International Journal of Social Science and Economic Research

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

A STUDY ON SOLAR TREND AMONG HOUSEHOLDS: AN ECONOMIC ANALYSIS

[1]T. AMOSE, [2]Capt. Dr. KR. JEYAKUMAR

[1]Ph.D Research Scholar, Research Department of Economics, Arumugam Pillai Seethai Ammal college, Tiruppattur – 630 211, Sivagangai District, Tamilnadu, India.

[2]Associate Professor, Research Department of Economics, Arumugam Pillai Seethai Ammal college, Tiruppattur – 630 211, Sivagangai District, Tamilnadu, India.

ABSTRACT

Invention of 'Electricity' is a gift of technology for the modern world. Now a days, consumption of electricity goes beyond without boundary due to invention and innovation of alternative products that demands the electricity power. So, recently countries togethered 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'. Hence, this research work has given significance for solar energy to equip the economic components among the public by research reflections and effective suggestions. Sivagangai is one of the backward district of Tamilnadu state is chosen for the study with a total of 300 sample respondents and results exposed on purposes, savings and satisfaction among solar panels installed consumers. Moreover, discussion and suggestions have been given for the feasible of future actions.

Keywords: Savings, Satisfaction, Electricity, Consumers, Solar energy.

INTRODUCTION

Electric power is not only demanded recently, it prevails from very past with the invention ideas of people to create perpetual sources to consume in all required purposes and circumstances. It can be also produced from the sunlight as history and technology invention says. 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 utilised heat and light energy from sun-star for various purposes. Especially, in the third century (214–212 B.C.), the Greek inventor used 'Archimedes' to expose heat rays to destroy enemy's ships during battle and mirror also was used to bring sufficient sunlight in dwelling places (Mathias Aarre Maehlum, 2013). Hence,

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

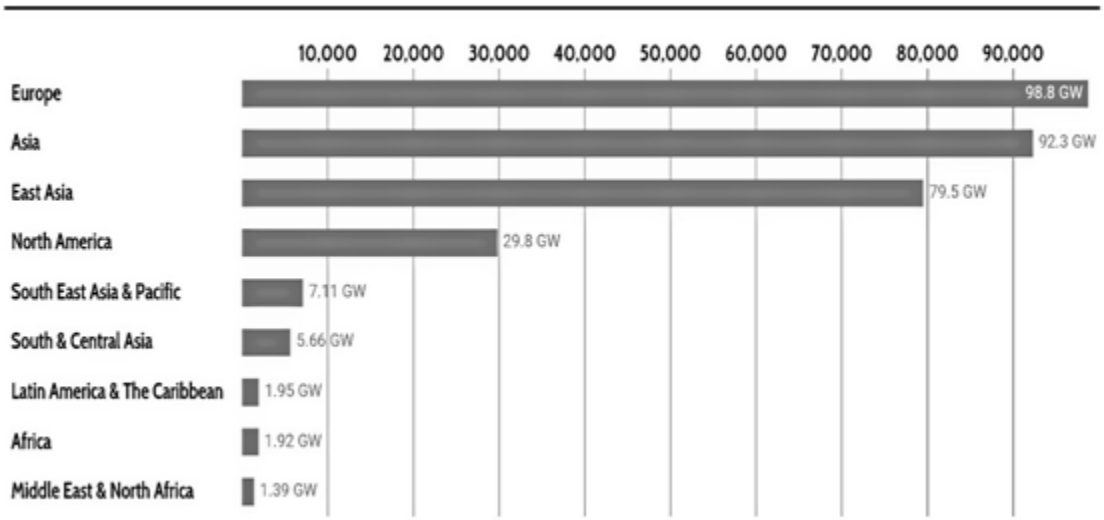
people were clear that sun-star is emitting heat and light energy and they emphasised light than heat energy to utilised even the night of a day. So, the invention came to bring out light energy for various purposes which leads to generate electricity further. In 1839, French physicist Edmund Becquerel 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. In 1876 ,William Grylls Adams and his student Richard Evans Day have observed a tiny amount of electricity when the plate was exposed to light. So, it paved to identify photovoltaic (PV) by an American inventor, Charles Fritts in 1883. Photovoltaic is the word that describes converting sunlight into electricity. 'Photo' meaning pertaining to light, and 'voltaic' meaning producing voltage (Go Solar California, 2007).

