satisfaction

with the results on their solar rooftop panel investment. However, the users who claimed that the prices were low were not all the same.

The cost savings are the primary driver behind households' adoption of this new technology. The proliferation of technology would become problematic if these users were dissatisfied with the savings. According to the report, 61% of households were happy with the bill savings.

The satisfaction with respect to the technical factor is depicted in the following figure.

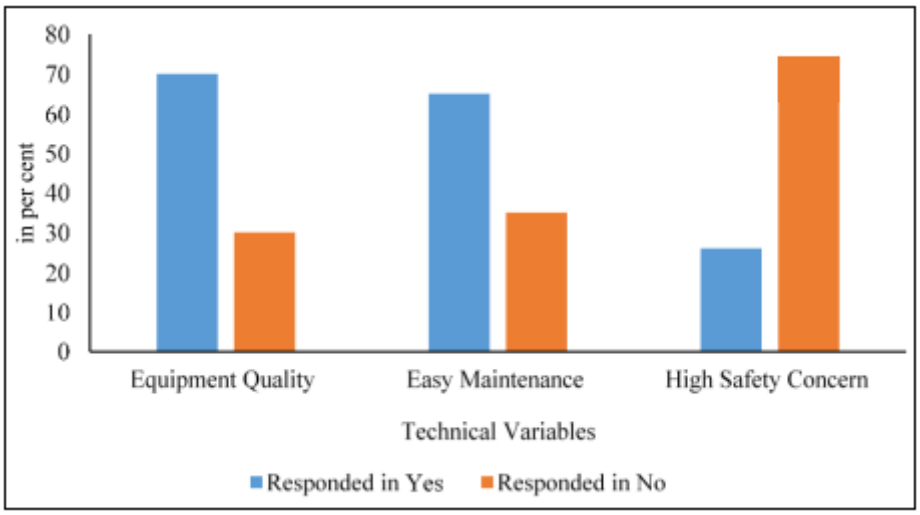

Figure 2: Percentage of Technical Factor.

Figure 2 70% of households expressed satisfaction with the equipment's quality. It indicates that a high number of people judged the quality of the panels and other connected equipment to be satisfactory.

The system as a whole did not require much maintenance, according to 65% of users. It indicates that the system was deemed controllable and capable of producing satisfactory results with little effort spent on maintenance. The remaining 35% said the maintenance procedure was difficult and hence inadequate.

Production of electricity is thought to be dangerous. There are safety risks associated with high voltage and Direct Current (DC) generated by solar panels. However, the panels have been constructed in a way that makes them safe for all users. These can be installed in homes without posing a risk to safety with a little understanding of procedures. Seventy-four percent

of families held the same belief. Concerns about their safety were not very strong among users.

The users' satisfaction with the environmental factor is shown in the following figure.

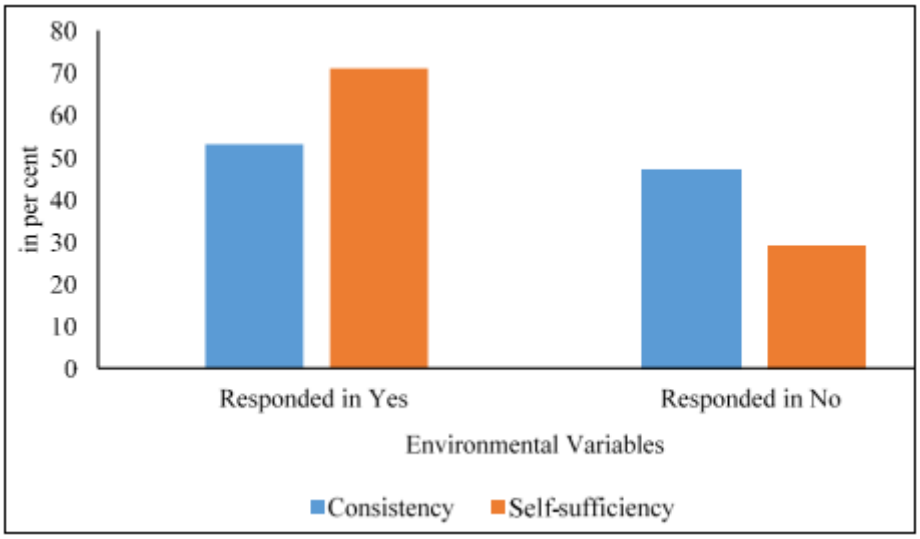

Figure 3: Percentage of Environmental Factor.

