Indian J. Applied & Pure Bio. Vol. 41(1), 357-364 (2026). **ISSN: 0970-2091**

Economic Analysis of Households consumption of Solar energy in Sivagangai District of Tamil Nadu, India

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Abstract

Now days, ingesting of power goes outsidedeprived of boundary due to creation and novelty of other products that stresses the power. So, recently countries together formed "International Solar Alliance" (ISA) which targets to obtain all energy from sun because, they stated that the 'Sun is the source for all energy'. As a result, the findings of this study have established the significance of solar energy in empowering the public's economic components through effective recommendations and research reflections. The study with a total of 300 sample dependants and consequences unprotected on determinations, savings and satisfaction among solar panels fitted clients.

Key words : Consumers, Electricity, Savings, Satisfaction, Solar energy

Electricity isn't just something that's been needed recently; it's been around since the beginning thanks to people's ingenuity in coming up with permanent sources that can be used for everything. History and the development of technology both indicate that it can also be produced from sunlight. Ancestors were known that the star and 'Sun' can expose heat and light for our use but they also expected that it can be availed in all seasons (day and night) of a day. Due to lack of technology invention it could not be visualized but history says that they have utilized heat and light energy from sun star for various purposes. People were clear that sun-star is emitting heat and light energy and they emphasized light than heat energy to utilize even the night of a day. As a result, the invention was created to generate electricity further by bringing light energy to bear on a variety of tasks. In 1839, French physicist Edmund Becquerel who was 19 years old at the time discovered that voltage can be created when a material is exposed to light and then it was considered as the foundation of solar power. With a high potential for rooftop solar generation (637 GW),

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particularly among the 25 crore Indian households, solar energy is quickly becoming an important green energy solution in India. However, only 2.7 GW is currently generated by households, with most solar power concentrated in seven states. Solar energy's share in India's electricity mix has grown from 1% in 2017 to 5% in 2022 and is projected to reach 25% by 2032. In order to provide each household with 300 free units of electricity, the Indian government intends to install 10 million rooftop systems.

The process of converting sunlight into electricity is known as photovoltaic. "Photo" refers to light, and "voltaic" refers to the process of producing voltage (Go Solar California, 2007). However, the "Solar cell," a solid-state device that uses the effects of photovoltaic to directly convert sunlight into electricity, performs the majority of the Photovoltaic in the solar panel (Shivananda Pukhrem, 2013). Taking into account the past of solar technology and use, the sun's light and heat are the efficient and sufficient sources of energy for applied photovoltaic (PV) and concentrated solar power (CSP) to generate electricity. The International Solar Energy Society (ISES) was established in 1954 as a non-profit organization devoted to the alternative use of solar energy by consumers worldwide. In addition to scientists, researchers, and other private and public organizations, more than 110 nations have joined as associated members. Particularly, it aimed to speed up the process of developing solar energy applications. Additionally, it aims to educate the general public about the non-polluting resources that are necessary for our day-to-day lives. In 2015, the International Energy Agency (IEA) released a report stating that worldwide, there were a staggering 227 GW of photovoltaic `(PV) installations. It accounted as 197GW by member countries and remaining from rest of the same.

Solar energy in India :

India is a developing nation that intends to implement a variety of feasible and beneficial policies for the public good. The current administration, in particular, places a strong emphasis on safeguarding and maximizing the use of natural energy in a sustainable manner. As a result, the Ministry of Power of India puts a lot of effort into looking for and promoting alternative sources of energy. In addition, inventors are always welcomed and encouraged under policies that are feasible for entrepreneurs. The ministry of power has set a goal of 1,229.4 billion units (BU) of electricity to be produced in the fiscal year 2017-18, 50 BU more than the target for 2016-17 (Electrical Machinery Sector Report, 2017). This is in response to the country's rising electricity consumption ratio. The ministry of power is looking for alternative resources that can provide electricity even during times of consumption in order to increase electricity production. Solar power can eventually be installed in all of the country's homes, but only through its introduction. However, the ministry's value and goal have been shifting horizons as a result of household awareness of the importance of installing solar plants. However, the central government is putting in a lot of effort to build solar plants in a number of departments under the ministry of power. These plants will use solar energy to power agricultural operations, street lights, and homes. The fluctuations that occur when a solar panel generates electricity are not only determined by the intensity of the sun, but also by three significant factors: the efficiency of the solar cells, the size of the solar panel, and

the amount of sunlight that is directly reflected off the panel. In an effort to increase public satisfaction with electricity consumption, India has launched additional alternative plans that would use solar panels to generate electricity. As a result, the government's efforts to improve solar policy have been highlighted in this study.