Though, the significant part of Photovoltaic in the solar panel is performed with the 'Solar cell' being as solid-state working to convert sunlight into electricity directly with the effects of Photovoltaic (Shivananda Pukhrem, 2013). Considered the history in solar use and technology, the outcome of sun-star as heat and light are the efficient and sufficient energy to produce electricity by applied Photovoltaic(PV) working through light energy and Concentrated Solar Power(CSP) working through heat energy (https://en.m.wikipedia.org › wiki › Solar...). In 1954, International Solar Energy Society (ISES) has been formed as non-profit organisation that dedicated to alternative use of solar energy among world wide consumers. Therein more than 110 countries have joined as associated member which also consists of scientists, researchers and other private and public organisations. Especially, it focused to lift up the developing process in application of solar energy. And it also aims to bring awareness among public to understand the non-polluting resources that need to apply in our every day life (https://en.m.wikipedia.org › wiki › Intern...). According to the report of International Energy Agency (IEA) in 2015, the aggregate Photovoltaic (PV) installation was whopping 227Gw at worldwide. It accounted as 197Gw by member countries and remaining from rest of the same (Christopher McFadden, 2017).

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

Figure 1: Solar Installed Capacity by Region



Source: World Energy Counsel (2016)

SOLAR IN INDIA

India is a developing country planning to execute kinds of feasible and favourable policies for the welfare of the public. Especially, the present Government is focusing on natural energy to be secured and utilised optimistically in sustainable manner. Hence, seeking and promoting alternative energy sources is a major efforts of the Ministry of Power of India and also the inventors are always welcomed and promoted under feasible policies of the entrepreneurs. As increasing consumption ratio of electricity among the consumers of the nation, ministry of power has been targeted 1,229.4 billion units (BU) of electricity needed to be produced in the financial year 2017-18 with 50 BU higher than the target for 2016-17 (Electrical Machinery Sector Report, 2017). To mount up the production volume of electricity, ministry of power is seeking such alternative resources which brings electricity even in the time of consumption. Eventually, it is possible only by the introduction of solar that it should be installed all over the houses of the nation. But, due to critical awareness among households to install solar plants, it's value and target of the ministry has been moving horizon. Though, the central government is taking enormous efforts to execute solar plants in several departments under the ministry of power like solar for agricultural activities, street lights and for households also. Generally, to produce 1 MW solar power by PV system about 100000 Sq feet (about 2.5 acres, or 1 hectare) is required (Kumaar Thakkar, 2016). The fluctuations of generating electricity from a solar panel are not only based on sun's intensity but also covers three significant factors that are, solar cell efficiency, solar panel size and the amount of sunlight directly hitting the panel

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

(www.solarcity.com › solar-energy-faqs). India has launched some more alternative plans which would generate electricity from solar panels to bring satisfaction among the public in the consumption of the same. Hence, this study has pointed out the efforts of the government in policy enhancing about spreading solar utilisation.

(i). Policies and Schemes,

- India has introduced 'Jawaharlal Nehru National Solar Mission (the "JNNSM")' in 2010 aiming to produce about 100,000 MW of grid connected solar power capacity by 2022 (Ran Chakrabarti, Anubha Sital and Shaima Khan, 2016).
- Ministry of New and renewable Energy (MNRE) has drawn a scheme titled 'Solar Park Scheme' to produce many number of solar parks throughout the States of India with the goal of producing above 500 MW (Solar Energy Corporation of India limited).
- The government of India has projected various schemes under Central and State government, to produce 1000 MW of Grid-Connected Solar PV Power in the name of Central Public Sector Undertakings Scheme (CPSUs) (Ministry of New and Renewable Energy).
- Under the 'Defence Scheme' Ministry of Defence and Para Military Forces have enforced to produce up over 300 MW of Grid-Connected and Off-grid Solar PV Power by Projects (Ministry of New and Renewable Energy).
- There are three categorised 'Viability Gap Funding (VGF) schemes' targeted to generate 750MW, 2000MW and 5000MW of Grid-Connected Solar PV Power (Ministry of New and Renewable Energy).
- IIT Faculty and Solar Industry Experts have designed to conduct 'SOLARINSTALL-Solar PV System Installation Training' on 9th to 15th September 2017 in IIT Bombay, Powai, Mumbai, India. This training programmes is aims to spread awareness among households to be installed feasibly (Solar Policies, Tenders, News Updates & More – India).

(ii). Current Affairs on Solar (Oct/2016 - Sep/2017)

- ★ Under the Ministry of Shipping, Directorate General of Lighthouse and Lightships (DGLL) which is presently maintaining 193 lighthouses with electricity and diesel as input that exposes 900 kg of Co2 by one Mega Watt Hour (MWh), plans to replace the source of energy with solar in order to reduce Co2 emission. According to the organisation report, 176 out of 193 lighthouses have been solarised (Current affairs 2016, noreply+feedproxy@google.com, 08/10/2016).
- ★ Indian Prime Minister Narendra Modi has raised voice for International Solar Alliance (ISA) focusing solar energy to be made affordable throughout the world by involving all

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

stakeholders including multilateral development banks. ISA designed to operate more than $1,000 billion as investment by 2030 which may lead to future solar energy generation, storage and good technologies for countries' individual needs. According to a report, India has contributed Rs.175 crore ($27 million) to create the ISA corpus fund to meet the cost of secretariat for prime five years. Around 19 countries have signed in the framework agreement of International Solar Alliance (ISA) on the sidelines of the Conference (Current affairs 2016, noreply+feedproxy@google.com, 19/11/2016).