Figure 3 After installing solar rooftop panels, 53% of households agreed that the system was reliable in production and that power stability had improved. However, 47% of respondents disagreed.

It is essential to have faith in the system in order to encourage new consumers to utilize solar panels. Renewable energy is the fuel of the future since fossil fuels are running out. It becomes essential for consumers to think that self-sufficiency in terms of power production may be attained through it in order to persuade them to move in that direction. Seventy-one percent of households had a favorable opinion of it. This optimistic outlook would serve as the foundation for future users.

CONCLUSION

The majority of customers were found to be content with the returns on their investments, and many of them also regarded the cost of installation to be affordable. Equipment quality and maintenance requirements go hand in hand since there is no discernible difference in how satisfied these two factors are. It is simple for users to maintain, and this is directly related to how well the equipment works. Additionally, individuals don't worry about safety because they are satisfied with the quality of the equipment.

People believe that this might be the fuel of the future, guiding the nation toward self-sufficiency, since they are content with investment returns and production stability.

However, Gurugram's household income level and urban lifestyle cannot be assumed for the remainder of the state. When it comes to overall solar panel installations, the district shines out as well. Therefore, the information gathered here can be utilized to influence people's attitudes about their level of contentment throughout the state, but identical responses in other cities—aside from those with high GDP—cannot be assured.
We can infer that most individuals are satisfied with returns, equipment, stability, and electricity bill reductions when the installation is completed. The users might say that the solar panels' overall performance is satisfactory.

Therefore, the emphasis should be on increasing the number of individuals involved through awareness campaigns because, from the users' point of view, the technology produces good results once it is employed.

REFERENCES

1. Chaurey A, Kandpal TC. Carbon abatement potential of solar home systems in India and their cost reduction due to carbon finance. Energy Policy. 2009;37(1):115- 125.
2. Dawn S, Tiwari PK, Goswami AK, Mishra MK. Recent developments of solar energy in India: Perspectives, strategies and future goals. Renewable and Sustainable Energy Reviews. 2016;62:215-235. 3. Ghosh D, Shukla PR, Garg A, Ramana PV. Renewable energy technologies for the Indian power sector: mitigation potential and operational strategies. Renewable and Sustainable Energy Reviews. 2002;6(6):481-512.
3. Golovanov N, Lazaroiu G, Roscia M, Zaninelli D. Power quality assessment in small scale renewable energy sources supplying distribution systems. Energies. 2013;6(2):634-645.
4. Hareda. Department of New & Renewable Energy, Government of Haryana. http://www.hareda.gov.in/en
5. Harish SM, Iychettira KK, Raghavan SV, Kandlikar M. Adoption of solar home lighting systems in India: What might we learn from Karnataka? Energy policy. 2013;62:697706.
6. Hiremath RB, Kumar B, Balachandra P, Ravindranath NH, Raghunandan BN. Decentralised renewable energy: Scope, relevance and applications in the Indian context. Energy for Sustainable Development. 2009;13(1):4-10.

7. Oikonomou EK, Kilias V, Goumas A, Rigopoulos A, Karakatsani E, Damasiotis M, et al. Renewable energy sources (RES) projects and their barriers on a regional scale: The case study of wind parks in the Dodecanese islands, Greece. Energy Policy. 2009;37(11):4874- 4883.
8. IEA. Solar Energy Perspectives. OECD Publishing; c2011.
9. Parsad C, Mittal S, Krishnankutty R. A study on the factors affecting household solar adoption in Kerala, India. International Journal of Productivity and Performance Management, 2020;69(8):1695-1720. https://doi.org/10.1108/ijppm-11-2019-0544
10. Reddy VS, Kaushik SC, Panwar NL. Review on power generation scenario of India. Renewable and sustainable energy reviews. 2013;18:43-48.
11. Suman SK, Ahamad J. Solar energy potential and future energy of India: An Overview. IJESC. 2018;8(5):17575-17579.