Solar in Tamil Nadu :

Tamil Nadu's solar capacity has grown from a modest 30 MW in 2010 to over 6,000 MW by 2022, with plans to reach 20,000 MW by 2030. Policy and incentives: Through policies like the Tamil Nadu Solar Energy Policy 2019, the state government has actively promoted solar energy. This policy aims to make solar energy accessible, affordable and a major contributor to a sustainable energy future. Net Metering: Tamil Nadu was the first state to implement net metering, which allowed customers to sell excess electricity to the grid and generate their own solar power.

Rooftop Solar : The state has seen an increase in interest in rooftop solar systems, which are now a viable option for both individuals and businesses thanks to subsidies and incentives. Large-Scale Solar Farms: The world's largest solar power plant is located in Tamil Nadu. Additionally, the state intends to establish solar parks in each district. Manufacturing: Within the state, the government is encouraging investment in solar manufacturing units. Initiatives by the government include the Chief Minister's Solar Rooftop Capital Incentive Scheme, which provides subsidies for domestic solar PV systems that are connected to the grid. Obstacles: Despite advancements, rooftop solar adoption has encountered obstacles such as policy complexity and bureaucratic obstacles. Future Objectives: Tamil Nadu intends to lead the way in renewable energy and significantly expand its solar capacity.

Review of literature :

Lakshmi Priya[3] specified that greatestlimecustomers have shown optimisticmethod on by income of solar energy produce in India. The purpose is to investigate the users' demographic and socio-economic backgrounds. Technologies like data analysis and drawing inferences are used to collect the data. The findings are 6763- megawatt power has been produced in solar in 2016 and solar power tariff was reduced to 2.44 in 2017. The respondents' average intention to purchase in the future is 72.75 percent.

According to Nirmala[4], the high initial cost of solar energy systems is a major barrier to their use. Compared to conventional energy sources, the costs of using solar or other renewable energy sources are significantly higher. The objective is to study the full demographic shape of the designatedpatrons of Tirupur District who uses astral energy and consumer's awareness towards solar energy and their willingness to switch over to renewable energies. 40% of defendants were from urban areas, 38% were from semi-urban areas, and only 22% were from rural areas. 40% of respondents said they were moderately aware of solar energy, while 36% said they were highly aware of solar energy products.

Roy[5] conducted the study to determine the various internal and external factors that influence consumers' purchasing decisions and

to suggest modifications to the marketing strategy for renewable energy products. The objects are to classify and measure the issuesswaying the clients' buying choice and to assess and analyze the factors constraining the marketing of new and renewable energy products. Documents and the company website, as well as external data in the form of facts and figures like structured questions, are the tools used. There were 78 customers in the sample, and 79% of them were male, according to the results.

Kumar[2] Using a structured research schedule and convenient sampling, the data of 510 respondents from rural Punjab (India) were gathered. Customers' attitudes toward solar energy products are influenced by a number of different factors. Multiple regression analysis was used to measure the magnitude of the impact of the identified dimensions on the customer attitude. Regression analysis confirmed that green purchasing habits and government initiatives significantly influence customer attitudes toward solar products.

Objective of the study :

- To know the purpose of the solar in household in the study area.
- To economic savings of On-grid users in the study area.