- ★ An independent solar power producer named 'Azure' has planned to boot construction of 100MW solar power plants in Andhra Pradesh. This project was auctioned by National Thermal Power Corporation (NTPC) and National Solar Mission (NSM) (Current affairs 2016, noreply+feedproxy@google.com, 03/12/2016).
- ★ Mr. Chandra Bhushan, Deputy Director General of Centre for Science and Environment (CSE) has recommended housing societies to install solar rooftops to get sufficient energy from nature with least cost that comes below Rs.10 compared to diesel generator which consumes presently Rs.27 - Rs.33 per unit (Current affairs 2017, noreply+feedproxy@google.com, 12/01/2017).
- ★ Mr. Prakash Javadekar, Minister of Human Resource Development (HRD) has instructed government-run Navodaya Vidyalayas to adopt solar rooftops and technology to water harvest. And also proposed this to new institutions that it should be a part of proposal in construction (Current affairs 2017, noreply+feedproxy@google.com, 01/09/2017).

Table 1: Solar in Tamilnadu state of India

No.	Title	Brief summary
1.	Clean energy: Rooftop solar farms	Spinning mills in the field of textile from Coimbatore and Tirupur, seeking investors to form the solar farm on the rooftops of their factories.
2.	Chennai Airport set to go Solar	Chennai airport has planed to plant solar equipments to produce 1.5MV solar power to meet its energy demand and to save Rs.8 crore as annual expenses.
3.	Southern Railway to set up solar panels	Southern Railway as service provider has planed to set up solar panels in 38 location of southern zone to produce power at cheaper rates and empower the value of greenhouses.
4.	Chennai Metro Rail to go	In six months, Chennai Metro Rail may have its first solar

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

	solar	power generation facilities with a production capacity of 1MW.
5.	Powerloom units at solar energy	Thousands of powerlooms in Tirupur and Coimbatore districts have designed a plan to go for green and captive power.
6.	Fuel Station in Tamil Nadu	To meet power needs among fuel stations, solar energy producing facility was inaugurated at a dealer outlet of the Indian Oil Corporation Limited (IOCL) in Rasipuram.
7.	Status of schemes to Solar Plan	According to the data report from India's Ministry of New and Renewable Energy (MNRE), India would install 5,248MW of grid-connected solar capacity on Jan. 31, 2016.
8.	Solar energy system must	Chennai as an urban have special buildings that contains above four floors. Now a days, Chennai Metropolitan Development Authority will provide plan if they have proposal that focusing solar energy system.
9.	Solar power at 'Anna Maaligai'	'Anna Maaligai' in Madurai district of Tamilnadu is the first corporation of the state that installed solar panels for Rs.55.83 lakh and produces 44KW of power. This will reduce the expenditure of electricity consumption.
10.	Domestic Solar Rooftops - Individual	1. Applicable to individual homes/flats with solar systems up to a capacity of 1KWp 2. Provision to avail subsidy of Rs 20,000 for first 10,000 PV systems 3. Additional 30% subsidy from MNRE 4. Net Metering facility 5. Applicable only to grid-connected PV systems.
11.	Domestic Solar Rooftops - Group	1. Applicable to residential apartments/flats with solar systems having capacities of 5KW, 10KW or more 2. Provision to avail subsidy of Rs 20,000 for first 10,000 PV systems 3. Additional 30% subsidy from MNRE 4. Eligible for Net Metering 5. Applicable only to grid-connected PV systems.

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

12.	List of Manufacturers/Suppliers of Solar Products Enlisted with TEDA	Tamilnadu Energy Development Agency (TEDA) has been enlisted the list of Manufacturers/Suppliers of Solar Products.
13.	Tamil Nadu solar Energy policy 2012	Tamilnadu state of India has planned to achieve 3000MW of solar power generation by Utility Scale Projects, Roof tops and Renewable Energy Certificate (REC) mechanism.
14.	Solar power: Adani group starts transmitting to grid	Adani Green Energy (Tamil Nadu) Limited has generating power in one of the three 72 MW units and booted power transmission to the grid.
15.	NIT for 1 MW solar power plant at Kamarajar Port Limited, Ennore, Chennai, Tamil Nadu	Solar Energy Corporation of India (SECI) invites e – bids for Design, Engineering, Procurement and Supply, Erection, Testing, Commissioning for seven years of 1 MW (AC) 1 MW (760 kW + 240 kW) solar power plant at Kamarajar Port Limited, Ennore, Chennai, Tamil Nadu.
16.	Coimbatore City Municipal Plans to Invest USD1 Million in Solar Power Plant in Coimbatore, Tamil Nadu, India	Municipal corporation of Coimbatore district of Tamilnadu plans to invest INR50 million (USD0.83 million) to construct and develope the solar power plant in Kavundampalayam.
17.	Gamesa Announces 15 MW Solar Project in TN	Gamesa has announced its second solar project totalling 15 MW in the state of Tamil Nadu. The project is expected to be commissioned within the first quarter of 2016 in Puddukotai, Tamil Nadu.
18.	Empanelment for Capital Incentive Scheme	Government of Tamil Nadu has implemented of "Hon'ble Chief Minister's Solar Rooftop Capital Incentive Scheme". Under this scheme, a capital of Rs. 20,000 will be provided towards installation of Grid tied battery less Solar Rooftop Photovoltaic power plants for Domestic consumers.

Source: Secondary data (www.eai.in › ref › sol › policies)

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

OBJECTIVES

Objectives of the research work is an inducer to produce result and discussion towards the creation of public satisfaction in energy consumption. Hence, this study has framed few objectives to reveal the depth understanding of solar in the selected area.

- ★ To know the impact of solar policies and programmes unto the society.

To know the trend of economic characters of Solar installation in sivagangai district.

Area Profile

'Sivagangai' is a district under the state of Tamilnadu, India and it is a headquarters of the district had a great dominance experience as it's background and it is surrounded by Madurai District on the West, Ramanathapuram district on South East, Tiruchirappalli district on the North, Pudukkottai district on the Northeast, Virudhunagar district on South West (ecourts.gov.in › sivaganga). District occupies 4189.Sq.KM304with total of 1,33,39,101304population which consists of 6,70,429304females for 6,68,672304males in total of 3,38,938 households. Among 6,20,174304working people there are 3,91,305304males and 2,28,866304females, 1,17,030304are cultivators, 1,22,166304are agricultural labourers, 9,864304are household industrial workers and 3,71,111 as other workers (dcmsme.gov.in › dips › DIP.SIVAGANG...). According to 2011 census, total literacy rate of Sivaganga district is 79.85 percent that consists of 78.71 percent male literacy and female 64.65 percent (www.censusindia.co.in › district › sivaga...). Ministry of Panchayati Raj (MPR) has considered the district Sivagangai as one of the 250th backward district among 640 and out of six districts in Tamilnadu, Sivagangai is also receiving funds from the Backward Regions Grant Fund Programme (BRGF). Tamil Nadu Agricultural University (TNAU) plans to create the State's first Red Soil Dryland Research Centre in Sivaganga district due to major workforce is in agricultural activities (72.8 percent) that focuses to cultivate paddy, sugarcane, groundnut, pulses, millets and cereals (https://m.facebook.com › posts).

DATA SOURCES AND METHODOLOGY

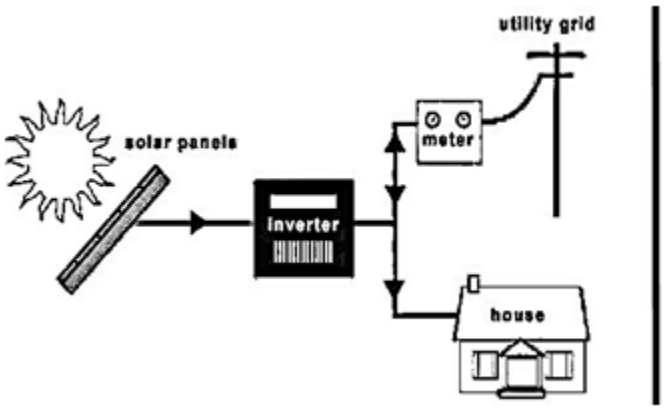
To prove the study's originality and quality, data sources and methodology is an important part. Especially, methodology is an outline to the research work which directs the study towards providing feasible solution to the selected problems. Hence, this study has emphasised on both data sources and methodology. This research work has been undertaken with a total of 300 sample respondents from Sivagangai district of Tamilnadu 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