Research methodology :

Especially, methodology is an outline to the research work which directs the study towards providing feasible solution to the selected problems. As a result, the methodology and data sources of this study have been emphasized. This research work has been undertaken with a total of 300 sample respondents from Sivagangai district of Tamil Nadu state. Especially, all sample respondents are not selected based on single sampling procedure it meant, 120 respondents are chosen under probability sampling procedure by snowball sampling for solar energy users 180 sample respondents are chosen under non-probability sampling procedure that covered total of nine (Sivagangai, Manamadurai, Ilayangudi, Thiruppuvanam, Kalaiyarkoil, Thiruppatur, Karaikudi, Devakottai, Singampuneri) taluks of the district. From each taluks 20 respondents have been taken and this is for non-solar energy users to identify the opinion of not using the same.

Analysis and Interpretation :

Significance of energy fulfillment among households of the nation is provoked by demand, consumption pattern and technology interference which each individual and family enhancing their lifestyle. Due to the influence of factors that are distinct from economic factors, electricity as an energy source is increasingly emphasized to promote economic components like production, supply, consumption, and demand. As a result, the Sivagangai district, which is economically disadvantaged, is increasing its electricity consumption without any additional sources. Solar power has been added as an additional source to reduce the cost of producing electricity in light of the rising global electricity consumption. The public is encouraged to seek out alternative energy sources by massive programs and policies to meet household needs. As a result, solar power as an alternative and simple source of energy for producing electricity has spread throughout regions and even economically disadvantaged

districts. In addition, the purpose of this study was to gather information about the savings and satisfaction of solar customers in the Sivagangai district. As a result, it makes it possible to implement a policy that caters to all household needs and clearly identifies the reasons why households use solar power. In the field of economics, which investigates the present and future of both individuals and groups, savings and contentment rank among the most significant variables. As a result, the interests of customers are gathered as data to determine the solar consumption pattern and future trend.

Table-1. Purposes of Solar in households

	Types of solar system		
Purposes	On-grid	Off-grid	Total
Cooking	0 (0.0)	0 (0.0)	0 (0.0)
Lighting	49 (81.6)	57 (95.0)	106 (88.3)
Other purposes	7 (11.6)	3 (5.0)	10 (16.6)
All purposes	4 (6.6)	0 (0.0)	4 (3.3)
Total	60 (100.0)	60 (100.0)	120 (100.0)

Source: Primary data

The purpose for which households in a given district use solar energy as electric power is shown in Table-1. The data in each row are categorized according to the purposes for which energy is used, and the data in the columns are categorized according to the types of solar systems. There are 60 respondents for each system. Out of the 60 people who responded, only about 49 (81.6%) of them use solar power for lighting, and only about four of them use it for all household purposes. However, the remaining seven people use solar power for other household purposes like entertainment. Out of the 60 Off-grid users who responded, approximately 57 (95.0) used their energy for lighting and three for other household purposes. As a result, out of the total 120 respondents, 106 gave lighting the highest priority, while ten and four gave all household purposes and other purposes, respectively.

Table-2. Economic Savings of On-grid users

Economic	No. of respondents
savings	(On-grid)
Below 500	11 (18.3)
501 - 1000	30 (50.0)
Above 1000	19 (31.6)
Total	60 (100.0)

Source: Primary data

The respondents' savings and profits from solar installation are shown in Table-2. According to the findings of the research, respondents who use an on-grid solar system enjoy significant advantages. Of the 60 defendantson network category, 30 (50.0) obtainincomes between Rs. 501 and Rs. 1000, 19 acceptadequateassistances in extra of Rs. 1000, and 11 receive minimal benefits at a reduced cost of less than Rs. 500/-.

Table-3. Satisfaction opinion of the sample respondent

	Types of solar system		
Purposes	On-grid	Off-grid	Total
Satisfied	60 (100.0)	47 (78.3)	107 (89.16)
Not satisfied	0 (0.0)	13 (21.6)	13 (10.83)
Total	60 (100.0)	60 (100.0)	120 (100.0)

Source: Primary data

The data in table-3 showed how satisfied people were with their use of solar energy for electricity. As a result, out of the total 120 respondents, 107 (89.16) are pleased with the installation of solar panels, while 13 are dissatisfied with the technology that was developed for the system.