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

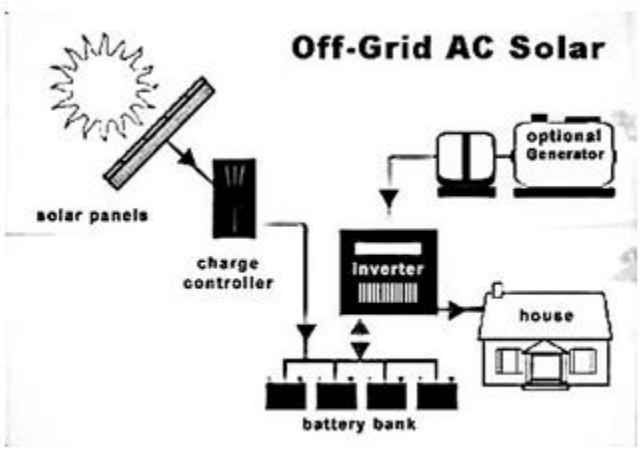
seperated them as on-grid (60 respondents) and off-grid (60 respondents) and herebelow the figure are indicates and differentiates the on and off-grid solar system.

Figure 2: On-grid solar system



Source: Google>picture of on-grid solar system

Figure 3: Off-grid solar system



Source: Google>picture of on-grid solar system

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

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

have been taken and this is for non-solar energy users to identify the opinion of not using the same. Moreover, overall study has been analysed by micro analytical programme to identify savings and satisfaction level among the solar installed consumers.

Solar Trend in Selected Area

Significance of energy fulfilment among households of the nation is provoked by demand, consumption pattern and technology interference which each individual and family enhancing their lifestyle. Now a days, electricity as an energy is emphasised to promote the economic components such as, production, supply, consumption and demand due to the force of factors away from economic components. Hence, the Sivagangai as an economically backward district, is trending up in the improvement of electricity consumption without any additional sources. Considering the promotion of electricity consumption level throughout world, as an additional source Solar has been introduced to minimise the cost of electricity production. Enormous policies and programmes leads the public to find alternative energy sources to fulfil the necessities of their households purposes. Thereby, Solar as an alternative and easy availing energy source for electricity production, has been spread throughout the regions and even economically backward districts also. Moreover, this study data has been builded on a purpose to find out the savings and satisfaction opinion of solar consumers among the Sivagangai district. Hence, it clearly reveals the purposes of solar use among the households just to make feasible policy to all household purpose. Savings and satisfaction are the important variables in the study of economics which deals with present and future of individuals and others. So, the consumers interests are broughtout as data to identify the consumption pattern and future trend of solar.

Table 2: Purposes of Solar in households

Purposes	Types of solar system		Total
	On-grid	Off-grid	
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

Note: Figures in bracket are percentage to the total

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

Table. 2 reveals the purpose of solar energy consumption as electric power in the households of selected district. Each row has data related to the purposes of energy use and column has separated as types of solar system, each system has equal number of respondents 60. Among the 60 respondents of On-grid users, maximum of about 49 (81.6 percent) repondents consumes solar for lighting purpose and very less of about four respondents using the same for all purposes of the households but, remaining seven of them consumes solar for other households purposes such as entertainment. Among 60 respondents of Off-grid users, maximum of about 57 (95.0) of them consumes for lighting and three for other households purposes. Thus, among the total of 120 respondents, 106 respondents gives priority to lighting purpose and 10 and four respondents for other and all households purposes respectively.

Table 3: Economic Savings of On-grid users

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

Source: Primary data

Note: Figures in bracket are percentage to the total

Table.3 expresses saving amounts of the respondents earned as a profit from solar installation. There is huge benefits to the respondents using On-grid solar system which the research data has proved, as among the total of 60 respondents in On-grid category, highly 30 (50.0) of them are getting profit of Rs. 501-1000, 19 of them are sufficient beneficiaries about above Rs.1000 and 11 respondents are minimum beneficiaries with the reduced cost of below Rs. 500.

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

Table 4: Satisfaction opinion of the sample respondents

Particulars	Types of Solar system		Total
	On-grid	Off-grid	
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

Note: Figures in bracket are percentage to the total

Data of the table.4 pointed out the status of satisfaction in consumption of solar as electric energy. Among the 60 respondents of On-grid users, 100 percent of the respondents are satisfied with this but, among Off-grid consumers, highly 47 (78.3) of them are satisfied and remaining 13 respondents exposed unsatisfactory interest. Hence, among the total of 120 respondents, highly 107 (89.16) respondents are satisfied with solar installation and 13 respondents are not satisfied with technology invented system.

Table 5: 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)

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

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

Note: Figures in bracket are percentage to the total

Table.5 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.

Study Analysis

Analysis part is an important work in an article execution to bringout accurate result and declare the appropriate solution to the selected problems. The study analysis has been taken to produce the results for micro problems and to fulfill the scope of the research work. Hence, this research work emphasised this part as a study based on economic analysis to expose the level of savings and satisfaction of the selected sample respondents of Sivagangai district.

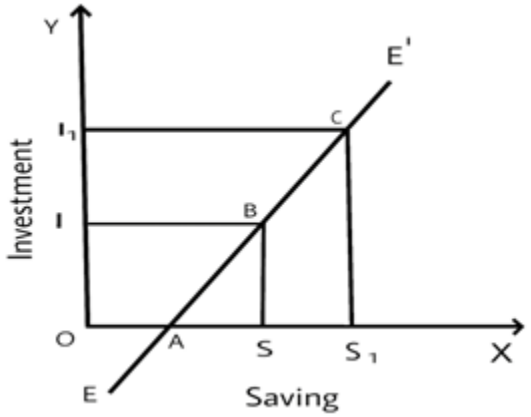
The study focuses on the savings and satisfaction of the sample respondents as primary data collected from the Sivagangai district. In the context of Economics, the components of same such as consumption, savings and satisfaction will not comeforth without any interpretative function. Hence, this study emphasised the 'Investment function' to access the consumption, savings and satisfaction among the consumers of solar energy. 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. Apart from the general concept of investment function, the study has been taken to prove the level of savings and satisfaction with the support of micro analytical programme as to all the consumers have been investing as any structure to utilise the purpose of investment.

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

Generally, investment has been classified as induced and autonomous investment which are as internal sources (prices, wages and interest...) motivates to invest, it is called induced investment and which are external sources (innovations, inventions and researches...) inspiring to invest is called autonomous investment (Jhingan,ML. (2010). Thereby, Solar energy consumers in the selected region are also considered as an autonomous investors to utilise the natural energy for alternative household purposes and herebelow given micro analytical figures will reveal the level of savings and satisfaction with the function of investment.

Figure 4: Impact of market structure in investment and savings (On-grid users)



Source: Computed by Author

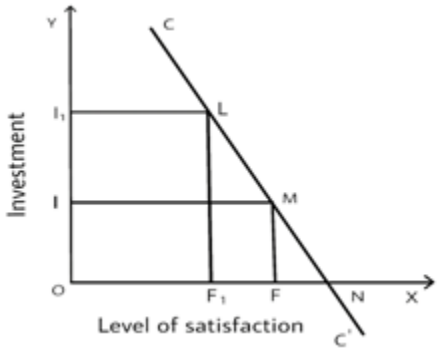
Figure.4. Explains the level of investment and savings of the On-grid respondents. Vertical axis 'OY' represents the investment level and 'OX' horizontal axis deals the level of savings. 'EE^{I}' is income group curve that contained, 'E to A' is low income group, 'A to B' is middle income group and 'B to C and above C' is high income group. Generally, among the three income groups of the consumers, middle and high income groups of the respondents only comeforth to install alternative energy sources like solar. But, low income group consumers are satisfied with service electricity and are not interested in solar installation. 'II$_1$' expose the level of investment among on-grid users and it has been seperated as unauthorised solar equipments distributor 'I' and authorised solar equipments distributor 'I$_1$'. Because, awareness and Government policy initiation and execution promote the demand level on solar equipments. Hence, distribution of solar equipments have become open market products with less quality and cost. So, middle income group of consumers becomes rational consumers. On the other hand, authorised distributors possesses quality solar equipments with appropriate price which apt for high income group of consumers. Here, the level of saving is found only with on-users but it neglected off-grid users electricity expenses has been saved by on-grid users by their production but, there is nothing in

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

saving part of off-grid users. 'EA' level of low income group of consumers are not investors and their savings is shown below 'X' axis. 'AB' Level of middle income group of consumers have interests to install solar as an on-grid type from unauthorised solar equipments distributor with low cost so, 'OI' level of investment at the 'B' point directed them to save money at 'OS' level. Now, the high income group of consumers are investing at 'OI_1' and receiving equipments from authorised provider at appropriate cost so, the point 'C' leads them to save money at ' OS_1' level. Thus, high income group of consumers are benefiting than middle income group of consumers due to the differentiation in quality of solar equipments.

Figure 5: Impact of investment in the determinants of level of satisfaction



Source: Computed by Author

Table.5. Express the variations of the level of investment that leads to changes in the level of satisfaction. The horizontal axis 'OX' shows the level of satisfaction and 'OY' vertical axis says the changes of investment. 'CC^I' is the consumption curve which works as intermediary to evaluate the level of investment and satisfaction. 'I_1F_1' is the level of investment and satisfaction of the off-grid users and 'IF' is same for the on-grid users. There is variations in investment and satisfaction of both between on and off-grid users. According to the data result of table.4, on-grid users are satisfied with the available connection as it can be used all the time without any consumption difference and it is possible to save money because of self electricity production from sunlight. But, there is no such facilities to off-grid users it meant, they may not consume electricity without difference in level of consumers during climate change and there is no concession in electricity bills due to absence of production. Figure.4 points that there is investment variations between on and off-grid users because, cost of on-grid installation is less compared with off-grid equipments based on the capacity of electricity saving battery. As a general information, off-grid users are paying much 'OI_1' level so, the point 'L' in consumption curve directed them to make satisfaction at 'OF_1' level. But, with minimum investment at 'OI' level of on-grid users leads to satisfy at 'OF' level by 'M' in consumption curve. 'C^IN' is the

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

consumers who are not interested to invest and satisfy by the natural energy so, there is absence of investment and satisfaction.