Table-4. Public opinion in the quiet of solar use

Taluks	Public Opinion				Total
	Additional expenses	Insufficient electric exposition	Desultory energy	Not aware	
Sivagangai	8 (40.0)	2 (10.0)	5 (25.0)	5 (25.0)	20 (100.0)
Manamadurai	9 (45.0)	1 (5.0)	7 (35.0)	3 (15.0)	20 (100.0)
Ilayankudi	12 (60.0)	2 (10.0)	3 (15.0)	3 (15.0)	20 (100.0)
Thiruppuvanam	10 (50.0)	2 (10.0)	3 (15.0)	5 (25.0)	20 (100.0)
Kalaiyarkoil	8 (40.0)	3 (15.0)	2 (10.0)	7 (35.0)	20 (100.0)
Thiruppatur	7 (35.0)	5 (25.0)	6 (30.0)	2 (10.0)	20 (100.0)
Karaikudi	13 (65.0)	2 (15.0)	3 (15.0)	1 (5.0)	20 (100.0)
Devakottai	11 (55.0)	4 (20.0)	2 (10.0)	3 (15.0)	20 (100.0
Singampuneri	11 (55.0)	0 (0.0)	1 (5.0)	8 (40.0)	20 (100.0
Total	89 (49.4)	22 (17.2)	32 (17.7)	37 (20.5)	180 (100.0)

Source: Primary data

Table-4 describes the statistical data of public opinion in the absence of solar as electric energy consumption and each taluk consists of equal number of 20 sample respondents. The purposes of negligence of solar among public has been variates related to the depth characters of Solar energy. Among the 180 respondents from different taluks of Sivagangai district, highly 89 (49.4) respondents revealed that the solar installation is an additional expense, 22 of them have pointed out that the technology invented solar panels will emitted insufficient electric power, 32 respondents have stated that the electric power from sunlight is an unsustainable energy because of climate change and 37 of non-solar users are still in absence of awareness in solar installation and consumption.

The analysis section of an article is crucial for obtaining accurate results and identifying the appropriate solution to the chosen issues. The purpose of the study analysis was to complete the scope of the research and produce results for the microproblems. In the context of Economics, the components of same such as consumption, savings and satisfaction will not come forth without any interpretative function. As a result, the "Investment function" was emphasized in this study to gain access to the consumption, savings, and contentment of solar energy consumers. In the Keynesian terminology, investment refers to real investment which adds to capital equipment and John Robinson also focusing that investment means an addition to capital. Thus, economically, investment meant business related activities and it is always applicable to the business and other profit gaining process. In addition to the overarching notion of the purpose of investment, the study was conducted with the intention of demonstrating the level of savings and customer satisfaction with the assistance of a micro-analytical program, as all customers have been investing in order to fulfill the purpose of investment.

Suggestions :

This study has brought out original data regarding solar consumption and it's pattern among households. In addition, the findings and discussion were provided in order to develop a practical policy in the respondents' favor that favors both economically healthy and unhealthy society. As a result, the trend of research has been followed by suggestions for additional developmental activities, which are presented below.

- On-grid solar customers must be boosted by government investment. For the benefit of everyone, it is necessary to take the necessary steps to provide solar equipment of comparable quality.
- Off-grid users must be made aware that even with high economic installation, there are no savings.
- Government feasible policy should be made for the production of electricity from each house holds by solar panels.
- Every household must receive a subsidy for the installation of solar equipment. It should be made known that solar power is good for the environment and can save money. The unlicensed distributor of solar equipment needs to be controlled or allowed to direct the distribution of quality equipment.

For the production of electricity, which is in high demand by all sectors of a developing nation like India, solar energy is an important source of energy. On the other hand, the government is obligated to make enormous efforts to meet the energy needs by increasing energy production and developing new energy sources. However, because solar energy plays a crucial role in a nation's development, it is necessary to provide electricity at a low cost of installation. As a result, this study evaluated the consumption and satisfaction of a backward district called "Sivagangai" with solar energy in order to offer feasible solutions to the electricity shortage issues that currently exist. Due to the fact that the data revealed the true state of the district regarding solar installation, only a small number of rational consumers have installed solar and are pleased with their decision. Therefore, this study's contribution may increase the level of investment in solar installations for energy consumption

and customer satisfaction.

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