DISCUSSION OF THE RESULTS

Discussion of any disputes would lead to finalise image to enact sufficient solution and policy making. So, the final part of the this study emphasise the 'discussion of the results' to expose the causes for data fluctuations and to provide effective suggestions for policy makers.

Table.2. Reveals the data about the purpose of solar use among the selected region. According to the data reflection, among 60 respondents as on-grid users, 49 (81.6 percent) of them are using solar only for lighting purpose because, according to figure.4, minimum economic condition of consumers has installed low quality of solar equipments which produces insufficient electric supply. But, remaining seven respondents from the same category have applied quality solar equipments and they consume for all other purposes of the households. On the other hand, among 60 respondants as off-grid consumers, 57 (95.0 percent) of them have reported that they use solar only for lighting purpose and remaining three consumers are using for other purposes of households due to variations of battery capacity in savings electric power from sunlight. Thus, out of 180 respondents, 106 (88.3 percent) consumers have emphasised that has been solar used only for lighting purpose because, glowing lights in households are very significant compared with other purposes of households.

The data results of table.3 says the economic savings of on-grid solar consumers. Highly 30 (50.0 percent) respondents saves 501-1000 rupees as amount reduction from electricity bill and 11 consumers saves below Rs.500 but, 19 (31.6 percent) respondents saves above Rs. 1000 because, there is differentiation in quality of solar equipments provided by authorised and unauthorised suppliers. Suppliers are seperated by the quality of solar equipments based on the cost of production and demand for households purposes. So, economically sound people install high quality and save great economic value.

Table.4 enunciate the satisfaction of both on and off-grid consumers in the consumption of solar energy. According to the result, 60 (100.0 percent) respondents from on-grid category are satisfied with their installed solar equipments because, while consumption prevail in this system, production will also accompany at the same time. So, the balance between production and consumption may be almost equal. Thereby, there will be huge benefits of satisfaction and economic savings. On the other hand, out of 60 respondents among off-grid users, 47 respondents (78.3 percent) are satisfied with the installation of solar system due to satisfaction of the basis necessity like lighting even in link-off of service electricity supply. But, remaining 13 consumers are not satisfied because, due to their poor economy strength they have installed low

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

quality of solar equipments which shall not function well during climate change and power-off. Thus, among selected 120 respondents, 107 (89.16 percent) consumers are satisfied with solar energy and 13 of them are not satisfied with this.

Table.5 clearly pointed out the public opinion for not using solar energy. According to data result collected from nine taluks of Sivagangai district says, among 180 respondents, highly 89 (49.4) respondents exposed their opinion that installing solar for household purposes is additional expenses because majority rational consumers from the district are economically poor and depends on temporary job which gives them minimum wage or salary around Rs.3000 to 5000. There are 37 respondents still in the absence of solar energy awareness because, existing solar consumers are not from rural but they were from urban and semi-rural areas of the district. So, there is only way to install solar by snowball observation of respondents elsewhere, it is impossible to know and execute. And 32 respondents enunciated that the sunlight energy is an unsustainable one because, when climate changes occurr it will affect the rational consumers consumption pattern of electricity. Finally, 22 respondents expressed their opinion that sunlight emits insufficient electric exposition because, the radiation from sunlight is not being same always. Thus, as highlight of this research in absence of not using solar energy is, additional expenses to most of consumers.

CONCLUSION

Solar energy is an important source of energy for the production of electricity which is highly demanded by all sectors of the developing country like India. On the other hand, as an obligation of the government taking enormous efforts to fulfil the needs of energy by boosting the energy production and inventing new sources for the same. However, Solar plays a vital role in the developing process of a country, therefore providing electricity at minimum cost of installation is needed. Hence, this study evaluated with a backward district 'sivagangai' in consumption and satisfaction of solar energy to provide feasible solutions to rectify the existing problems as scarce of electricity. Given data exposed the real condition of the district in solar installation and as a major result only very few rational consumers have installed solar and are satisfied with that. So, the contribution of this study may enhance the level of investment for solar installations for the consumption and satisfaction of the energy consumers.

SUGGESTIONS

This study has broughtout original data regarding solar consumption and it's pattern among households. Moreover, results and discussion were given to produce feasible policy for the favour of economically healthy and unhealthy society respondents. Hence, followed by the trend

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

of research work, suggestions for further developmental activities have been emphasised and proceeded herebelow.

● Government investment need to boost the On-grid solar consumers.

● Necessary action must be taken to supply equal quality of solar equipments to benefit overall.

● Awareness to be provided for off-grid users that there is no economic savings even with high economic installation.

● Government feasible policy should be made for the production of electricity from each households by solar panels.

● Subsidy must be given to solar equipments to be installed in every household.

● Information should be proclaimed that the solar energy is eco-friend and can save economic expenses.

● Efforts need to regulate the unauthorised solar equipment distributor or let they direct to distribute quality of the same.

REFERENCES

1. Mathias Aarre Maehlum (2013), "The History of Solar Energy", The History of Solar Energy - Timeline - Energy Informative, energyinformative.org › the-history-of-s..., (29/08/2017).

2. Go Solar California (2007), "History of Solar Energy in California", www.gosolarcalifornia.ca.gov › about, (30/08/2017).

3. Shivananda Pukhrem (2013), "How Solar Cells Work — Components & Operation Of Solar Cells", Solar news & commentary, Solar love, solarlove.org › how-solar-cells-work-co..., (31/08/2017).

4. Solar power by country - Wikipedia, https://en.m.wikipedia.org › wiki › Solar... (31/08/2017.

5. International Solar Energy Society - Wikipedia, https://en.m.wikipedia.org › wiki › Intern... (31/08/2017).

6. Christopher McFadden (2017), "Top 10 Performing Countries for Solar Energy", Science/Energy & Environment, https://interestingengineering.com › top-... (31/08/2017).

7. World Energy Counsel (2016). "Energy Resources > Solar", https://www.worldenergy.org › resource, (31/08/2017).

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

8. Ran Chakrabarti, Anubha Sital and Shaima Khan (2016), "Solar Power In India: Solar Panels, Domestic Content Requirement And The WTO", INDUSLAW, Mondaq, www.mondaq.com › india › Renewables, (01/09/2017).

9. Kumaar Thakkar (2016), "How much land is required to setup a 1MW solar power generation Unit?", M.D, Belifal Innovations & Technologies Pvt. Ltd, Mumbai, https://www.quora.com › How-much-lan... (01/09/2017).

10. Narasimhan (2014), "Area Required for Solar PV Power Plants", Solar Power Plants, Suncyclopedia, www.suncyclopedia.com › area-required... (01/09/2017).

11. Innovative Solar Systems, "Requirements for Solar Farms", Requirements for Solar Farms | Solar Farm Project Planning, innovativesolarfarms.com › requirements... (01/09/2017).

12. Ministry of Power, Government of India, "Power Sector at a Glance ALL INDIA", powermin.nic.in › content › power-secto... (01/09/2017).

13. Electrical Machinery Sector Report (2017), "Power Sector in India", Power Sector in India - Solar Energy, Renewable & Wind Energy Sector - IBEF, https://www.ibef.org › Industry, (01/09/2017).

14. Solar city, "Solar energy production", How Much Energy Does A Solar Panel System Produce? | SolarCity, www.solarcity.com › solar-energy-faqs (02/09/2017).

15. Solar Energy Corporation of India Limited, "Solar Park", A Government of India Enterprise, www.seci.gov.in › content › innerpage (05/09/2017).

16. Ministry of New and Renewable Energy "Scheme / Documents", Government of India, www.mnre.gov.in › introduction-2 (05/09/2017).

17. Central and State Government Solar Policies- Energy Alternatives India ...>Solar Policies, Tenders, News Updates & More – India, Solar Mango – #1 guide for solar, www.eai.in › ref › sol › policies (05/09/2017).

18. History of Sivagangai | Official Website of District Court Of India, ecourts.gov.in › sivaganga (09/09/2017).

19. MSME - Development Institute, "Brief INDUSTRIAL PROFILE SIVAGANGAI (2015-16)", Government of India, www.msmedi-chennai.gov.in, dcmsme.gov.in › dips › DIP.SIVAGANG... (07/09/2017).

ISSN: 2455-8834

Volume:03, Issue:01 "January 2018"

20. Sivaganga District is an administrative... - □□□□ □□□□□ □□□□□ ..., https://m.facebook.com › posts (09/09/2017).

21. Census India, "Sivaganga District Population, Caste, Religion Data (Tamil Nadu) - Census 2011", www.censusindia.co.in › district › sivaga... (09/09/2017).

22. Jhingan.ML (2010), " Advanced Economic Theory-13th Edition, Vrinda Publications (P) Ltd, New delhi, ISBN: 978-81-8281-165-2, PP: 814-815.

